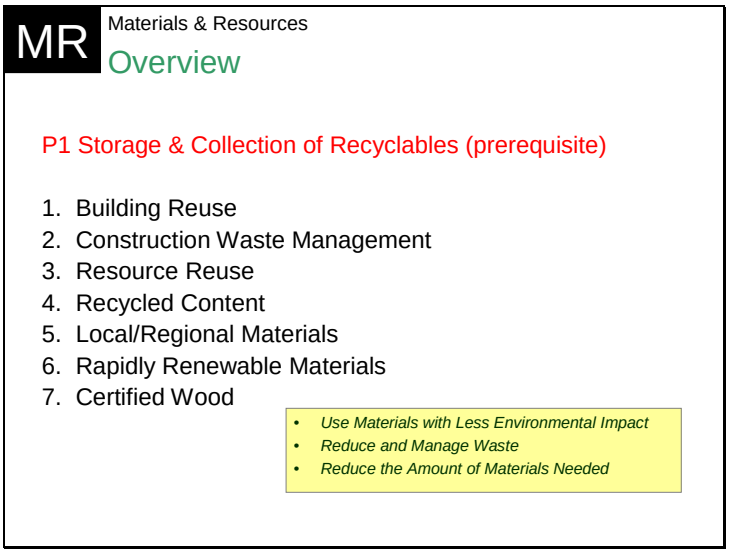
Slide 1



The construction and development industries have a tremendous impact on the environment. Construction and demolition waste make up 40% of all the waste in the United States. There is a huge potential for the construction industry to change their practices that can have much lower environmental impacts and create a marketplace for environmentally friendly products. For example, reusing and salvaging building materials saves production and transportation energy involved in making a new material, as well as landfill space where the old material would go.

This area of LEED encourages the use of reuse, recycled or rapidly renewable products and materials (especially those regionally available), as well as a comprehensive construction waste management strategy to divert as much waste as possible from the landfill.

Slide 2

MR

Materials & Resources: Prerequisite 1

Storage & Collection of Recyclables

INTENT: Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

REQUIREMENTS: Provide easily accessible area for separation, collection, and storage of materials including (at least):

- **Paper**
- **Corrugated cardboard**
- **Glass**
- **Plastic**
- **Metals**

SUBMIT: Project plans with recycling center indicated

An environmentally friendly constructed building is important, but the building and the occupants impact the environment after construction. The average waste per employee is 3 pounds per day! It is important that the building occupants have the option to maintain good recycling programs throughout the lifespan of the building. LEED requires an area dedicated to recycling inside the building, so occupants have the option to recycle paper, cardboard, glass, plastic and metals. By recycling these basic items, there is a reduction in the need for virgin materials as well as a significant reduction in the amount of waste going to landfills. With minimal initial cost to achieve this prerequisite, there are less land, water and air pollution impacts.

Slide 3

MR

Materials & Resources: Credit 1.1

Building Reuse: Maintain 75% of Existing Walls, Floors & Roof

INTENT: Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Reusing shell and non-shell components *reduces*:

- Construction waste
- Impacts of raw material extraction, manufacturing and transportation
- Habitat disturbance and infrastructure development
- First costs of construction

By reusing a building, there is a significant reduction of materials going to the landfill. The reuse of materials is important because of the embodied energy that is within the production, manufacture, transportation, and construction of the new material. Reuse prevents new products from being produced and avoids the negative impact of embodied energy. The goal is to reduce raw material extraction. Projects can earn a point in this credit if it reuses structural portions or shell components of an existing building such as walls, floors, or roof.

* The project cannot earn this credit if a building addition's square footage is more than twice the existing building's square footage.

Slide 4

MR

Materials & Resources: Credits 1.1 & 1.2

Building Reuse

1.1: Maintain 75% of Existing Walls, Floors and Roof (shell and structure)

1.2: Maintain 95% of Existing Walls, Floors and Roof (shell and structure)

Shell = exterior skin and framing, excluding window assemblies and non-structural roofing materials

Note:

If the project has an addition that is > 2 times the original square footage, it is considered a "new" building and is not eligible for MR-1 credits (Reused materials would count towards MR-2 credit)

The Bass Lofts building in Atlanta was reused; it was formerly an elementary school.

