# Analysis I – Achieving Sustainability

## Background

Tishman Speyer Properties is among the elite real estate owners, developers, operators, and fund managers of first-class real estate in the world. They pride themselves in seeking opportunity where others see difficulties and transforming those opportunities into assets of even greater value. They feel that vertical integration is the key to their success, as well as their ability to envision a broader array of possibilities than others. 1099 New York Avenue is to be one of Tishman Speyer's premier office buildings in the District of Columbia from both a design and functional standpoint.

Efforts towards green construction have had an increased concentration as of late from both the design and construction perspectives. With energy conservation in the national limelight, a substantial amount of research has been made in the construction industry. This is extremely important considering that buildings consume a significant amount of the energy produced each year.

## Problem

Shortly after construction on 1099 New York Avenue began, Tishman Speyer Properties adopted a new company wide policy which stated that all new projects were to achieve at least a Leadership in Energy and Environmental Design (LEED) Silver Rating. The policy was intended to keep Tishman Speyer at the forefront of the real estate industry as one of the leaders in green construction. The primary focus of their policy is centered around the recycling of waste, the use of easily renewable materials, the implementation of energy efficiency and water conserving measures, and the establishment of a healthy and productive indoor environment. Although 1099 New York Avenue is to be Tishman Speyer's premier office building in the District of Columbia, it was not originally designed to be a sustainable building. Therefore, in order to achieve this rating the design and construction methods have to be altered.

## Objective

The objective of this analysis is to investigate the variety of sustainable practices currently being utilized in the industry and determine which aspects of 1099 New York Avenue can be

enhanced to achieve the LEED Silver Rating for Core and Shell Construction. This rating requires a minimum of 28 credits to be earned.

## Analysis Part I

### Evaluation of Current Credits Obtained

Although 1099 New York Avenue was not designed with sustainability in mind, there are still a few aspects of the project that meet the requirements of the United States Green Building Council. (Please note that all LEED Criterion is based on the Core and Shell Development Version 2.0 Reference Guide since this was the most current edition at the time of design and construction.)

**Credit SS 1 – Site Selection**

1099 New York Avenue was developed on a site that was previously occupied by a two story rental car office. It is not located on undeveloped farmland or within a 100 foot radius of any wetlands as defined by United States Coded of Federal Regulations 40 CFR, Parts 230-233 and Part 22.

**Credit SS 4.1 – Public Transportation Access**

The project site is located within the maximum ¼ mile radius from one or more stops for two or more public bus lines. There is a bus stop located at the corner of 11$^{th}$ Street NW and New York Avenue NW that serves six separate transit routes.

**Credit SS 7.1 – Heat Island Effect (Non-Roof)**

100% of the parking spaces for the building are located underground. This exceeds the minimum of 50% for the credit.

**Credit WE 1.1 and Credit WE 1.2 – Water Efficient Landscaping**

The tree planters being installed along 11 Street NW and New York Avenue NW do not require any form of permanent irrigation systems.

**Energy and Atmosphere Prerequisite 1 (No Credit Given)**

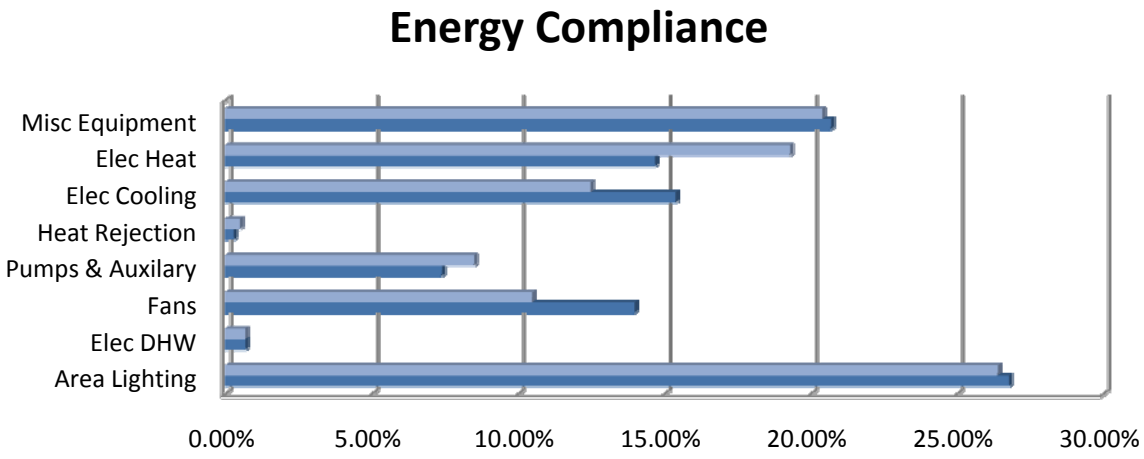
This prerequisite is concerned with the commissioning of the building energy systems. In order to fulfill this requirement, an individual (separate of the design and construction management teams) must be designated as the Commissioning Authority to lead, review and oversee the completion of the commissioning process. The owner must also

document their own commissioning requirements for the project from which the design team shall develop the Basis of Design.

