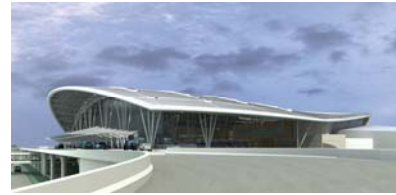


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## Sustainable Design Breadth

### Introduction

The Indianapolis International Airport has just begun its construction 8 months ago in August 2005. Although the design is finalized by the design architects, however, I do propose here that several adjustment made in my schematic lighting design and architectural integration can potentially help yielding more points in LEED (Leadership in Energy & Environmental Design) certification issued by USGBC(United States Green Building Councils). The original design intent of this airport is to become the first high-tech and sustainably built airport since the Post-911 terrorist attack period. A thorough research and analysis has been performed on the existing condition in addition to my proposed Sustainable Design Study, in order to improve the building's sustainability features and achieving a higher LEED-NC(New Construction & Major Renovation) rating.

### LEED Certification Levels:

|           |            |
|-----------|------------|
| Certified | 26 to 32   |
| Silver    | 33 to 38   |
| Gold      | 39 to 51   |
| Platinum  | 52 or more |

### Existing Sustainable Design Features

#### Sustainable Sites Category:

Credits Earned:

1. Site Selection (1)
2. Development Density (1)
3. Brownfield Redevelopment (1)
4. Reduced Site Disturbance (1)
5. Stormwater Management (1)
6. Heat Island Effect (1)

#### Water Efficiency Category:

Credits Earned:

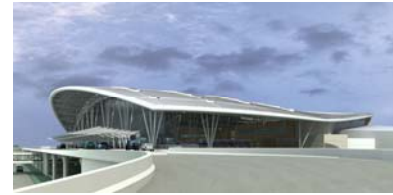
7. Water Use Reduction (1)
8. Water Efficient Landscaping (1)

#### Energy & Atmosphere Category:

Credits Earned:

9. Optimize Energy Performance(6)

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10. Additional Commissioning (1)

**Materials & Resources Category:**

Credits Earned:

- 11. Construction Waste Management (1)
- 12. Resource Reuse (2)
- 13. Recycled Content (2)
- 14. Local/Regional Materials (2)
- 15. Certified Wood (1)

**Indoor Environment Category:**

Credits Earned:

- 16. Carbon Dioxide (CO2) Monitoring (1)
- 17. Construction IAQ Management Plan (2)
- 18. Low Emitting Materials (4)
- 19. Indoor Chemical & Pollutant Source Control (1)
- 20. Thermal Comfort (2)
- 21. Daylight & Views (1)

**Innovation & Design Process Category:**

Credits Earned:

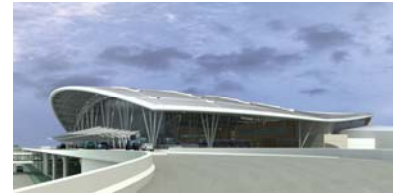
- 22. LEED Accredited Professional (1)

Total Credits Earned: 34 Credits (Silver Certification Standing)

**Brief Narrative**

- The airport currently is not using all the available land at the site, and is a highly compressed development to minimize building footprint and land usage. (2,4)
- The building itself is a structural steel frame set on all local concrete with a high-performance glass envelope. Some 4,815 tons of asphalt and 2,433 tons of concrete from existing pavement has been rubbleized and reused as infill for the terminal project. (11,12,13,14)
- Using regional (within a 500-mile radius) materials in the construction and local and regional plants in the landscaping. (14)
- Materials such as adhesives, sealants, glues, concrete curing compounds, and solvents are also closely monitored to ensure they are low-emitting VOCs (Volatile Organic Compounds). (16,17,18)
- The project team has been proactive in certification of what wood is used on the project, making a concerted effort to ensure that wood is taken from Forest Stewardship Council control-managed forests. They are also working with construction managers on the project to enforce construction waste management. (11,15)

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- Inside the new terminal, recycling stations are included in the design, with one major one in the main terminal and a smaller station in each of the two concourses. (*Materials & Resources Prerequisite*)
- The Mid-field Terminal will combine natural daylighting and high-efficiency systems to significantly reduce its energy consumption. The terminal's roof, for example, has been designed to manage storm water, to lower the amount of heat on the building and to allow as much daylight as possible into the building. Meanwhile, designers(including myself) are working carefully to ensure the new terminal does not release unnecessary light pollution to the night sky. (9)
- A new two-tiered glycol recovery system will be installed beneath the ramp(arrival), which will allow for separate collection of high- and low-concentrated stormwater runoff. The high-concentrate runoff could be collected for recycling, while the low-concentrate would be collected for treatment. (5)
- The savings in jet fuel for the carriers and preconditioned air at the gates will result in less pollution. Additionally, the use of rechargeable electric tugs and other alternative fuels in airport vehicles will provide cleaner burning fuel options. (9)

(Qualified for earned credit from categories above)

### Design Criteria

To follow and meet with all the guidelines established by the United States Green Building Council (USGBC) in order to achieve more credits for LEED certification.

