The LEED criteria considered below are the ones that can be achieved by utilizing resources in and around Blacksburg. The guide lists some of the resources which can be utilized

Abstract

The scenic town of Blacksburg is very environmentally conscious. The town encourages environmentally friendly projects and LEED certified projects. If the city has a resource guide which helps the developers who are interested in building projects which helps them to find out all the resources offered by the city, which helps them achieve LEED credits, it will go a long way in encouraging green construction.

Keywords: Green Buildings, LEED ratings

INTRODUCTION

The US Green Building Council (USGBC) works to develop industry standards, design guidelines, policy positions, conferences and educational tools that support the adoption of sustainable design and building practices. They developed a system to help them define which building is a "green building" and came up with LEED[1]. Leadership in Energy and Environmental Design (LEED^{TM}) is a Green Building Rating system which is a nationally accepted benchmark for design, construction and maintenance of high performance green buildings. A whole building approach to sustainability of promoted by measuring performance in key areas of human and environmental health; sustainable site development, water savings energy efficiency, materials selection and indoor environmental quality[2].

Based on a project's fulfillment of the LEED criteria, the projects are given points and certified.

SUSTAINABLE SITES

Buildings affect the ecosystem of the surrounding area, the location of the site should be such that it avoids areas like endangered species habitat, open spaces agricultural land etc. This credit deals with the development density of the project area, accessibility to public transport facilities (to reduce dependency on automobiles which are a major cause for air pollution) and also pollution caused due to construction activities.

Construction Activity Pollution Prevention

In order to meet the prerequisite and qualify for any LEED points in this category, measures should be taken to prevent the loss of soil by runoff, preventing sedimentation of storm sewer, and preventing air pollution due to the construction activities. The civil engineer should identify the soil erosion areas and incorporate an erosion prevention plan.

Simple points to consider for this prerequisite [3]

- Limit staging areas on the site as much as possible
- Protect the top soil during the construction process
- The pervious surfaces can be preserved by limiting vehicular traffic, equipment, materials and workers
- Use erosion and sediment pollution control program manual
- Try to maintain existing topography, terrain, tree and vegetation population
- Make efforts to reduce air emissions due to construction processes

Site Selection

GIS resources were obtained from Katherine Smith, GIS Coordinator, Blacksburg[4]. Maps showing open spaces, future open spaces, creek valley overlays etc were obtained. The site selected should be such that it should have a minimal or no impact on the surrounding ecosystem and habitat. Development should not be carried out in such areas to get LEED points for this criterion.

Simple points to consider for this credit

- Do not consider sites designated as open spaces
- Avoid sites which house endangered species
- Avoid flood plains
- Try to develop on brownfields

Following map shows the areas in Blacksburg which are not suitable for development with respect to LEED points. Avoiding these areas would fulfill this criterion.

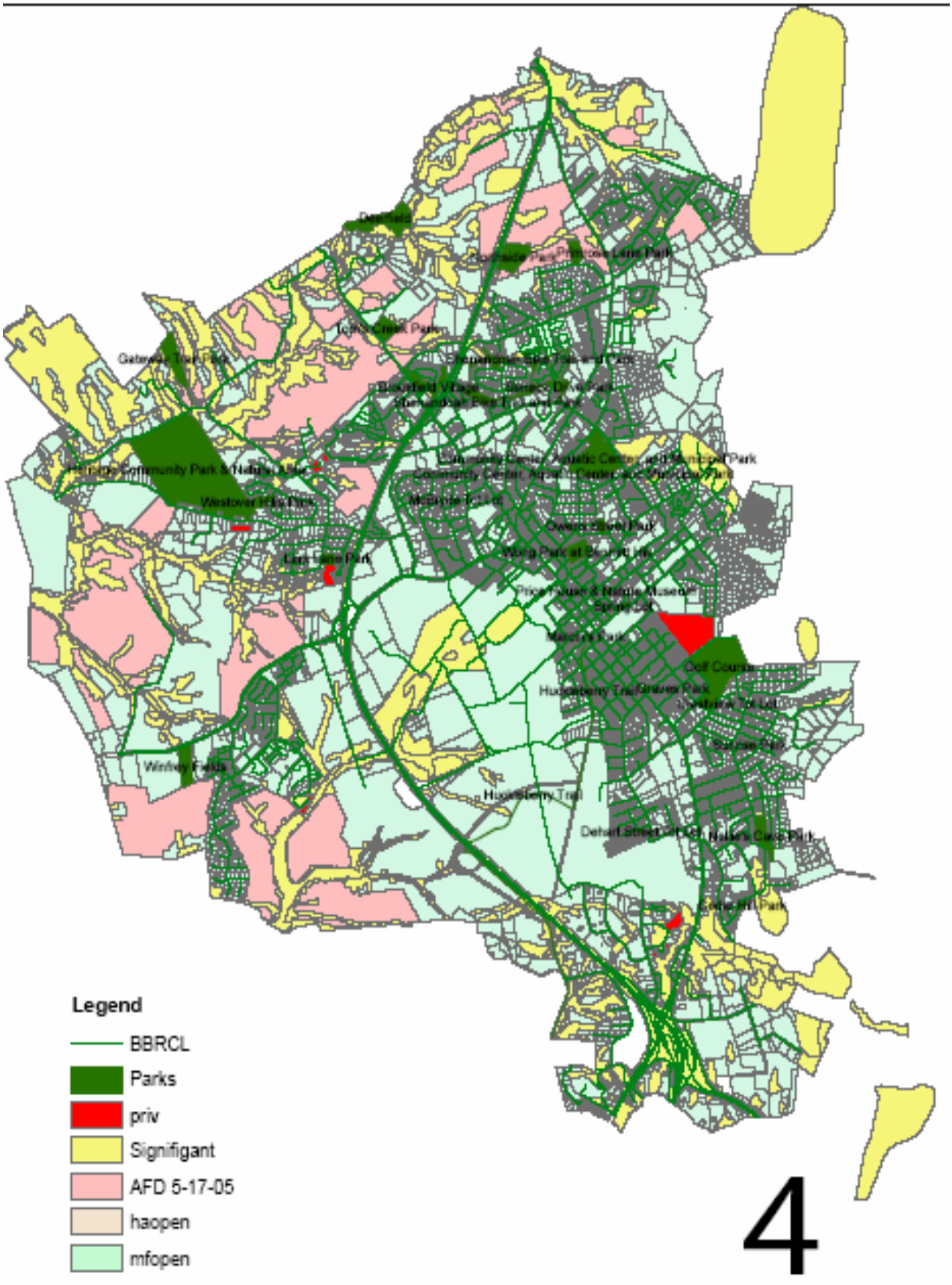

Fig 1 (Courtesy: Katherine Smith)