Currently W.E. Bowers, the Mechanical Contractor, is responsible for the commissioning process and have appointed a person who is to be responsible for overseeing the process. The commissioning requirements for the project have been included in the construction documents by Tishman Speyer and the design team. They are under Division 19 in the Construction Specifications.

**Energy and Atmosphere Prerequisite 2 (No Credit Given)**

This prerequisite requires that the energy systems for the project be designed to comply with the mandatory provisions of ASHRAE/IESNA Standard 90.1 (without addenda). As seen in Chart 1.1 below, the designed system meets the ASHRAE 90.1 energy code by 0.95%.




| | Area Lighting | Elec DHW | Fans | Pumps & Auxilary | Heat Rejection | Elec Cooling | Elec Heat | Misc Equipment |
|---|---|---|---|---|---|---|---|---|
| As-Designed | 26.40% | 0.70% | 10.50% | 8.50% | 0.50% | 12.50% | 19.30% | 20.40% |
| ASHRAE 90.1 | 26.80% | 0.70% | 14.00% | 7.40% | 0.30% | 15.40% | 14.70% | 20.70% |

**Chart 1.1** visualizes the buildings compliance with ASHRAE 90.1

**Energy and Atmosphere Prerequisite 3 (No Credit Given)**

The prerequisite refers to the refrigerant management on the project. The criterion states that no CFC-based (chlorofluorocarbons) refrigerants are to be used on the project. The project complies since the only refrigerant specified to be used is R-22, a hydrochlorofluorocarbon that causes significantly less depletion of the ozone.

## Credit MR 5.1 & Credit MR 5.2 – Regional Materials

Credit 5.1 requires that 10% of the materials or products (based on value) be extracted and produced within a 500 mile radius of the project site. Credit 5.2 requires that 20% of the materials or products (based on value) be extracted or produced within the same 500 mile radius of the project site. The LEED Reference Guide for Core and Shell Development states that the cost of materials for the project can be estimated as 40% of the total cost of construction for the Construction Specification Institute's (CSI) Divisions 2-10. (Mechanical, Electrical, and Plumbing Costs are not to be included in this calculation)

The total cost of construction for Divisions 2-10 for 1099 New York Avenue is $22,875,000. The total cost of materials is therefore estimated to be **0.4 x $22,875,000** which equals **$9,150,000.**

The cementitious material, aggregate, and reinforcement for the structural system are all extracted and produced within the required 500 mile radius and their value of **$1,972,937** is **21.56%** of the total material cost which exceeds the required 20% of total cost for regional materials. See **Table 1.1** below for calculations.

| Material | Weight (ton) | Unit Cost | Total Cost | Manufacturing Location | Dist. from Proj. (mi) | Percent of Material Cost |
|---|---|---|---|---|---|---|
| NewCem Additive | 1,130 | $95.00 | $107,350.00 | Sparrows Point, MD | 47 | 1.17% |
| Portland Cement | 3,389 | $135.00 | $457,515.00 | Union Bridge, MD | 70 | 5.00% |
| Fine Aggregate | 8,833 | $14.00 | $123,662.00 | Chase, MD | 57 | 1.35% |
| Coarse Aggregate | 12,325 | $14.00 | $172,550.00 | Frederick, MD | 51 | 1.89% |
| Steel Reinforcing | 1,065 | $1,044.00 | $1,111,860.00 | Marion, OH | 466 | 12.15% |
| | | | | | | |
| | | **Total** | **$1,972,937.00** | | **Total** | **21.56%** |

**Table 1.1** Summarizes the manufacturing location and cost for the cast in place concrete materials

## Indoor Environmental Quality Prerequisite 2 (No Credit Given)

This prerequisite has already been met considering smoking is prohibited in all indoor facilities throughout the District of Columbia.

**Credit EQ 8.1 & Credit EQ 8.2 – Daylight and Views**

Because of the glass curtain wall and the open floor plan of a core and shell building, the project meets the daylight requirements according to the procedures outlined in Option 1, Glazing Factor Calculations. The calculations are included in **Appendix C.**

## Analysis Part II

### Evaluation of Credits to be Obtained

As you can see above, after extensive research the project is only eligible to receive 9 of the 28 credits required for LEED Silver. The second portion of my analysis will include suggestions for different courses of action that could have been taken on this project to obtain the balance of credits and will be proven useful as guidelines for future Tishman Speyer projects.

**Credit SS 4.2 – Bicycle Storage and Changing Rooms**

The building is already equipped with a fitness center which houses locker rooms containing showering facilities. If secure bicycle racks were to be provided within 200 yards of the building's entrance, a credit could be earned. The amount of bicycle racks to be installed must equal at least 3% of the building's full time occupancy. Since all tenant spaces have yet to be leased, the default occupancy loads provided in Appendix 1 will be substituted.

Default Occupancy Load (General Office) = **1 person / 250 sq. ft.**
Gross area per office floor = **13,037 sq. ft.**
Total area = **130,370 sq. ft.**

**Full Time Expected Occupancy = 130,370 sq. ft. / 250 sq. ft. / 1 person = 522 persons**

**Number of Storage Stalls Required = 0.03 x 522 persons = 16**

**Credit SS 4.3 – Low Emitting and Fuel Efficient Vehicles**

Encouraging commuters to travel in fuel efficient vehicles is considered sustainable construction since it is an effort to reduce the amount pollution in the environment. A LEED credit can be earned by allotting 5% of the available parking spaces as priority parking spots for fuel efficient vehicles.

