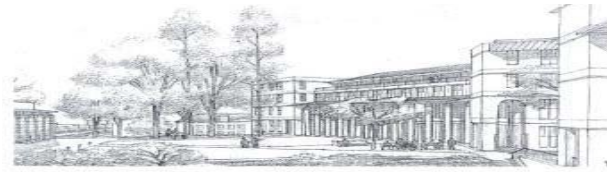


**Analysis I – Additional LEED Points:
Materials & Resources**



Analysis I – Additional LEED Points: Materials & Resources

Overview:

This analysis came about in the form of a request. There were points in the materials and resources section of the LEED scorecard that were suggested but not pursued by Holder. I gathered the information to determine what it would take to gain the points for rapidly renewable materials, as well as diverting 75% of construction waste materials. I priced the proposed materials alternatives, and found that they were less expensive, but also less durable materials than originally proposed. As for the 75% construction waste diversion, a rather clever idea was implemented. Speaking with the project manager, it was determined that the tower crane pad, as well as site asphalt could be recycled, and it would put the total waste diverted over 75%. A simple calculation for the weight of the tower pad and an estimate from the jobsite for asphalt showed an increase from roughly 62% to 86% waste diverted.

Background:

When I first began to study this project, I was interested in the LEED points it was being awarded and the areas that Holder was pursuing to earn those points. I received a copy of the project's LEED scorecard which is broken down into the following six categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation & Design Process. My first task was to study the points that Holder had already been awarded, and which areas my research would be most useful. In doing so, I was able to discern several things. First, within the materials and resources category, the project was set to receive only one of a possible 13 points. I spoke with the project manager about the points available in this category and he told me that there were several they looked into, but decided not to pursue. I took this opportunity to determine what it would take to gain two additional points in this section, and what impact it would have on the project.



I also determined that there are several points being awarded which do not have nearly as strong of an environmental impact as the items in the materials section. There are four points alone being awarded in the “alternative transportation” section. This section has been targeted for its easy and inexpensive points to be awarded, but they do little for the building itself as an environmentally aware facility. Being on a large university campus, it is likely that the majority of the people using the building will be students, who are almost all walking or riding bikes to class already. A public university would be providing access for buses and bicycle racks regardless of its LEED rating. Yes, the addition of a bicycle rack and public transportation access are helpful, but using recycled materials or rapidly renewable materials has a much more direct environmental impact.

Proposed Solution:

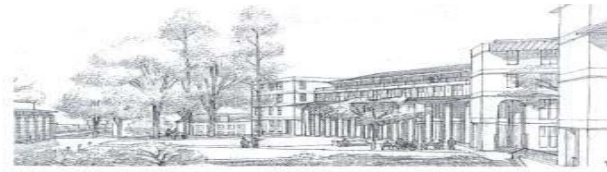
Now knowing that I am aiming to add two points under the materials and resources section, I had to narrow this down to the specific areas within the materials and resources section. I worked closely with the project manager to determine which areas would be best to look into, and it was determined that the *rapidly renewable materials* and the *construction waste* sections would be of most interest and benefit.

Rapidly Renewable Materials:

For the first point, under the rapidly renewable materials section, I had to go through a number of steps to successfully determine a means to earn this point. First I found a small list of materials that would meet the requirements of this section. The requirements are as follows:

Intent: Reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.

Requirements: Use rapidly renewable building materials and products (made from plants that are typically harvested within a ten-year cycle or shorter) for 5% of the total value of all building materials and products used in the project.



The materials I looked into were Tile, Millwork, and Doors. Table 1 breaks down the materials which are currently being installed in the building, and the materials that were determined for use in earning the point for rapidly renewable materials.

Table 1: List of Materials and Alternative Choices

Current Material	Proposed Alternative
Porcelain and Quarry Tile	Bamboo Flooring
Millwork: Cherry Wood	Poplar Wood
Wood Door Frames Wood Base	Wood Door Frames Wood Base
Particleboard Core Wood Doors	Particleboard Core Doors (Aspen, Poplar, Basswood Core)

*The materials chosen satisfy the 5% of the total building material requirement.

When choosing material alternatives, I used the general suggestions of materials that Holder had determined during their preliminary discussion of this LEED point. They thought that this would be a good opportunity to see the cost and availability implications of finding these alternative materials for use in the building. It was also a good opportunity to see what kind of research and work goes into earning a particular LEED point, as it is likely that an owner would request that a specific point be earned.