BBRCL : Represents the road centerline

Mfopen : Represents Multi family apartment open space

Haopen : Represents Open space for home owners associations

Signifigant : Represents future and existing open space

AFD : Represents Agricultural Forest Districts

The resources available are

1. **Environmental Engineering Incorporated[5]**

   3866 South Main Street

   Blacksburg, VA 24060

   Phone: (540) 951-1600

   Toll Free: 1-866-951-1600

   Fax: (540) 951-1970

   Email: info@env-eng.com

This company provides services like remediation, engineering, regulatory compliance, site assessment, brown field redevelopment and other services. They can be a useful resource for selecting a suitable site.

Alternative Transportation :Public Transportation Access

Blacksburg has good public transportation facility. Blacksburg Transit runs buses within the town with conveniently located bus stops. Projects developed within quarter mile radius of two bus stops servicing different routes get a LEED point.

Simple points to consider for this point

- Look at sites which are close to the Blacksburg Transit service routes
- If the project is large and expected to generate a lot of traffic, request Blacksburg transit to consider servicing that area

The following maps show the location of the bus stops (BT Transit) in the town and the sites within quarter mile radii of the stops. Developing a project in these areas would qualify it for a LEED point.

The **first map** shows entire Blacksburg with all the bus stops. The circles around the bust stops are 0.25 miles in radius and the areas or parcels lying within them are the ones that are good with respect to the required credit.

The **second map** is zoomed southern portion of Blacksburg, to show that the entire map (which is available as a GIS file) can be zoomed in, to get the details of the areas which lie within the quarter mile radius circles

The schedules and maps of all Blacksburg transit buses and routes can be obtained on the following link:

http://www.btransit.org/cms.php/routes/

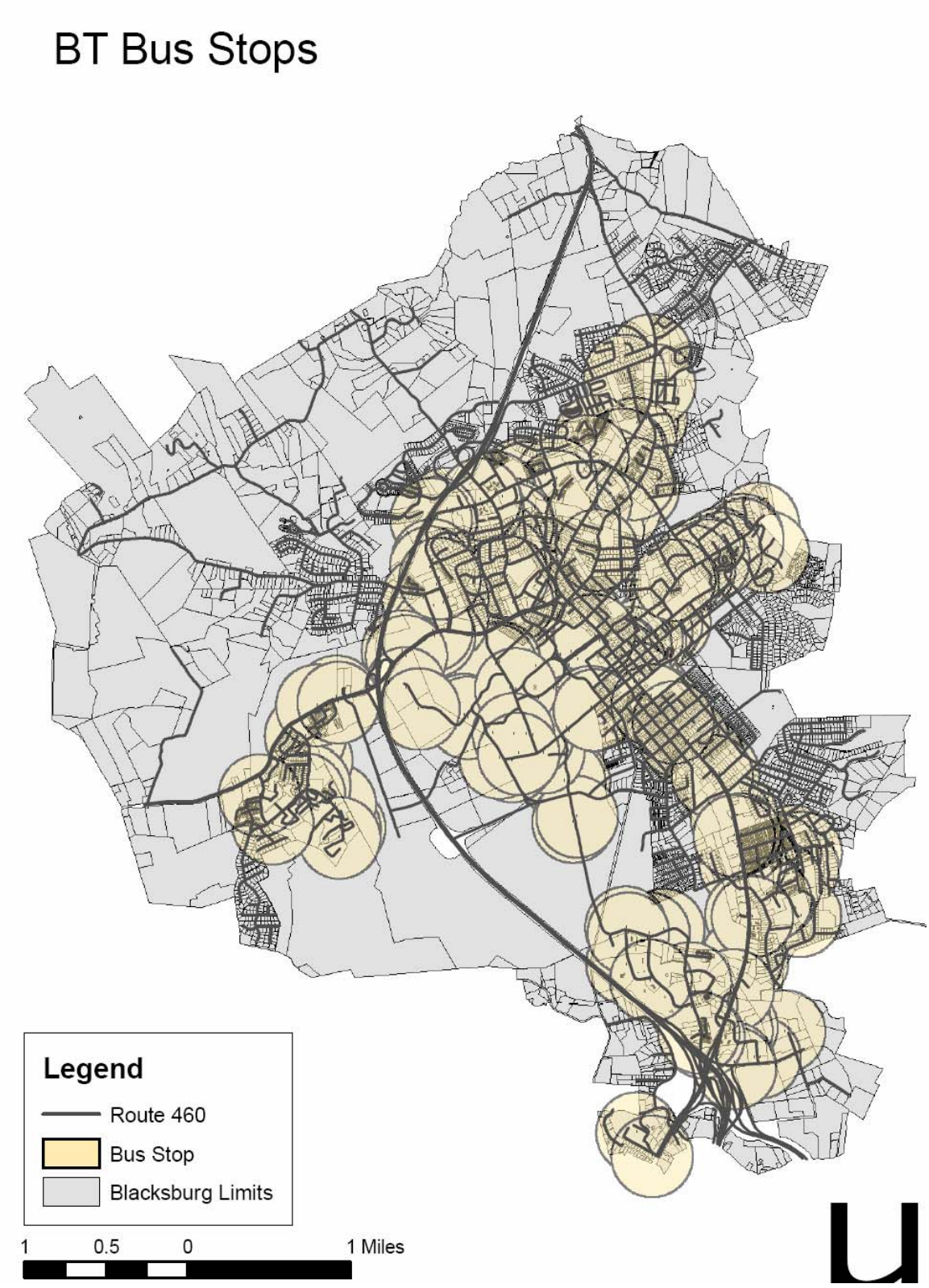

Fig 2 (Courtesy: Katherine Smith)