**Total number of parking spots = 95**
**Required preferred parking = 0.05 x 95 = 5 parking spots**

The building contains a total of 95 parking spaces, thus only 5 spots would have to be reserved.

**Credit SS 6.1 Stormwater Design & Credit SS 7.2 – Heat Island Effect (Roof)**

Credit SS 6.1 and Credit SS 7.2 can both be obtained with the addition of a green roof to over 50 % of the current roof area above the eleventh floor and the mechanical penthouse. The roof is already designed to have public access, why not improve its function?

Green roofs have many ecological benefits and serve as enhanced protection for conventional waterproofing systems on a building. They are divided into two different categories, extensive and intensive. Extensive systems tend to be less than 6 inches in depth and are designed to satisfy engineering performance requirements. Typical plant life is small shrubs, grasses, and mosses. Intensive systems tend to be more elaborate and will contain trees and larger brushes. They generally create more of a structural burden than the shallower system. With this in mind, an Extensive Green Roof would be the most appropriate addition to 1099 New York Avenue.

Some of the ecological benefits a green roof can provide for the project include better control of storm water runoff, mitigation of the urban heat-island effect, prolongation of the service life of roofing materials, energy conservation and improvement of the aesthetic environment.

**Storm Water Runoff**

Runoff over paved surfaces, such as the concrete pavers on the current roof, tends to be rapid and contributes to destructive flooding, erosion or pollution. The granular consistency of a green roof can slow this process through retention and detention. A typical extensive green roof can retain 2 inches of rainfall, whereas a conventional roof system can only retain 0.40 inches. There may not be as great of a concern for flooding or erosion from a roof in an urban environment, but a reduction in flow allows for a decrease in size for the storm water management system in the building. This means smaller pipe sizes can be used, which in turn provides smaller slab penetrations and an increase in valuable plenum space. Also, a smaller surge will be experienced on the building's sump pumps and the city's sewer and storm water systems during a peak storm. Reductions of up to 65% of runoff have been measured in the District of Columbia. The current impermeable area used in calculation for the site is 22,000 sq ft. In order to earn credit SS 6.1, the volume of runoff must be decreased by 25% of the pre-development runoff rate. The addition of a green roof covering at least 50% of

15,800 sq ft (the building footprint) will reduce the impermeable area by 36% and in turn reduce the flow of runoff. If the following equation was used,

**(Runoff Rate = Runoff Coefficient x Average Intensity of Rainfall x Impermeable Area)**

the runoff rate for the 1 year and 2 year 24-hour storms will be reduced by the same 36%. See **Figure 1.1** below for a sample reduction measurement.

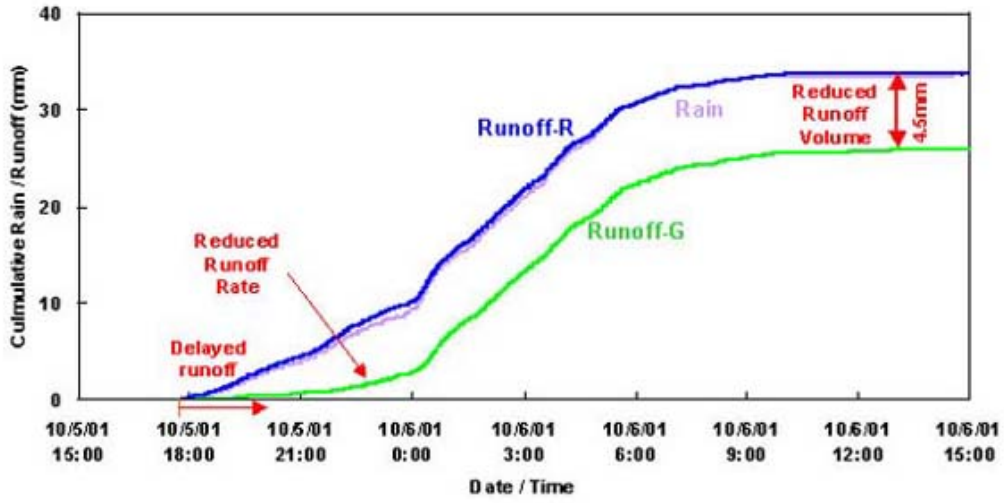



**Figure 1.1** from the National Research Council's Institute for Research in Construction shows the decreases in runoff as measured during a 15 hour period in October of 2001. The graph also indicates that green roofs provide a delay in storm water runoff which prevents surging.

### Urban Heat-Island Effect

The Urban Heat-Island Effect is the temperature difference between an urban area and its surrounding countryside. It is largely due to the large concentration of hard and reflective materials on roofs that absorb solar radiation and release it into the atmosphere as heat. Reduction of this effect can decrease the amount of smog as well as particle matter in the air. It also plays a role in the reduction of greenhouse gas emissions such as sulfur dioxide, nitrogen dioxide and carbon monoxide. Green roofs do this by reducing the air conditioning use and peak load capacities, decreasing outdoor temperatures through evaporative cooling, and reducing collection of particles in the atmosphere by plant leaves.