The calculation is based on the surface area of the reused and existing portions. If a project cannot meet the 75% threshold to get this credit, the portions can still be reused and counted toward the Materials and Resources (MR) Credit 2 calculation. These credits do not include window assemblies because LEED prefers that projects do not reuse them again, but rather upgrade to more energy efficient windows. Windows can be reused for other means, for example as interior partitions, and counted toward MR Credit 3.

Slide 5

MR

Materials & Resources: Credits 1.1 & 1.2

Building Reuse

Structural Reuse:

Structural Element	Existing [SF]	Reused [SF]	% Reused
Foundation	8,000	8,000	100%
Columns	1,000	1,000	100%
Floor Decks	1,000	1,000	100%
TOTALS	**10,000**	**10,000**	***100%***

Shell Reuse

Shell Element	Existing [SF]	Reused [SF]	% Reused
Structural Roofing	5,000	4,000	80%
North Ext. Wall	5,000	5,000	100%
South Ext. Wall	5,000	5,000	100%
East Ext. Wall	2,500	0	0%
West Ext. Wall	2,500	0	0%
TOTALS	**20,000**	**14,000**	***70%***

Building Reuse = (24,000/30,000) = 80%

(In this example CREDIT 1.1 is attained)

The example above describes the calculations involved in determining the percentage of the building that will be reused. Calculate the square footage of each material of floors and roof decking. Existing exterior and connecting walls require the amount of surface area, not including windows and doors with glazing. If at least 75% of the existing building is reused in the new construction, a point will be attained.

Slide 6

MR

Materials & Resources: Credit 1.3

Building Reuse: Maintain 50% of Interior Non-Structural Elements

INTENT: Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Non-Shell Reuse Example:

Non-Shell Element	Existing [SF]	Reused [SF]	% Reused
Ceilings	50,000	40,000	80%
Flooring	50,000	10,000	20%
Wall Panels	50,000	40,000	80%
TOTALS	**150,000**	**90,000**	**60%**

$$\text{Non-Shell Reuse [\%]} = \frac{\text{Reused Elements [SF]}}{\text{Total Elements [SF]}}$$

Use interior non-structural elements of an existing building in at least 50% of the new building. Products can include refurbished wood floors, doors, and interior walls. Again, this credit is not applicable to projects where an addition is more than twice the amount of the existing building.

Slide 7

MR

Materials & Resources: Credit 2.1 and 2.2

Construction Waste Management: Divert 50% / 75% from Disposal

INTENT: Divert construction, demolition and land-clearing debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.

REQUIREMENTS:

2.1: Recycle/salvage/divert 50% C & D waste

2.2: Recycle/salvage/divert 75% C & D waste

- Develop a waste management plan for project site
- Monitor the total waste and recycling stream by weight or volume (must be consistent)
- Calculate the rate of recycled waste in tons or volume (exclude excavated soil or hazardous waste)

Commercial construction generates 2-2.5 pounds of solid waste /SQ FT

Create a recycling area and clearly label recycling bins on site (above). Many companies come to a site and chip recycled material for easier recycling (below).

In the past, recycling was not a priority due to large amounts of landfill space and low tipping costs. Today, due to increased disposal costs and regulations, recycling opportunities are rapidly expanding, making waste diversion more attractive. It is generally economically viable to recycle materials such as metal, concrete, wood and asphalt from most construction sites as well as cardboard, paper, and plastic. Even materials such as wallboard, existing plants, roofs and other items can be recycled and used on different projects.

The goal of this credit is to divert as much construction waste from the land fill as possible. Landfills are responsible for contaminating the environment by polluting groundwater and destroying green space. By recycling construction and demolition debris, there is a reduction in waste generation and future environmental impacts.

The construction industry can have a tremendous impact on the amount of construction waste that is diverted from landfills by following the credit requirements in LEED. Develop a construction waste management plan for the project site and monitor the recycling stream by weight through the duration of the construction phase. Designate a specific area on site for recycling project materials. Materials that should be considered for recycling include concrete, glass, wood, plastic, gypsum, tile, sheet rock, insulation, and carpet. Donations of materials to charities also count in the calculations for credit documentation.

* Note: Materials preserved from a re-used building may be applied to this credit or MR-1, but materials included in MR Credits 3, 4, 5, 6, & 7 cannot apply to this credit!