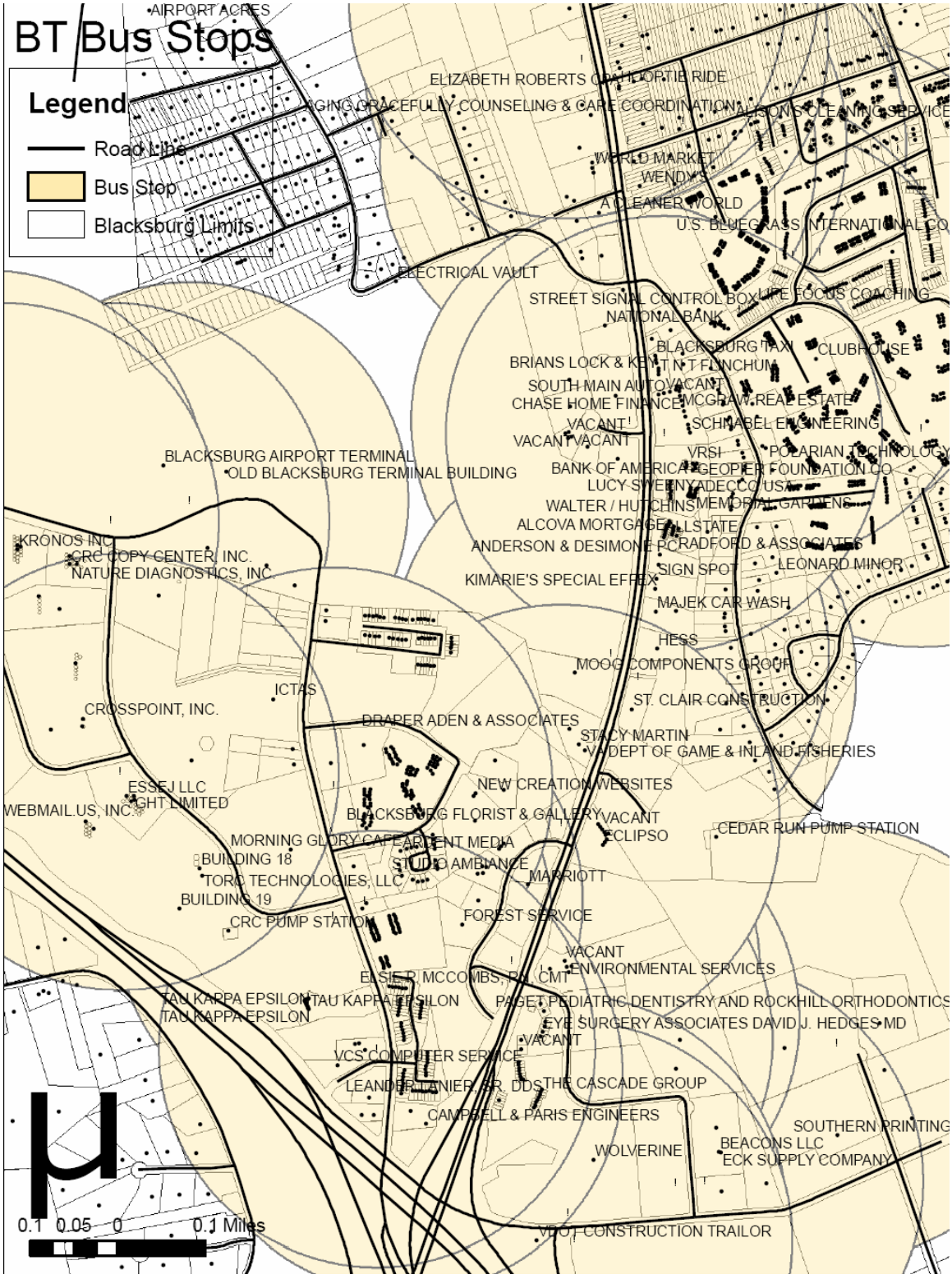

Fig 3 : Map showing addresses and parcels (Courtesy: Katherine Smith)

MATERIALS AND RESOURCES

A lot of extraction processing and transportation steps go in the processing of building materials which pollute air generate waste and destroy natural habitats. This credit deals with diversion of construction waste from landfills reusing materials to reduce demand for virgin materials and use of salvage materials.

Storage and collection of recyclables (prerequisite):

To meet the prerequisite make sure the construction site has well marked storage areas for non hadardous recyclables. This area should be centrally located and easily accessible by collection vehicles. The size of the recycling area depends on the square footage of the Commercial building.

Commercial Building Sf.	Minimum Recycling Area Sf.
0 to 5000	82
5001 to 15000	125
15001 to 50000	175
50001 to 100000	225
10001 to 200000	275
200001 or greater	500

Table 1 (Ref: LEED NC 2.2 pg 238)

Steps to consider for credit [3]

- Have a dedicated storage area and separate cardboard, paper, wood
- Recyclable waste such as plastic bottles, cans and glass can be stored in one container as the recycling facility near Blacksburg is equipped with the ability to separate these
- Before disposing the bottles ensure that the lids are removed
- Separate construction waste and prepare stockpiles on the site
- Be knowledgeable about the legal compliances concerning the amount and type of waste generated
- Keep hazardous waste separate
- Centralize the cutting operations to reduce waste and simplify sorting, and also place recycling dumpsters as close to the working area as possible

Some of the resources available are

1. Montgomery County Government Centre[6]

755 Roanoke street Suite 1C

Christiansburg, VA 24073-3172

Ph: (540)382 5793

Fax: (540)381 6816

This facility accepts waste like aluminum cans and foils, steel lids, empty paint cans and lids, empty aerosol cans, cardboards, Glass(brown green, clear and light blue) plastics, Paper (including newspapers), cardboard containers and Used Motor oil and Antifreeze[7]. Paint cans, cardboard, paper, plastic and motor oil are all generated during construction operations, this facility accepts them.