### Service Life of Roofing Materials

The multiple layers of green roofs preserve the roof materials underneath by protecting against mechanical damage from humans and wind blown elements. It also shields

against ultra-violet radiation and neutralizes temperature extremes that may cause cracking from expansion and contraction. Modern green roof systems have not been installed for a period longer than 35 years; however, researchers expect that the lifespan will be approximately 50 years before any significant repairs will have to be made. Although the initial cost may be greater, this life expectancy exceeds the current span of roofing materials by a factor of 2-3. The current roofing system on 1099 New York Avenue is only to be warranted for 20 years.

**Energy Conservation**

Green roofs serve as a more complex form of insulation than traditional systems. Since cooling is a more energy intensive process than heating, the majority of conservation from green roofs is experienced during the summer when air conditioning loads are at their peak. This is when the capacity to reduce the heat flow in a building is the most beneficial. Please see **Analysis II** for an in depth calculation of the building's peak load requirements following the installation of a green roof system.

**Improvement of the Aesthetic Environment**

Green roofs accessible to the public in commercial environments can provide enhanced property values as well as increased job satisfaction for all employees in the building. Potential clients and future workers will appreciate the garden atmosphere as well as a skylight view of the nation's capital atop their own office building. Not many developments or establishments are able to provide such a setting for its occupants in such a dense urban area.

**Re-Greening Washington, DC**

The American Society of Landscape Architecture (ASLA) has recently proposed a movement under the name of the Casey Trees Endowment Fund. The effort is focused on quantifying the storm water and air quality benefits of green roofs in Washington, DC. The organization states that DC does not meet federal water quality standards for the Anacostia, Potomac, and Rock Creek Rivers and is not meeting federal air quality standards for ground-level ozone and particulate matter. Population, however, is still on the rise as well as the demand for construction. Their goal is to have 80% of all proposed buildings install green roofs and 20% of all existing buildings that are classified as "green roof ready" install green roofs as their current roofing systems require repair or replacement. The Casey Trees Endowment Fund states that this plan would provide 21,700,000 square feet of green roofs inside the district if it is followed through with and adopted by DC Government. The following projections in benefits are to be expected:

- 30 million gallon increase in the city's storm water storage capacity
- 430 million gallons of rainwater stored of the course of a year
- 1.7% reduction in runoff citywide
- 15% decrease in the number of combined sewer overflows discharged each year in to the city's river
- Annual removal of 16.8 tons of air pollutants
- Annual removal of 6.0 tons of ground-level ozone
- Annual removal of 5.7 tons of particles from the air

**Credit SS 9 – Tenant Design and Construction Guidelines**

As part of Tishman Speyer's policy for achieving sustainability, there are certain guidelines that are written into lease agreements that tenants must follow.

- All contractor requests are to include alternative material with minimum percentages of recycled content
- All contractor requests are to include alternatives for low Volatile Organic Compounds (VOCs) in paints, sealants and adhesives
- Standard specifications for green materials will be distributed to assist in sustainable procurement and contracting

In addition to these requirements, Tishman Speyer must also include guidelines that educate and aide the tenants in other areas of sustainable design and construction. As part of these guidelines, a description of the sustainable measures taken on the core and shell construction that delineates the project's intent and objectives for LEED accreditation must be included. The proposed LEED credits in this analysis that are applicable to the project and need to be addressed include:

- Water Use Reduction
- Optimizing Energy Performance (Lighting Power, Controls, & HVAC)
- Energy Use and Metering
- Measurement & Verification
- Construction IAQ Management
- Indoor Chemical and Pollutant Control
- Controllability of Systems
- Thermal Comfort
- Daylighting & Views
- Commissioning

**Credit WE 3.1 – Water Use Reduction**

In order to obtain this credit, water efficiency within the building must be reduced by 20% as compared to the baseline established by the Energy Policy Act of 1992 –

Standards for Plumbing Fixture Water Usage. Those baseline values can be seen in **Table 1.2** below.

| Fixture | Energy Policy Act of 1992 (and as amended) Standards for Plumbing Fixture Water Usage |
|---|---|
| Water Closet (gpf) | 1.60 |
| Urinals (gpf) | 1.00 |
| Showerheads (gpm) | 2.50 |
| Faucets (gpm) | 2.20 |
| Faucet Replacement Aerators (gpm) | 2.20 |
| Metering Faucets (gal/cy) | 0.25 |

**Table 1.2** Baseline values for Plumbing Fixture Water Usage

With the exception of fixture P-3A, the typical lavatory faucet in the building, none of the specified fixtures are below the maximum flow rates outline by the EPA. In order to achieve the 20% reduction in water usage, alternative fixtures by the same manufacturer that provided a lower maximum flow rate were selected as replacements.