Slide 8

MR Materials & Resources: Credits 3, 4, 5, & 6

Calculations

All credits are based on a percentage of Total Material Cost (excludes equipment, labor, & MEP)

- The Total Material Cost can be determined by hand

  OR

- Assume 45% of total construction budget

EXAMPLE:
Total budget = $1M
Estimated Total Material Cost = 45%
= $450k

For example,
a project *reuses* $23k worth of materials.
This equates to 5.3% (23k/450k)
& would qualify for one point under MR 3.1

LEED calculates credit compliance as a materials cost value, rather than the material content amount. Most projects assume the 45% of total construction budget to save them time and money, but that method may not be in a project's best interests. To use the 45% default option, the total construction cost is determined from the hard costs from CSI 1995 Divisions 2-10 only. Both options require a detailed materials list from the entire project with cost values.

Slide 9

MR

Materials & Resources: Credit 3

Materials Reuse

3.1: Specify salvaged / refurbished for 5% of all materials

3.2: Specify salvaged / refurbished for 10% of all materials

INTENT: Reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.

Southface used crushed, old toilets as backfill for their Eco Office

- Salvaged materials can extend material life while reducing overall first costs
- Buildings use 40% of raw stone, gravel and sand, and 25% of virgin wood
- Reuse of building materials (MR 1 & 3) is preferred over recycled materials due to environmental costs of collection, transport and processing

The intent of this credit is to reuse materials from existing buildings or find new uses for products that would otherwise go into the landfill. Many times, this credit is specific to historic renovation. Though some salvaged materials are more costly, their use can reduce the environmental impacts associated with extracting virgin materials. Often salvaged materials are of better quality then new ones and are more localized, thus saving money on transportation fees. Projects receive credit compliance if at least 5% of the total materials cost is salvaged or refurbished materials. A second point is given if the project reaches 10% of the materials value.

Slide 10

MR

Materials & Resources: Credit 3

Materials Reuse

- Salvaged materials: recovered from existing buildings or construction sites and reused in other buildings
- Salvaged materials cannot be applied to MR 1, 2, 4, 6, or 7

$$\text{Salvage Rate [\%]} = \frac{\text{Salvaged Materials Cost [\$]}}{\text{Total Materials Cost [\$]}}$$

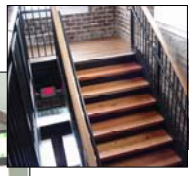
Example:

Brick (salvaged) …. $14k

Wooden beams ….. $10k

Total reused…….$24k

% Salvaged = $24k / $450k = 5.3%



Wooden beams re-milled as stair treads in a historical renovation project. The 1330 7th Street Building (above) in Washington DC is an example of brick reuse.

If materials are from project renovation on site, materials are categorized into two categories: if they can no longer serve their original function and are reprocessed and installed for a different use they are “fixed” materials; if they need refurbishment to be functional they are “finished” and can serve their intended purpose. For example, if brick was once cladding, it could only be counted if it was then used as a paving material.

Slide 11

MR

Materials & Resources: Credit 4

Recycled Content

INTENT: Increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

- Post-consumer is valued more because there is a greater need to stimulate post-consumer recycling.

Recycled content materials DO NOT apply to MR 1, 2, 3, 6 or 7.

Recycled Content Plastic Decking

Cellulose insulation

Examples of the many products that may contain some recycled content:

- steel beams, posts, brackets
- plastic lumber decking & picnic tables
- drywall
- fly-ash concrete
- floor & wall tile
- carpet tiles and backing
- fiber cement siding
- cellulose insulation
- plastic rainwater cistern

One goal of this credit is to develop the recycled content marketplace. By including more recycled content into building, there is less solid waste and less impact of materials on the environment. Today there are many goods with recycled content on the market that perform similarly to products with only virgin materials. In the LEED Program two types of recycled materials are counted: post consumer and pre-consumer.

Post-consumer material is defined as waste material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose.