### Design Goals

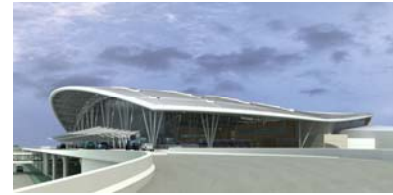
The building currently holds an expected LEED silver rating. With the modification I put forth, the airport will gain from the following LEED credits; hopefully I will be able to elevate it through design excellence to a LEED Gold rating status:

1. Lighting Pollution Reduction (*Sustainable Site*)
2. Rapidly Renewable Materials (*Materials & Resources*)
3. Innovation in Design (*Innovation & Design Process*)

### Construction Management Outlook

Building an airport that is environmentally friendly and sustainable does not have to mean additional cost. In some instances, the upfront cost was lower than traditional materials or practices, and the long-term energy savings and sustainability of the structure will benefit the airport

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## Lighting Pollution

**Intent:** Eliminate light trespass from the building and site, improve night sky access and reduce development impact on nocturnal environments.<sup>1</sup>

**Requirements:** Meet or provide lower light levels and uniformity ratios than those recommended by the Illuminating Engineering Society of North America (IESNA) Recommended Practice Manual: Lighting for Exterior Environments (RP-33-99). Design exterior lighting such that all exterior luminaires with more than 1000 initial lamp lumens are shielded and all luminaires with more than 3500 initial lamp lumens meet the Full Cutoff IESNA Classification. The maximum candela value of all interior lighting shall fall within the building (not out through windows) and the maximum candela value of all exterior lighting shall fall within property. Any luminaire within a distance of 2.5 times its mounting height from the property boundary shall have shielding such that no light from that luminaire crosses the property boundary.<sup>2</sup>

**Solution:** For exterior, by reducing the lighting fixtures to half of its original amount as of Design Development phase, with a new set of fully shielded fixtures, new aiming angles and distribution configurations (see Exterior Lighting Depth) that will allow all the light to fall within the property (roof overhang), and prevent any lights shooting directly into the night sky. The perimeter luminaires that are currently utilized to uplift the North and South façades are all taken out in order to maintain a light-pollution-free outdoor environment. Secondly, for the curtain wall over at landside along the Ticket Hall, interior fixtures are also specified to include a full cut off shielding, re-aimed toward the inside roof of the Ticket Hall. Meanwhile, the operable roof blind for the skylight will shield off any lights traveling upward into the sky, making the roof a completely night-sky friendly enclosure.

**Synergy & Tradeoffs:** With the reduction of lighting fixtures outside, lower light levels cannot achieve the same contrast level as well as the kind of accent effect that higher light levels can produce.

## Rapidly Renewable Materials & Innovation in Design

**Intent:** To provide design teams and projects the opportunity to be awarded points for exceptional performance above the requirements set by the LEED Green Buildings Rating System and/or innovative performance in Green Building categories not specifically addressed by the LEED Green Building Rating System.<sup>3</sup>

**Requirement:** Identify the intent of the proposed innovation credit, the proposed requirements for compliance, the proposed submittals to demonstrate compliance, and the design approach (strategies) that might be used to meet the requirements.<sup>4,5</sup>

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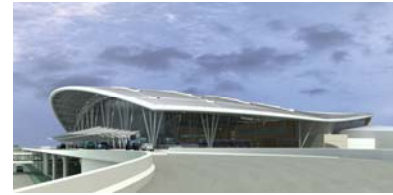
<sup>1</sup> Inserted from the USGBC LEED Reference Guide, for New Construction & Major Renovations (LEED-NC) Version 2.1. Second Edition, May 2003.

<sup>2</sup> Inserted from the USGBC LEED Reference Guide, for New Construction & Major Renovations (LEED-NC) Version 2.1. Second Edition, May 2003.

<sup>3</sup> Inserted from the USGBC LEED Reference Guide, for New Construction & Major Renovations (LEED-NC) Version 2.1. Second Edition, May 2003.

<sup>4</sup> Inserted from the USGBC LEED Reference Guide, for New Construction & Major Renovations (LEED-NC) Version 2.1. Second Edition, May 2003.

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**Solution:** By utilizing massive plantation in the Civic Plaza, we are creating an artificial nature within a confined boundary, as I would like to call it an Urban Jungle or a Civic Garden rather than a Civic Plaza. This area of greenery provides a breath of fresh air, lowers indoor carbon dioxides level, provides a very organic way of shielding end-users from the harsh sunlight and glares from the giant skylight above them. The trees can also serve as a temperature barrier, provides cooling during summer months when direct heat gain from the skylight above and cause thermal comfort issues. In terms of the construction and material aspect of the massive plantation, this action can harvest at least 10% of the trees that were chopped off prior to the construction. While planting trees requires earth/soil to be its base, we can scrap off up to 50% of existing flooring, replacing them with locally harvest soil can count as dematerialization, resulting in a lower cost in construction simply because less is used. Replanting Trees can easily be qualified and yield as an extra credit for the Construction Waste Management, Resource Reuse(1), Regional Materials(1), Rapidly Renewable Materials(1) Category.

**Synergy & Tradeoffs:** Potential bug and moisture problems can occur if the foliage are not properly maintained during humid seasons.

### Conclusion

For both the Lighting Pollution solution, these particular adjustments will meet and exceed with the LEED exterior and interior lighting pollution requirement, earning an extra credit in the Sustainable Site Category. As far as the massive plantation scheme goes, Rapidly Renewable Materials is the one credit can be confidently secured. With careful documentation and negotiation during the submittal, we can conservatively estimate that: two to four additional LEED credits can potentially be acquired through my design solutions. However, in conclusion, they are not sufficient to meet the minimum 39 credits that a LEED Gold Certification requires, it still serves the environment right, and we as the occupants of this planets will reap from this benefits ultimately.

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<sup>5</sup> Since it is for thesis design purposes, I will ignore the submittal requirement of this study.