- **Change:** Fixture P-3B (ADA Approved Lavatory Faucet) was specified as Chicago Faucets, 786-E3-245 and had a maximum flow rate of 2.2 gpm. It was replaced by a similar model made by Kohler, K-7313-K, that has a maximum flow rate of 2.0 gpm.
  **Cost:** The Chicago Faucet is listed as $273.27. Kohler K-7313-K is listed as $183.15 per fixture. A total savings of $1,980.44 for 22 fixtures.
- **Change:** Fixtures P-6 and P-6A (Shower Heads) were specified as Powers, e425, and had maximum flow rates of 2.5 gpm. They were replaced by Delta, 11W243, a shower head with a maximum flow rate of 2.1 gpm.
  **Cost:** The Powers e425 is listed as $364.99 whereas the Delta 11W243 is listed as $272.09. A total savings of $371.60 for 4 fixtures.
- **Change:** Fixtures P-1 and P-1A (Water Closets) were specified as Sloan, Royal Optima 152, with maximum flow rates of 1.6 gal/flush. They were replaced with a new automated dual flush model by Sloan Eco, 8313-1.6/1.1 with an average flow rate of 1.2 gal/flush. The flushometer can be seen in **Figure 1.2** below.
  **Cost:** The Royal Optima is listed as $707.86 whereas the Sloan Optima G2-8186 can be purchased in tandem with the Eco 8313-1.6/1.1 Retrofit Conversion Kit can be purchased for an additional $701.82. A total savings of $332.20 for 55 fixtures.


**Figure 1.2** The Sloan Royal Optima. As described by Sloan, the user enters the beam's effective range, 2 to 42 inches, the beam is reflected into the Scanner Window to activate the Output Circuit. Once activated, the Output Circuit continues in a "hold" mode for as long as the user remains within the effective range of the sensor. Once a user is detected, if the user leaves in 65 seconds or less, a reduced flush of 1.1 gpf/4.2 Lpf will automatically initiate. If the user stays longer than 65 seconds, a full flush of 1.6 gpf/6.0 Lpf will automatically initiate when the user leaves. The circuit automatically resets and is ready for the next user.

**Tables 1.3 and 1.4** below display the calculations for the water conservation experienced from the alternative fixtures.

| Flow Fixture | Daily Uses | Flow Rate (GPM) | Duration (sec) | Occupants | Water Use (gal) |
|---|---|---|---|---|---|
| Lavatory Faucet P-3A | 3 | 2.2 | 12 | 522 | 689 |
| Lavatory Faucet P-3B | 3 | 2.2 | 15 | 522 | 861 |
| Shower Faucet P-6 | 0.1 | 2.5 | 300 | 522 | 653 |
| Shower Faucet P-6A | 0.1 | 2.5 | 300 | 522 | 653 |
| | | | | | |
| **Flush Fixtures** | | | **Duration (Flush)** | | |
| Flushometer P-1 & P1-A (male) | 1 | 1.6 | 1 | 261 | 418 |
| Flushometer P-1 & P-1A(female) | 3 | 1.6 | 1 | 261 | 1,253 |
| Flushometer P-2A (male) | 2 | 1.0 | 1 | 261 | 522 |
| Flushometer P-2A (female) | 0 | 1.0 | 1 | 261 | 0 |
| | | | | | |
| | | | **Total Daily Volume (gal)** | | 5,048 |
| | | | **Annual Work Days** | | 260 |
| | | | **Total Annual Volume** | | **1,312,412** |

**Table 1.3** Shows the current schedule water usage for the building.

| Flow Fixture | Daily Uses | Flow Rate (GPM) | Duration (sec) | Occupants | Water Use (gal) |
|---|---|---|---|---|---|
| Vola HV1/150 (as Designed) | 3 | 1.0 | 12 | 522 | 313 |
| Kohler K-7313-K | 3 | 2.0 | 15 | 522 | 783 |
| Delta 11W243 | 0.1 | 2.1 | 300 | 522 | 548 |
| Delta 11W243 | 0.1 | 2.1 | 300 | 522 | 548 |
| | | | | | |
| **Flush Fixtures** | | | **Duration (Flush)** | | |
| Sloan 8313-1.6/1.1 Dual Flush | 1 | 1.2 | 1 | 261 | 313 |
| Sloan 8313-1.6/1.1 Dual Flush | 3 | 1.2 | 1 | 261 | 940 |
| Sloan Royal Optima 195 - 0.5 ES-S | 2 | 1.0 | 1 | 261 | 522 |
| Sloan Royal Optima 195 - 0.5 ES-S | 0 | 1.0 | 1 | 261 | 0 |
| | | | | **Total Daily Volume (gal)** | 3,967 |
| | | | | **Annual Work Days** | 260 |
| | | | | **Total Annual Volume** | **1,031,472** |

**Table 1.4** Shows the scheduled usage after the addition of more efficient fixtures.

As calculated in the tables above, the baseline volume annual water usage for 1099 New York Avenue is observed at **1,312,412 gallons**. With the installation of the more efficient fixtures in lieu of the specified fixtures the annual water usage becomes **1,031,472 gallons.** This can be calculated as an average savings of **280,940 gallons** per year, or **21.4%,** which meets the minimum of 20% for the credit. The current rate for water usage in the District of Columbia is **$2.14/ccf**. This would mean that Tishman Speyer and their future tenants would save approximately **$400** annually on their water utility.