Pre-consumer material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

Slide 12

MR

Materials & Resources: Credit 4

Recycled Content

4.1: 10% (post-consumer + ½ pre-consumer)

4.2: 20% (post-consumer + ½ pre-consumer)

$$\text{Recycled Content Value [\$]} = \text{Material or Product Cost [\$]} \times \text{Recycled Content [\%]}$$

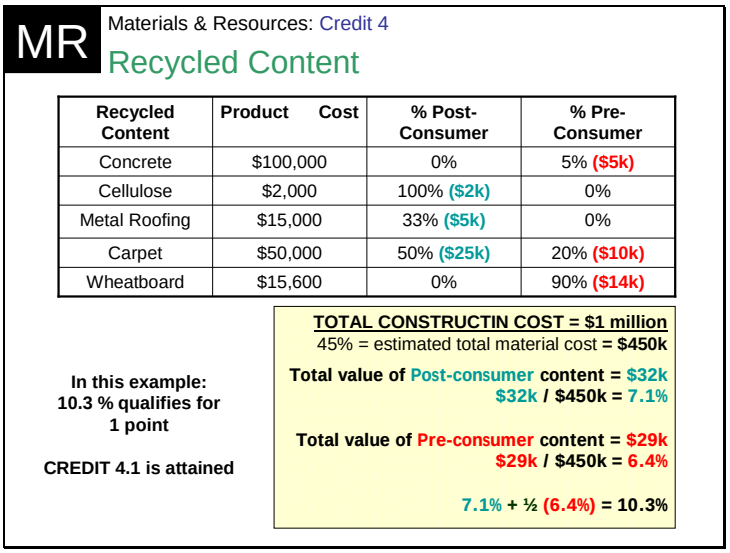
$$\text{Recycled Content Rate [\%]} = \frac{\text{Recycled Content Value [\$]}}{\text{Total Materials Cost [\$]}}$$

$$\text{Assembly Recycled Content} = \frac{\text{Material weight [lbs] x Recycled Content [\%]}}{\text{Total Weight [lbs]}}$$

The post-consumer materials in the building are valued twice as much as those materials that are post-industrial materials in LEED. This is because materials used from post-consumer products are being diverted from the waste stream, creating a greater positive environmental impact.

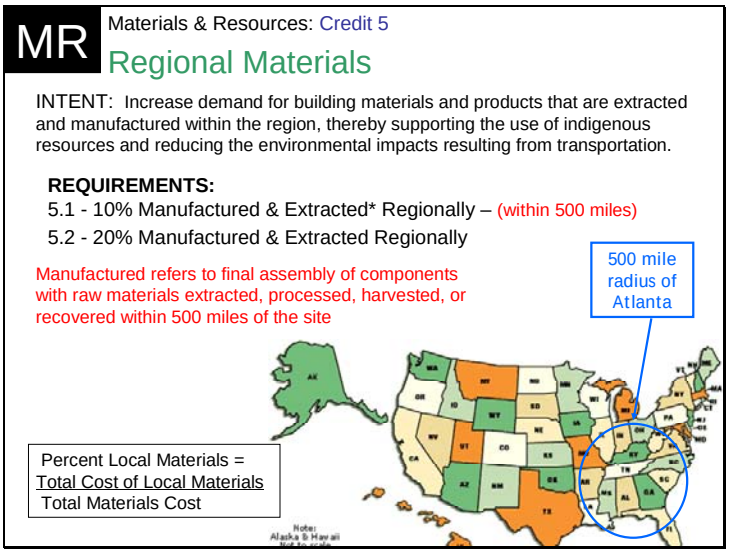
* An additional innovation credit is given if 30% of the materials used in the project contain recycled content.

Slide 13



This case study shows how to calculate the recycled content used in the project, remembering that only half of the percentage counts for pre-consumer products. It is best to allocate recycled content for high cost materials to have a greater impact on the recycled product calculation.

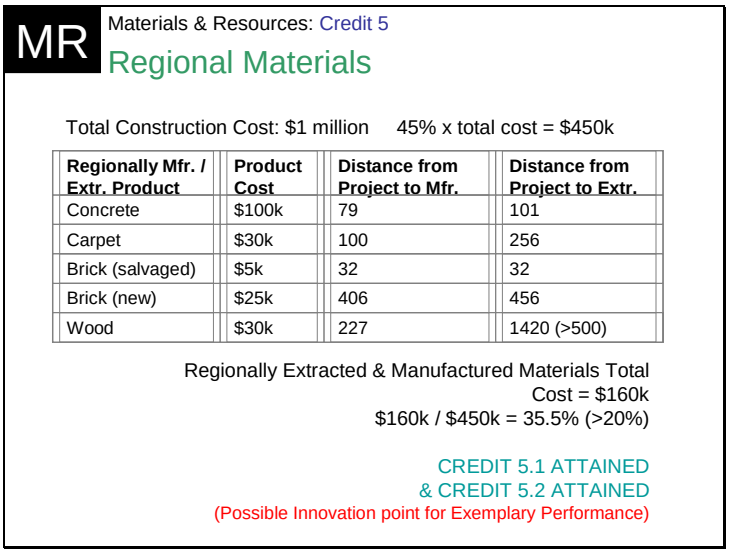
Slide 14



Projects that have at least 10% regionally manufactured and extracted materials will achieve one point. Increasing the value to 20% of regionally manufactured and extracted products will give the project two points in this category.