Construction Waste Management: diverting 50percent from landfill & 75 percent from landfill

To get credit for this, 50 percent of the construction waste (by weight) generated must be diverted from a landfill. This can be done by separating the construction waste on the site and sending it to recycling facilities. Wood and cardboard form a substantial part of construction waste and recycling these go a long way in getting this credit. If 75 percent of the construction waste is diverted from a landfill another credit is obtained

Simple points to consider for this credit

- Create stockpiles of salvageable construction material on site which would help in donating this material
- Identify the salvageable and recyclable material in the waste and search for resources which accept these
- Consider the following checklist for identifying recyclable building materials[3]
    - Asphalt
    - Land Clearing Debris (vegetation, dirt etc)
    - Acoustical Ceiling Tiles
    - Metals
    - Carpet and Carpet pads
    - Paint & Paint Cans
    - Cardboard
    - Plastic Film (packaging, shrink wrap, sheeting)
    - Drywall
    - Window Glass
    - Concrete
    - Wood
    - Glass
    - Insulation
    - Rebar

Some of the resources available are

1. Blue Ridge Disposal and Recycling[8]

205 Scatterwood Dr. Nw
Christiansburg, VA 24073
Ph: (540) 382 1270

This company accepts cardboard, aluminum, copper, brass, and a few other recyclable construction waste, however they do not accept newspapers, glass and plastic.

2. Habitat for Humanity of the New River Valley[9]

New River Valley, P.O. Box 570
Christiansburg, VA 24073
Ph: (540)731 8660
Fax: (540)731 4650

Habitat for humanity is an international non profit organization that builds houses for the poor. If the reusable construction materials are properly sorted at the construction worksite, the volunteers from this organization channel this towards house construction or material recyclers.

3. **Montgomery County Government Centre[6]**

755 Roanoke street Suite 1C
Christiansburg, VA 24073-3172
Ph: (540)382 5793
Fax: (540)381 6816

This facility accepts waste like aluminum cans and foils, steel lids, empty paint cans and lids, empty aerosol cans, cardboards, Glass(brown green, clear and light blue) plastics, Paper (including newspapers), cardboard containers and Used Motor oil and Antifreeze[7]. Paint cans, cardboard, paper, plastic and motor oil are all generated during construction operations, this facility accepts them.

Material Reuse : 5 percent & 10 percent

If salvaged, refurbished or reused materials are used in the project and they constitute at least 5 percent of the total cost of the materials used 1 credit is obtained. Mechanical electrical plumbing components, elevators and equipment are not included. One more credit is obtained if these materials constitute 10 percent of the total cost of materials and if this exceeds 15 percent another credit is obtained in Innovation and design. (LEED NC 2.2, pg 257-260).

For the materials to qualify as salvaged, refurbished or reused, the following points should be considered

- For on site materials: The materials must no longer be able to serve their original purpose and must be reconditioned and installed for a different use or at a different place. A good example is a fire door which is modified to be used as a counter top.
- For on site materials: Finish materials can continue to serve their original purpose provided they have been refurbished to become functional.
- Off-site materials: Materials will be considered as reused if they have previously been used.

Some steps to consider for this credit[3]

- Try and use standardized and modular construction techniques as far as possible
- Dry construction techniques enable easier dismantling, for example drywall instead of CMU
- Minimize and standardize building components and materials & Utilize prefabricated and preassembled components
- Identify the reusable materials and assign storage spaces on the site for storing these
- Consider the following checklist to identify reusable materials[3]
    - Appliances
    - Bathroom Fixtures
    - Metal Framing
    - Tile

- Ceiling Tiles
- Cabinets
- Carpets
- Doors
- Fencing
- Ductwork
- Flooring
- Landscaping Materials
- Lighting Fixtures
- Marble
- OSB & Plywood
- Pipes
- Furniture
- Steel members
- Asphalt
- Stone
- Formwork
- Signage
- Paneling

The resources available are

1. Habitat for Humanity of the New River Valley[9]

New River Valley, P.O. Box 570

Christiansburg, VA 24073

Ph: (540)731 8660

Fax: (540)731 4650

This organization maintains an inventory of salvaged items like doors, cabinetry, kitchen counter tops etc. They might not have exactly what the developers are looking for and hence not a very reliable source for reused material, but definitely a resource which can be used.

Fig3. Salvaged Doors (Courtesy: Duke Fairchild)

Fig4. Salvaged Windows (Courtesy: Duke Fairchild)

Fig5. Salvaged Cabinetry (ourtesy: Duke Fairchild)

Recycled Content: 10% (post-consumer + ½ pre-consumer)

If you use building materials which have post consumer recycled content and pre-consumer content and they account for 10 percent of the total cost of materials then a credit can be acquired under this.

The post-consumer recycled content plus one –half of pre-consumer content should amount to 10 percent of the total cost of the materials.[1]

Explanation:

If a material costs $100 and has a total recycled content of 10percent, the value or recycled content is calculated as 0.1 x 100 = $10

The formula is as given below

Recycled Content Value ($) = (%post-consumer recycled content x Material Cost) + 0.5(%pre-consumer recycled content)[1] (pg 266)

Post consumer material: these are the waste generated by households, commercial, industrial and institutional facilities, and these products can no longer be used for their intended purpose.

Pre Consumer Material: it is the material diverted from the waste stream during the manufacturing process. Excluded is the waste generated which can be reutilized in the same manufacturing process.

Steps to consider for this credit

- Identify the material suppliers who can provide such kind of materials
- Distinguish between post consumer and pre-consumer recycled content to help in calculations

Some of the resources available are

1. **Weston Solutions Inc**.

   1400 Weston Way

   Po Box 2653, West Chester, PA 19380

   Ph. 610-701-5061

This company offers a product called green roof which contains about 60% post consumer recycled content.

2. **Cochran's Lumber & Millwork Inc**[10]

   523 Jack Enders Boulevard

   Berryville, Va 22611

   Ph. 877-297-8331 & 540-955-4142

   Website: www.lumberandmillwork.com

The company offers a range of products which are from reclaimed wood and can be used for flooring. They also offer other wood products made from reclaimed wood. They also accept salvage wood.

Regional Materials: 10percent & 20 percent

If the building materials and products which are extracted, processed and manufactured within 500 miles of the project are used and they account for at least 10 percent of the cost of materials a credit is achieved. If they account for 20 percent of the cost another credit is obtained. The idea behind this is to increase dependency on regionally available products and help reduce environmental impacts due to transportation.