**Credit EA 1 – Optimize Energy Performance**

The intent of earning this credit is to increase the level of energy performance above the baseline established in ASHARE 90.1 and in turn, reduce the environmental and economical impacts associated with energy usage. To earn one point in this category, the project must obtain a minimum of 10.5% in energy cost savings. An additional point will be given (up to 8 points total) for each 3.5% of savings. This can be calculated by performing a Building Energy Simulation and comparing the results with the baseline model. The default energy cost is 25% of the total energy cost for the baseline building. As mentioned in the first part of this analysis, 1099 New York Avenue exceeds the baseline performance by 0.95%.

Optimizing energy performance generally requires decreasing the demand on the HVAC System and in turn the load for sizing the equipment. Decreasing the load can be as simple as the changing design of the lighting or the types of computer monitors that are to be used. Down lighting is preferred as well as increased task lighting. Occupancy sensors during off hours also contribute to a reduced load. In terms of office equipment, flat panel LCD computer monitors produce the least amount of heat. On the other hand some solutions can are more complex such as monitoring the efficiency of the building envelope. 1099 New York Avenue is entirely glass on its South and West elevations. This can aide with heating and lighting loads, but it makes it more difficult to cool spaces in the summer. Adding automated solar shades that function based on the sun's position and time of day, in combination with dimming ballasts controlled by photosensors, can reduce lighting levels by approximately 20%. Increasing the air space between the panes of glass or enhancing the glazing so that it has a lower U-Value can provide better insulation of the curtain wall.

As mentioned previously, the addition of a green roof can also increase a building's energy performance. Please see Analysis II for an in depth calculation.

**Materials and Resources Prerequisite (No Credit Given)**

A building the size of 1099 New York Avenue requires a minimum of 275 sq. ft. to serve as a collection and storage area for all materials to be recycled on the project. These materials include paper, corrugated cardboard, glass, plastics, and metals. The Loading Dock area, which is located to the east of the building, is nearly 960 sq. ft. in area and is easily accessible from the public alley. This is currently where all waste materials on the project are being collected. As tenant construction begins and the construction area decreases, this area should still be able to provide adequate area for collecting and storing recyclable materials and still be functional as a loading dock.

**Credit MR 2.1 & Credit MR 2.2 – Construction Waste Management**

James G. Davis Construction Corporation currently has a developed waste management plan which they implement on all of their LEED projects. The provisions of this plan state that 75% of the waste material by weight generated on site will be diverted from disposal and recycled or salvaged for reuse.

Landfill diversion measures include targeting specific trades for their waste avoidance, donating reusable materials to charities such as Habitat for Humanity, and recycling those that cannot be salvaged or reused. Implementation is an effort on behalf of every member of the project team. Superintendents, subcontractors, and site workers are

trained prior to start of construction. DAVIS superintendents are there to monitor waste on a daily basis, but subcontractors are required by their subcontract agreement to comply with all aspects of the plan.

**Credit MR 4.1 – Recycled Content**

Earning this credit requires that 10% (based on cost) of the total materials on the project consist of both post-consumer and pre-consumer recycled content. Post-consumer content is defined as waste material that can no longer be used for its intended purpose. Pre-consumer waste is defined as material diverted from the waste stream during the manufacturing process. Other materials such as scraps that are generated from a process in which they can be reused are excluded from this classification. The ratio of the 10% recycled content is post-consumer + ½ pre-consumer.

As mentioned before, the total cost of materials is assumed to be 40% of the total cost of construction for CSI Divisions 2-10 is $9,150,000. NewCem, a concrete additive used on the project, is considered to be post-consumer recycled content. Its cost makes up 1.17% of the material cost, leaving only another $800,000 in recycled material to be purchased as a replacement for use on the project.

**Credit MR 6 – Certified Wood**

Since this is a core and shell project and there is now wood framing on the project, this credit is not an expensive one to obtain. In order to meet the requirement for this credit, 50% of the wood (by value) used for the wood doors, furniture, and solid surfacing must by certified in accordance with the Forest Stewardship Council Principals and Criteria for wood building components. The FSC criterion guarantees that all wood products are harvested from well-managed forests around the country. This requirement can be easily written into construction specifications and subcontracts. All proof is the burden of the subcontractor.

**Indoor Environmental Quality Prerequisite 1 (No Credit Given)**

This credit requires that the building's ventilation system complies with the guidelines established in section 4-7 of ASHARE 62.1, Ventilation for Acceptable Indoor Air Quality. The code applies to all indoor or enclosed spaces that people may occupy regularly. There are two methods for determining the minimum ventilation rates: the Ventilation Rate Procedure, which is the most commonly used, and the Indoor Air Quality Procedure. As outlined in the code, the breathing zone outdoor airflow must be greater than or equal to the sum of the outdoor airflow required per person times the zone population, plus the outdoor air flow rate required per unit area times the zone floor

area. The purpose of this prerequisite is to demonstrate that the building's delivered outdoor air or outdoor air intake is an adequate, healthy indoor environment.