This is what I found when researching the materials listed in the chart above. Using poplar wood for such millwork items as door frames and wood base was the first alternative. Poplar has a harvest cycle of less than 10 years, so it is deemed a rapidly renewable material. It is a hardwood, as is called for in the specifications, and is an excellent staining wood (see Figure 3). I have read in several wood comparisons that poplar is an excellent alternative for cherry if the wood is to be stained, and that the final appearance is very close to that of stained cherry. The cost of poplar tended to run around 60% less than that of cherry products. This was my basis for the cost comparison.

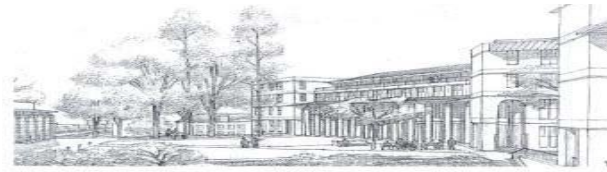
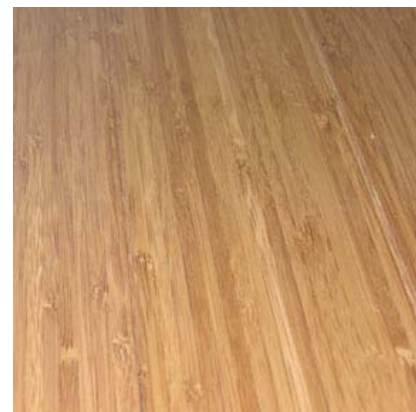


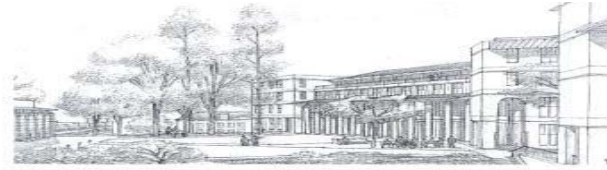
Figure 3: Cherry wood (Left) and Poplar wood (Right)

The second suggestion was to use wheat straw core doors in place of the solid core doors. I found an alternative door made by Marshfield Door Systems, who are listed in the specifications as an acceptable manufacturer for wood doors on the project. The doors have a particleboard core that consists of aspen, poplar and basswood and are certified to comply with the rapidly renewable material requirement. They also have the required 20 minute positive pressure fire rating. I spoke with a contractor that installs Marshfield doors and he quoted me the price per door. There are several available door styles, all of which are available with a particleboard core. Being that the face of the door remains the same, this makes for an easy replacement with the solid core doors currently on the project.

Figure 4: Bamboo Flooring

The final material suggestion was to look into bamboo flooring in place of the porcelain and quarry tile in the building (Figure 4). This alternative is the most visually different from the original material, but it is still a valid alternative nonetheless. Bamboo is a very durable flooring option, and is also quite visually appealing. The use of bamboo flooring in the building would have to be a judgment call on the owner's part, but the quality and value of this floor system are both very high.





Millwork

Material	Quantity	Unit	Unit Cost	Total Cost
Cherry Door Frames	42	frame	\$1,000.00	\$42,000.00
Cherry Wood Base	2150	lf	\$14.00	\$30,100.00
Poplar Door Frames	42	frame	\$400.00	\$16,800.00
Poplar Wood Base	2150	lf	\$5.60	\$12,040.00

Doors

Material	Quantity	Unit	Unit Cost	Total Cost
Particleboard Core Doors	213	door	\$450.00	\$95,850.00
Particleboard Core Doors (Aspen, Poplar, Basswood)	213	door	\$200.00	\$42,600.00

Tile

Material	Quantity	Unit	Unit Cost	Total Cost
Quarry Tile	1450	sf	\$4.04	\$5,858.00
Porcelain Tile	4500	sf	\$5.16	\$23,220.00
Bamboo Flooring	5950	sf	\$4.83	\$28,738.50
Original Materials		Grand Total:		\$197,028.00
Alternative Materials		Grand Total:		\$100,178.50
		Savings:		\$96,849.50

Table 2: Cost comparison of original materials vs. chosen alternatives

Rapidly Renewable Materials Conclusions:

From Table 2, it is easy to see that the alternative materials are less expensive, producing a savings of almost \$97,000. This was not the original intention of this analysis. Green alternatives may be most costly in some cases, but cost is not the main issue here. When determining alternative materials to add LEED points to a project, the idea is to find materials of the same quality but also satisfy the LEED requirements. When I speak of quality, I mean durability and overall performance. For example, poplar wood is a slightly softer hardwood than cherry. This is not likely to be a substantial difference, however. After applying stain and sealer, the wood will be well protected in either case. For the particleboard core doors, there is no difference in quality at all, the cores are merely made from rapidly renewable woods. Finally, for the bamboo flooring the durability is not an issue, but the appearance may be not what the owner would like. Overall, I feel that these alternatives match up fairly well with the original materials and if this point were to be requested, they would be a smart choice.