Specialty items like elevators , mechanical, electrical and plumbing components should not be included in the calculation.

Suppose if a product or a material has only a fraction of it manufactured locally then only that part by weight will be considered for the regional value. For example, if a building material costs $100 per unit and about 60 percent of its components are extracted processed and manufactured within a 500 mile radius then calculate it as

Regional value ($) = (60% x no. of units) x 100

Steps to consider for this credit

- Identify construction materials which fulfill this criterion and also suppliers who can help achieve this credit
- During the construction process make sure that the local materials are installed, quantify them
- Prepare a list of raw materials and the distances of their extraction processing and manufacturing points
- Give preference to contractors who have supplied to LEED projects in the past

Some of the resources available are

1.**CONROCK**

801 Industrial Park road

Blacksburg VA 24060

Ph.1-877-266-7625

Website: www.conrock.com

This company provides concrete and also other building materials

All the ingredients of concrete are obtained within Virginia except for the fly ash, making it a good resource for this credit. Further Details can be obtained by contacting the company.

2. **Heavener Hardware**

813 Kabrich Street

Blacksburg, VA 24060

Ph.540-552-1221

It is an independent hardware store located at Virginia Tech. They specialize in various aspects of construction. The lumber they use for trim work is harvested in Tennessee in an area which is within 500 miles of Blacksburg. This company can be a good resource for all wood items.

3. **40 West Building Supply**

804 Franklin Street

Rocky Mount, Virginia 24151

Ph.540-483-5181

This company specializes in interior construction which includes items like trim work, furniture, cabinetry etc. The company obtains most of its products from East Coast Millwork, which it located in Fredrick Maryland which is within the 500 mile radius. Further details about the extraction processing and manufacturing can be obtained from the company.

4.Plan House

Website: http://www.planhouse.com/gallery/vr-6-24060.html

This is a company gets the customer closer to the construction service and material suppliers in their local areas. The website listed above gives the name of the companies which provide construction services and building materials with 50 mile radius of Blacksburg. This can prove to be a great resource for planning out things to obtain the credit.

5.**Switch Board**

Website: www.switchboard.com

This website is a great resource to look for local suppliers. Just type in the business or the construction material needed with the location of the project and the website will give information of all the local suppliers within the area.

For example if you were looking for a brick supplier you just need to type in brickwork in the business box and Blacksburg zip in the location box and it will come up with a list of brick suppliers close to the project location.

This is a great resource for contractors looking for suppliers. Further information about the extraction, processing and manufacture of the materials can be found by contacting the respective suppliers.

6. **Viraconsulting**

Website: http://www.viracon.com/viraconsultingGreeB.html

This company provides consultancy services for obtaining LEED credits. They provide list of building materials which qualify for this credit (regional value) and also help in acquiring. They provide services for acquiring the other LEED credits as well.

Rapidly Renewable Materials

Use rapidly renewable materials as the construction materials for the project. The idea is to increase the usage of rapidly renewable building materials and products. These are materials made from plants which have very small harvest cycle, about 10 years or less. If the rapidly renewable building materials used account for 2.5 percent or more of the building material cost of the project, a point is achieved. If it accounts for 10 percent or more a point is obtained under the innovation title for exemplary performance.

For LEED rapidly renewable materials are those which are agricultural products both fiber and animal which take 10 years or less to harvest grow or raise in a sustainable fashion.[1] (pg 280)

Equation :

Percent Rapidly Renewable Material = Total Cost of Rapidly Renewable Materials / Total Materials Cost[1]

Steps to consider for this credit

- Identify the products that fulfill this criterion and also the suppliers capable of supplying these, preferably close to the project site
- Give preference to suppliers who have supplied such materials for previous LEED rated projects
- During construction ensure that the materials are installed
- Consider the following while preparing the list of products
    - Bamboo products
    - Wool
    - Cotton Insulation
    - Agrifiber
    - Linoleum
    - Wheat Board
    - Strawboard
    - Cork

Some of the resources available are

1. LOWE'S

350 Peppers Ferry Rd NE

Christiansburg, VA 24073

Ph. (540)-381-1000

This is a big store which sells hardware and construction products. They offer some rapidly renewable construction products like Cork Flooring, Bamboo Flooring and Wool Carpet. All of these are special order items and have an estimated delivery time of about two weeks.

2. Eco Solutions

Ph. (540)-929-4499

This company supplies environmentally friendly products. Some of the rapidly renewable products that are supplied are Wool Carpeting and Cork Flooring.

3. Ersan Flooring

Ph.(540)-951-4027

The company supplies rapidly renewable flooring products like Cork Flooring and Bamboo Flooring. The delivery time on the products is about a week.

4. Eco Solution Store

http://www.ecosolutionstore.com/store.html

This is a store which gives information on locally available resources like architects, contractors and suppliers who do sustainable construction. The link above provides names and contact details of the architects, contractors and renewable building material suppliers close to Blacksburg.

5. Display Smart

http://www.display-smart.com/resources.html

This is a product information database which provides information on various environmentally friendly building materials (including the rapidly renewable materials) with pictures. The resource provides useful information on the manufacturing process of the product, its applications and advantages.

Certified Wood

If 50 percent of wood based products and materials used in the project are certified in accordance with Forest Stewardship Council's principles and criteria for wood building components[1], a credit is obtained. The components include structural framing, general dimension framing, flooring, sub-flooring, wood doors and finishes and others, furniture may also be included if it has been consistently included in the material credits 3-7 (Resource Reuse, Recycled Content, Regional Materials, Rapidly Renewable Materials, Certified Wood)

The idea behind this is to encourage the purchase of wood from suppliers who have environmentally responsible forest management practices. Certified wood products mean that they are obtained from forest resources that are well managed.

Equation

Certified Wood Material Percentage = FSC-Certified wood material value / Total new wood material value[1]

Steps to consider for this credit

- Identify the wood products that find use in the project and find out which of them can be obtained with the FSC certification
- Identify suppliers who can supply these FSC certified wood products, preferably local
- Provide the project bidders with a list of these suppliers
- During construction process ensure that these components are installed
- Look up the LEED NC 2.2 guide for requirements for Chain Of Custody (COC) certification

Some of the resources available are

1. LOWE'S

350 Peppers Ferry Rd NE

Christiansburg, VA 24073

Ph. (540)-381-1000

According to the lumber department at Lowe's almost all the wood and doors that are sold are FSC- Certified. The deliveries are quick. An order placed before 3pm can be picked up in 3 hours, and an order placed after 6pm can be picked up after 7am the next day.