**Credit EQ 1 – Outdoor Air Delivery Monitoring**

This credit can be obtained by locating $CO_2$ sensors in the return ducts at each level. These locations will confirm that the ventilation system is functioning properly. Typically, these sensors are set for an indoor concentration of 1000 ppm before alarming. Because the building is designed to be mechanically ventilated, an air flow monitoring station will have to be provided at the outdoor air intake. In doing so, the measured ventilation rate can be directly compared with the minimum rate required.

**Credit EQ 3 – Construction Indoor Air Quality Management Plan**

Davis Construction currently enforces a Construction Indoor Air Quality Management Plan on all of their LEED Projects. The plan restricts the use of permanently installed HVAC equipment until commissioning and keeps it protected from dust and odors that may be produced from construction activity. Only low-emitting materials as specified in Credits EQ 4.1, 4.2, 4.3, & 4.4 are to be are to be used within the building envelope. Work areas are to be well ventilated with outdoor air, and regular cleaning is scheduled to control contamination. Construction activities that require the use of highly polluting materials must be completed during off hours to ensure the health of other construction crews as well. The plan was previously used for a retail/office project at Potomac Yard in Arlington, Virginia (a LEED Gold project). It could easily be transferred to meet the core & shell requirements of 1099 New York Avenue.

**Credit EQ 4.1, 4.2, 4.3, 4.4 – Low-Emitting Materials (3 Points)**

The intent of these credits is to reduce the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and applicants. This refers to all materials applied on-site within the weatherproofing system such as adhesives & sealants, paints & coatings, carpet systems and composite wood. These materials are still permitted on the project, but are limited to certain Volatile Organic Compound (VOC) levels. For instance, indoor carpet adhesives have a VOC density limit of 50 grams/liter (less water). Several manufacturers already make products that meet these specifications. Similar to using certified wood, this guideline can easily be written into construction specifications. It is already part of Tishman Speyer's contract agreement for future tenant construction.

**Credit EQ 5 – Indoor Chemical & Pollutant Source Control**

The purpose of this credit is to minimize the exposure of harmful pollutants to the building's occupants. On a core and shell project, the majority of this responsibility is placed on the tenants; however, there are several things the building developer can still to do help earn this credit. One way to do this is to provide adequate ventilation of hazardous gases and chemicals that may be present in the building. The primary location of these pollutants is in the below grade parking garage. In underground parking garages, the exhaust rate should be a minimum of 0.5 cfm/sq ft. Currently, the exhaust fans that are installed are set to perform at 24,000 cfm at each level. This is more than sufficient in a space of 15,800 sq ft. In order to complete this credit, it is recommended that exhaust fans be installed by the tenants in each work room that contains copy machines, printers and fax equipment. This equipment should also be located in rooms that have self closing doors to assure the toxins do not escape.

Air filtration is another area for pollutant control. In mechanically ventilated buildings, such as 1099 New York Avenue, all regularly occupied areas require air filtration media prior to occupancy that provides a Minimum Efficiency Reporting Value (MERV) of 13 or better. This rating refers to the average particle size (in ppm) that passes through the media. Filters with this rating are not specified for this project.

Dirt and particles from the outdoors that may be carried in on the feet of the building's occupants must also be monitored. Control of this requires the employment of permanent entryway systems of at least six feet in length in the primary direction of travel, which the building already has completed. However, within this entryway system there must also be grates, grilles, or slotted systems similar to the one depicted in **Figure 1.3** below that allow for cleaning underneath to collect dirt particles. Roll out mats may be substituted if they are maintained by a third party on a weekly basis.

**Figure 1.3** Depicts a standard entrance grate system. The tops of each strip can be finished with carpet, bristles, vinyl, or aluminum.

## Conclusion & Recommendations

When implemented at the right phase of the design, building green is not a difficult feat to accomplish. Once the decision to go green has been made, the planning, design, and construction phases all become a team effort, but the responsibility of creating the guidelines to follow lies heavily on the owner of the project. The location for the project, the types of materials to be chosen, the energy performance requirements, and construction methods are all important factors in how the building will be rated. The previous analysis explained 26 areas where LEED credits could have been earned in an effort towards a Silver Rating for 1099 New York Avenue and set goals for all other future Tishman Speyer projects to obtain. Many of which were very simple alterations such as installing bicycle racks, others such as increasing energy efficiency required some engineering.

Cost is always a matter of discussion in the construction industry, especially with LEED projects since they typically have a higher initial cost than a non-LEED project. A recent study by Davis Langdon in 2007; however, proved that this statistic is more myth than fact. The study compared the overall cost of several different types of projects (academic, laboratory, library, and ambulatory care facilities) and found that the cost of going green is actually quite comparable if not less than a standard project. The collected data can be seen in the figures below.