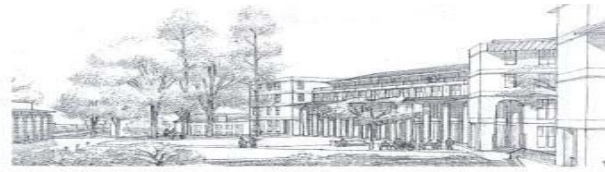
Construction Waste:

This section is based on diverting construction waste to be recycled, and is based on weight of material diverted. One LEED point is awarded for diverting 50% of waste material to a recycling facility, and an additional point is awarded for diverting 75% or greater. Holder has kept a log containing all the recycling information, and they were on target to achieve the 50%, but were striving to reach the 75% by the end of the project.

Discussing this portion of the analysis with the project manager, we worked to determine another source of materials to be recycled, thus increasing the total weight of waste diverted. I brought up concrete and asphalt, two heavy materials that may have opportunities for additional recycling. I asked what concrete they had been recycling currently, and what was still on site. I soon discovered that there was an abundance of site concrete and asphalt that they had not thought to recycle. In addition to those, there was yet another source of concrete that is normally overlooked, the tower crane pad. On most projects, this pad is just buried after the tower crane is removed. Running a quick calculation, I determined that an extra 120 tons of concrete could be diverted from recycling the 20' x 20' x 4' tower crane pad.

Construction Waste Conclusions:

They implemented these ideas and in the month of January, as shown in Table 3 on the following page, there was a substantial amount of concrete and asphalt material that was able to be recycled. The tower crane pad alone increased the total percentage from 77% to 86%. This can be a tip for contractors who are looking for materials to recycle. If you have poured a pad for your tower crane, recycle it instead of burying it!



Construction Phase Monthly Totals									
Months	Waste	Metal	Concrete	Wood	Gypsum Board	Asphalt	Total Waste in Tons	Total Recycled	Recycling Rate
April, 2004	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0%
May, 2004	17.07	0.00	0.00	0.00	0.00		17.07	0.00	0%
June, 2004	4.82	7.06	25.59	1.67	0.00		39.14	34.32	88%
July, 2004	2.69	6.13	50.34	7.43	0.00		66.59	63.90	96%
August, 2004	12.43	4.26	19.69	9.43	0.00		45.81	33.38	73%
September, 2004	19.58	5.72	28.09	11.91	0.00		65.30	45.72	70%
October, 2004	22.25	15.55	16.88	12.70	0.00		67.38	45.13	67%
November, 2004	26.72	5.94	11.27	6.50	0.00		50.43	23.71	47%
December, 2004	28.19	7.84	13.19	6.37	4.12		59.71	31.52	53%
January, 2005	26.24	15.25	507.49	8.87	42.08	192.46	792.39	766.15	97%
February, 2005	19.68	6.40	0.00	8.33	42.55	0.00	76.96	57.28	74%
March, 2005	0.00	0.00	0.00	1.87	10.22	0.00	12.09	12.09	100%
Totals	179.67	74.15	672.54	75.08	98.97	192.46	1292.87	1113.20	86%

Table 3: Waste diversion spreadsheet showing total waste recycled per month

Analysis / Conclusions:

Having gone through this analysis, I was able to perform a task that would very likely be asked of a contractor, to determine what it would take to earn certain LEED points at an owner's request. When approaching a request such as this, it is important to remember that constructing a green building means much more than using environmentally friendly materials and recycling. A green building should be of the same high quality as one which is not striving for LEED certification, if not higher. As I stated before, quality comes from the materials performance over the life of its use. It is not a luxury issue, high end and elegant items in place of plain ones. This is using materials that will last as long as the ones they are replacing, and will satisfy the LEED requirements as well. I have learned that there is much work to be done to achieve such a goal, and a sense of pride can be taken if it is reached.