2. Home Depot Store

200 Conston Avenue

Christiansburg, VA 24073

Ph.(540)381-0084

According to the information obtained this store does not have an inventory of FSC- certified wood products. FSC- Certified wood would be a special order. Most of the doors that they supply are FSC- Certified.

3. Forest Stewardship Council

http://www.fscus.org/faqs/fsc_products.php?link=3

This is an international organization which coordinates the development of forest management standards throughout the United States and provides public information on the FSC-Certification. The above website can be used as a resource for finding suppliers of FSC- Certified wood products. If a particular FSC-Certified wood product is not obtained then this organization can be contacted, and it will provide a list of suppliers who will contact the concerned party.

Fig 6: Stacks of FSC-Certified Wood at Lowe's(Pictures Courtesy of Lowe's) [14]

Fig 7: FSC-Certification on the Wood (Pictures Courtesy: Lowe's) [14]

Fig 8: FSC-Certified Door Frame [14]

INDOOR ENVIRONMENT QUALITY

People spend most of their time indoors and according to US Environmental Protection Agency the level of pollutants indoors may be 5 to 100 times more than outdoors. The inhalation of these pollutants lead to many health problems. The use of better construction practices and use of better products which emit less pollutants can help achieve a suitable indoor environment quality. This credit deals with construction practices and use of such building materials which prevent deterioration of indoor environment quality.

Minimum IAQ Performance - Prerequisite

This is a prerequisite and must be met in order to qualify for any LEED points under the IEQ category. The idea behind this is to have certain standards on the indoor air quality within the concerned building. The ventilation for acceptable indoor air quality should meet minimum requirement of section 4 to 7 of ASHAE 62.1-2004[1]. The mechanical ventilation system should be designed using ventilation rate procedure or the local code, whichever is more stringent.

Steps to consider for this credit

- Consider the three methods of ventilation
    - **Active Ventilation or Mechanical ventilation**: In this ventilation is provided by mechanically powered equipment. For spaces utilizing this form of ventilation, follow ASHRAE 62.1-2004[1](pg 291), section 6 and use either the Ventilation Rate procedure or the Indoor Air Quality procedure.
    - **Passive ventilation or Natural Ventilation**: For spaces utilizing this form of ventilation follow the ASHRAE Standard 62.1-2004, Section 5.1[1](pg 291)
    - **Mixed-Mode Ventilation**: This is a combination of mechanical and natural ventilation. For spaces utilizing this form of ventilation meet the minimum ventilation rates required by Chapter 6 of ASHRAE 62.1-2004[1](pg 291)
- Try and utilize occupant friendly alternatives[3]
    - Prefer hardwood over pressed wood
    - Latex paint over oil based paint
    - Water based over solvent based adhesives
    - Low formaldehyde emitting fabrics
    - Continuous filament carpet
- Set certain rules on the work site like[3](pg 281)

- No Chewing tobacco
- No smoking inside building
- Do not wear contaminated work clothes

Some of the resources available are

1. Virginia Sustainable Building Network

P.O.Box 6539, Arlington

VA 22206

Ph. (703)486-2966

This organization provides pre-construction training on almost all aspects of Green Building. The organization also helps is finding the resources.

2. Sustainable Design Consulting

1606 West grace Street

Richmond, VA 23220

Ph. (804)254-3880

www.sustainabledesign.com

This company consists of many LEED accredited professionals and provides consultancy for LEED project, on all the credits. They can assist with the design of the ventilation system.

Environmental Tobacco Smoke (ETS) Control- Prerequisite

This is another prerequisite which must be fulfilled to qualify for any points under the IEQ category. To fulfill this the building occupants indoor surfaces and ventilation system should have minimum exposure to Environmental Tobacco Smoke (ETS).

"**ETS** also called second hand smoke consists of airborne particles emitted from burning ends of cigarettes, pipes and cigars and exhaled by smokers. The particles contain about 4000 different compounds, 40 of which are known to cause cancer" [1] (pg 299)

To achieve the requirements either any one of the three options have to be fulfilled (Please refer LEED NC 2.2 for detailed explanations)

Option 1

- Prohibit smoking in the building and locate exterior designated smoking areas which are at least 25 feet away from entries, outdoor air intakes and operable windows

Option 2

- Allow smoking only in designated smoking areas within the building and locate exterior designated smoking areas as mentioned above
- Locate the designated smoking areas within the building effectively and ensure capture and removal of ETS from the building. This can be done by directly exhausting it to outdoors with no recirculation
- Test for worst case conditions transport of air from smoking areas to adjacent spaces

Option 3 (for residential buildings only)

- Prohibit smoking in all common areas and locate designated smoking areas outdoors as mentioned in option 1
- Seal penetrations in walls ceilings and floors between individual residential units to minimize the pathways for ETS transfer
- Doors leading to common hallways should be weather stripped to minimize air leakage in to the hallway

Steps to consider for the credit

- Incorporate all the requirements of designated smoking spaces in the design
- Locate designated smoking areas away from pedestrian traffic

Low Emitting Materials: Adhesives and Sealants

To get this point, the adhesives and sealants used in the project shall comply with the requirements of certain set standards. The idea behind this is to encourage the use of sealants and adhesives which do not add to or contribute to indoor air contaminants, which are odorous irritating and harmful to the occupants as well as the installers

The reference standards that should be met are

- Adhesives, sealants and sealant primers should meet the South Coast Air Quality Management District (SCAQMD) Rule #1168 please refer to LEED NC 2.2 pg 333 for the list of VOC limits
- Aerosol adhesives should meet Green Seal Standard for Commercial Adhesives G-36 requirements

Steps to consider for this credit

- Specify low VOC materials in the construction documents and also mention the VOC limits
- Identify products that meet the requirements and the suppliers that provide these, preferably local
- During construction process ensure that these products are being used