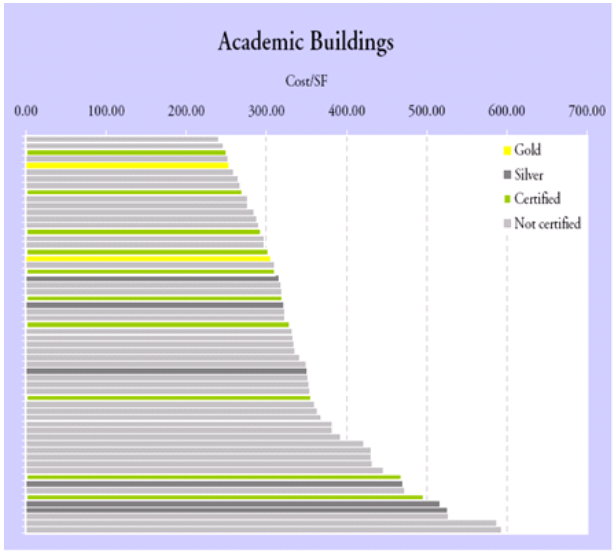



**Figure 1.4a**

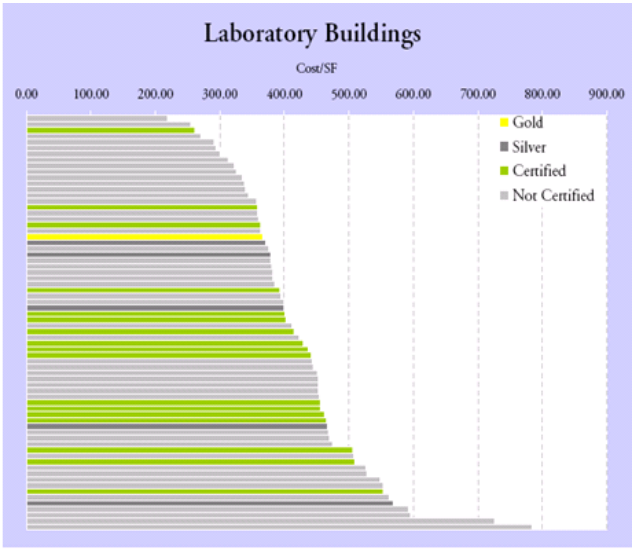



**Figure 1.4b**

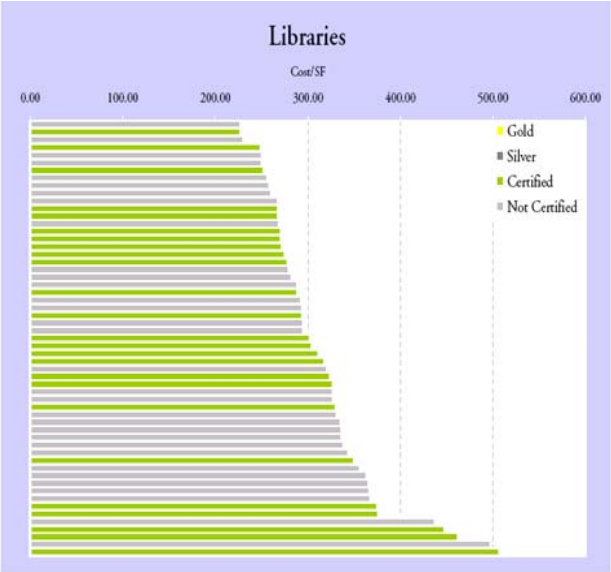



**Figure 1.4c**

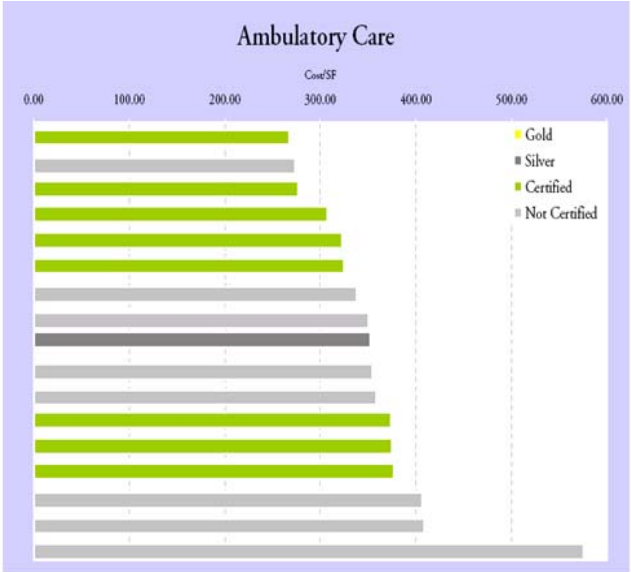



**Figure 1.4d**

**Figures 1.4a through 1.4d** Depict the results of a cost comparison between LEED and non-LEED projects as determined by Davis Langdon in 2007

It was determined that there is a large variation of costs on both green and non-green projects. You can have an expensive LEED project and a lower costing one, but the same can be said for non-LEED projects. The total cost will be primarily controlled by the overall program for the building. The benefit of building green, however, is that a sustainable building will pay for itself through savings over time. Studies by the United States Green Building Council have shown that on average, 1%-2% of the construction cost is paid back per year in energy savings alone.

Tishman Speyer has already made movements in the right direction by setting a goal for all new projects to achieve a LEED Silver Rating. The next step is to develop the guidelines and course of action designers and contractors are to take in order to obtain that goal.