Some of the resources available are

Following table lists some of the adhesives and sealants available near Blacksburg and also the stores that provide them

Location	Product	Application	Manufacturer	Manufactured	Within 500 miles	VOCs (g/L)	LEED approved	Cost
Lowes	Polyseam Caulk	All Purpose	OSI Sealants	Mentor, OH	YES	<72	NO	$3.49
	Alex Plus	All Purpose	DAP Inc.	Baltimore, MD	YES	<35	YES	$1.98
	Silicone II	Window and Door	GE Sealants & Adhesives	Huntersville, NC	YES	<28	YES	$5.38
	Liquid Nails	Heavy Duty	Macco	Stongsville, OH	YES	<375	NO	$2.27
	Power Grab Locktite	Window and Door	Henkel Consumer Adhesives	Avon, OH	YES	not stated	unknown	$4.47
	Perimeter Sealant	All Purpose	Precision Components	Kansas City, MO	NO	25-50	YES	$4.28
Home Depot	Kwik Seal	Tile and Tub	DAP Inc.	Baltimore, MD	YES	<30	YES	$2.19
	Silicone II XST	All Purpose	GE Sealants & Adhesives	Huntersville, NC	YES	15	YES	$5.39
	Phenoseal	All Purpose	Gloucester Co. Inc.	Baltimore, MD	YES	<85	NO	$4.19
	Alex Plus	Bath	DAP Inc.	Baltimore, MD	YES	<45	YES	$1.98
	400 Heavy Duty	Subfloor	OSI Sealants	Mentor, OH	YES	370	NO	$4.57
	Liquid Nails	Paneling	Macco	Strongsville, OH	YES	<69	NO	$2.87
	Great Stuff Foam	All Purpose	Dow Chemical Company	Wilmington, IL	NO	not stated	unknown	$5.33
Heavener	Duro Spray	All Purpose	Henkel Consumer Adhesives	Avon, OH	YES	65% wt. VOC	YES	$5.49
	Liquid Nails	Heavy Duty	Macco	Cleveland, OH	YES	<376	NO	$6.39
	TEC Premium	Carpet and Flooring	TEC Inc.	Palatine, IL	NO	0	YES	$7.49
	TEC Premium	Cove Base	TEC Inc.	Palatine, IL	NO	0	YES	$6.79

Table 2 [10]

The list of products is color coded and is explained below

GREEN : The product is LEED approved under credit 4.1(Adhesives & Sealants) and is manufactured within 500 miles of Blacksburg.

RED : The product does not meet the VOC limits as required to obtain credit 4.1 (Adhesives & Sealants)

BLACK : The product is LEED approved under credit 4.1(Adhesives & Sealants) but is not manufactured within a 500 mile radius of Blacksburg

The addresses of the stores are as under

1. LOWE'S

350 Peppers Ferry Rd NE

Christiansburg, VA 24073

Ph. (540)-381-1000

2. Home Depot

200 Conston Avenue

Christiansburg, VA 24073

Ph.(540)381-0084

3. Heavener Hardware

801 Kabrich St.

Blacksburg, VA

Ph.(540)552-1221

Low Emitting Materials: Paints and Coatings

To get this point, the paints and coatings used in the project shall comply with the requirements of certain set standards. The idea behind this is to encourage the use of paints and coatings which do not add to or contribute to indoor air contaminants, which are odorous irritating and harmful to the occupants as well as the installers.

The standards to be met are[1] (pg 337): (for detailed explanation on VOC content limits and values please refer LEED NC 2.2 reference guide pg. 337)

- Paints, coatings and primers applied to interior walls and ceilings must adhere to VOC content limits established in Green Seal Standard GS-11, Paints, First Edition, May 20, 1993
- Anti-corrosive and anti rust paints applied to interior ferrous metal substances must adhere to VOC content limits established in Green Seal Standard GC-03, Anti-corrosive Paints, Second Edition, January 7, 1997
- Clear wood finishes, floor coatings, stains, sealers and shellac applied to interior elements must adhere to VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural coatings, rules in effect on January 1, 2004

Steps to consider for this point

- Specify the requirement of low VOC content paints and coatings in the construction documents and also specify the VOC content limit on the materials
- Identify the products that fulfill the VOC content requirement and also the suppliers, preferably local
- During the construction process ensure that the specified paints and coatings are being used

Some of the resources available are

1. Sherwin-Williams Company

1725 N Franklin Street

Christiansburg, VA 24073

Ph. (540)382-8851

www.sherwin-williams.com

This company manufactures distributes and sells coatings and related products to professional, industrial, commercial and retail customers. The company has many retail outlets near Blacksburg. They have low VOC content paints, Stains and anti corrosive products [11]. The products are always kept in stock and the lead time is about 2-3 days. Almost all their products are Green Seal Certified.

2. Valley Paint and Decorating

1326 South Main Street

Blacksburg, VA 24060

Ph.(540)951-3404

They have an inventory of Green Seal Certified products. They provide low VOC content interior paints. The lead time for special orders is about 24 hours [12].

3. Duron Paints & Wall Coatings

6707 Williamson rd

Roanoke, VA 24019

Ph. (540)265-1217

This company offers a wide variety of eco-friendly paints and wall coverings. They provide a number of low VOC content interior paints, exterior paints. Almost all their eco-friendly products are Green seal Certified. A list of their products can be obtained on their website [13].

4. LOWE'S

350 Peppers Ferry Rd NE

Christiansburg, VA 24073

Ph. (540)-381-1000

They have low VOC content paints, latex and water-based interior paints. They also provide certain Green Seal Certified paints. The lead time for special orders is about 2 days.

Low Emitting Materials: Carpet Systems

To get this point, all the carpet system used in the building interior shall meet certain testing and product requirements. The idea behind this is to encourage the use of carpet systems which do not add to or contribute to indoor air contaminants, which are odorous irritating and harmful to the occupants as well as the installers. The carpet must not exceed the maximum emission factors used in CRI Green Label Program and follow the test protocols used by Green Label Plus[1] (pg. 342)

Explanation

Indoor Carpet systems consist of the carpet, carpet adhesive, or carpet cushion product that is installed onsite inside of the buildings weatherproofing system[1] (pg.343)

The requirements are as under[1] (pg. 341)

- The carpet installed in the interior of building should meet the testing and product requirements of the Carpet and Rug Institute's Green Label Plus Program
- The carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute's Green Label Program
- The carpet adhesive should meet the VOC content limit of 50g/L

Steps to consider for this credit

- In the construction documents specify the requirement certification of Green Label Plus program for carpet systems, or specify testing requirements if it is done by qualified independent laboratories
- Identify the products that fulfill the testing requirement and also the suppliers, preferably local
- During the construction process ensure that the specified carpet systems are installed

Some of the resources for this credit are

1. Carpetland USA

2425 Sycamore Street

Christiansburg, VA 24073

Ph. (540)381-4500

This store provides carpets, hardwood, Laminate and other products. They have a large selection of carpets with the Carpet & Rug Institutes Green Label Plus certification. The lead time is about 4 days. They also provide installation services.

2. America's Carpet Gallery

1324 South Main Street

Blacksburg, VA 24060

Ph. (540)951-8634

This store carries a few carpet brands which have CRI's Green Label Plus certification. Selections not in stock are delivered within a week. They also provide installation service.

3. LOWE'S

350 Peppers Ferry Rd NE

Christiansburg, VA 24073

Ph. (540)-381-1000

All carpets with the Green Label plus certification will be special orders and take about 5-7 days for delivery. The selection is ample.

4.

www.dhs.ca.gov/ps/deodc/ehlb/iaq/VOCS/Section01350_7_15_2004_F-INAL_PLUS_ADDENDUM-2004-01.pdf

The above link leads to a standard practice document which specifies testing criteria for carpet emissions that will satisfy the credit requirements[1] (pg.342)

Low Emitting Materials: Composite Wood & Agrifibre Products

To get this point, the composite wood and agrifibre used in the interior of the building should not contain any added urea-formaldehyde resins. The Laminates adhesives used to fabricate the composite wood should also not contain any added urea-formaldehyde.

Composite wood and agrifibre consist of particleboard, medium density fiberboards, plywood, wheatboard, strawboard, panel substrates and door cores. Wood elements which are not considered base elements are not included. (for example furniture and other equipment)[1]

Steps to consider for this credit

- Specify wood and agrifibre products that do not contain any added urea-formaldehyde resins
- Specify that the laminating adhesives that will be used for field and shop applied assemblies should contain no added urea-formaldehyde resins
- Identify products and suppliers of such products, preferably local, consider following checklist when looking for products
    - Particleboard
    - Medium Density Fibreboards MDF
    - Plywood
    - Wheatboard
    - Strawboard
    - Panel Substrates
    - Door Cores

- During construction process ensure that these products are being utilized

Some of the resources available are

1. LOWE'S

350 Peppers Ferry Rd NE

Christiansburg, VA 24073

Ph. (540)-381-1000

This store supplies the required products as special delivery. Their primary supplier is Georgia Pacific which does have a range of "non urea-formaldehyde resins" wood products.

2. Home Depot

200 Conston Avenue

Christiansburg, VA 24073

Ph.(540)381-0084

They supply a woodstock engineered fibreboard that has no urea-formaldehyde resins. It also has Georgia pacific products and also products from other companies.

3. http://www.earthsourcewood.com/productmain.htm

The link given above is of **EarthSource Forest Products** , it gives information on wood products with no urea-formaldehyde resins. It can be used as a resource for preparing a list of preapproved products for this credit.

Some more Resources

Listed Below are some of the consultants, companies and suppliers who provided services for LEED projects, and are located close to Blacksburg.

Consultants:

Virginia Sustainable Building Network

Contact Person: Annette Osso, Executive Director

Po. Box 6539, Arlington, VA 22206

Ph. 703-486-2966

Email: osso@vsbn.org

Website: www.vsbn.org

Nature Neutral

Contact Person: John Meggs, President

Greenbrier Square, 370C Greenbrier St

Charlottesville, VA 22901

Ph. 434-975-1036

Email:jmeggs@natureneutral.com

Website: www.natureneutral.com

Sustainable Design Consulting

Contact Person: Rebecca Aarons-Sydnor, LEED AP, Project Consultant

1606 West Grace Street, Richmond, VA 23220

Ph. 804-254-3880

Email: rebecca@sustaindesign.net

Website: www.sustaindesign.net

Community Design Studio

Contact Person: Colin M. Arnold, LEED AP, Director

990 Cambria Street, N.E, Christiansburg, VA 24073

Ph. 540-382-2002

Email: carnold@CHPC2.ORG
Website: www.communitydesignstudio.org

E^2 Solutions
Energy Efficient Solutions
Contact Person: Lorenz V. Schoff, PE
2906 Tall Oaks drive, Blacksburg, VA 24060
Ph. 540-961-2184
Email:lschoff@rev.net

Architects:

Archetype
Contact Person: Belinda Reeder, Architect
1841 Columbia rd, NW, Suite 202,
Washington DC, 20009
Ph. 202-265-7565

Thomas Koonz Architect PC
Contact Person: Thomas Koonz, President
300 Church Street, Blacksburg, VA 24060
Ph. 540-951-4925
Email: tom@tkapc.com
Website:www.tkapc.com

Suppliers:

Solar Connexion, Photovoltaic Contracting
Contact Person: Bryan Walsh
Po.Box 10095, Blacksburg, VA 24062
Ph. 540-961-5120
Email: bwalsh@moonlightsolar.com

Eco Painting & Wallpapering

Contact Person: John Roberts

Ph. 540-815-5564

References

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5. [cited 2007 03/26]; Available from: http://www.env-eng.com/index.shtml.
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7. [cited 2007 03/07]; Available from: http://civic.bev.net/hfh/#info.
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10. [cited 2007 03/27]; Available from: www.lumberandmillwork.com.
11. [cited 2007 04/17]; Available from: http://www.sherwin.com/pro/.
12. Interview with M. Holocomb
13. [cited 2007 04/18]; Available from: http://www.duron.com/products/eco_products/interior_eco_coatings/productinfo.asp?cat=17&subcat=1.
14. BC 2024: Construction Principles II, http://buildingconstruction,editme.com/TA1-Assignment