* An Innovation and Design credit is given if 40% or more of regional materials are used in a project.

Slide 15



This example calculates the percentage cost of regional materials in a project costing one million dollars. Furniture and furnishings (CSI - Division 12) are excluded from the calculations for this credit, unless they are included consistently across MR Credits 3-7.

* CSI - Construction Specifications Institute

Slide 16

MR

Materials & Resources: Credit 6

Rapidly Renewable Materials

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 for 2.5% of the total value of all building materials and products.

Rapidly Renewable: made from plants that are typically harvested within a ten-year or shorter cycle.

- Bamboo flooring
- Cotton batt insulation
- Linoleum flooring
- Wheatboard cabinetry
- Wool carpet
- Cork

Because rapidly renewable resources have a shorter harvesting cycle than traditional materials, there are many environmental benefits. Often the use of rapidly renewable resources can save land as well as other resources that usually go into conventional materials. Also by virtue of their shorter harvesting cycles, rapidly renewable materials can sustain a community for a longer period than more finite sources.

Slide 17

MR

Materials & Resources: Credit 6

Rapidly Renewable Materials

$$\text{Rapidly Renewable Material Portion [\%]} = \frac{\text{Rapidly Renewable Material Cost [\$]}}{\text{Total Materials Cost [\$]}}$$

Total Construction Cost = $1 M
45% = $450k = est. Total Material cost

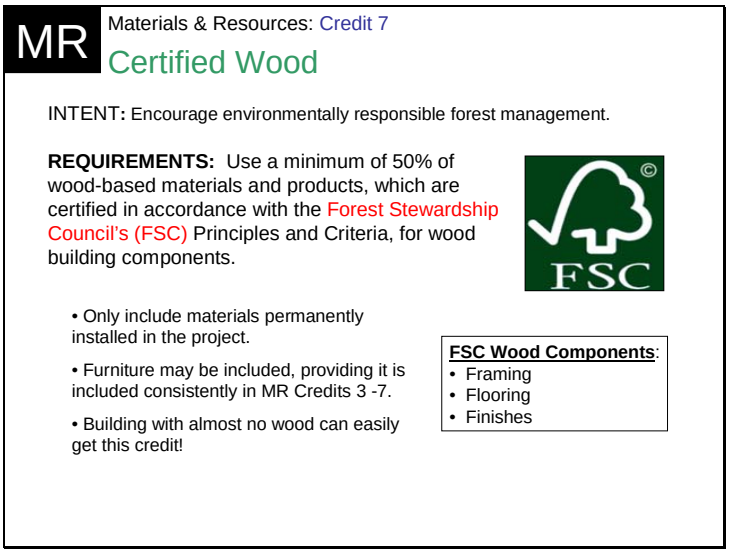
Rapidly Renewable Content Products Example:

Product Name	Product Cost	% Renewable	$ Renewable
Wheatboard	$3,400	90%	$3k
Linoleum	$5,000	100%	$5k
Bamboo flooring	$4,000	100%	$4k

Total value of rapidly renewable products = $12k
$12k / $450k = 2.7%
CREDIT 6 ATTAINED

There is no available innovation and design point for exceeding 2.5% of rapidly renewable materials required for this credit.

Slide 18



Current forestry practices have a multitude of negative effects on the environment such as soil erosion and loss of wildlife habitat. FSC certified wood guarantees that certain standards are met such as sustainable timber harvesting, preserving biodiversity, conserving endangered forests, and maintaining water and soil quality. The cost of FSC remains equal or higher than conventional wood though this is expected to change in years to come when wood products become more scarce.

Potential Technologies & Strategies:

Establish a project goal for FSC-certified wood products and identify suppliers that can achieve this goal. During construction, ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.

Slide 19

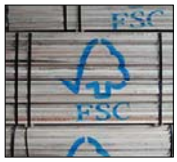
MR Materials & Resources: Credit 7

Certified Wood

$$\text{Certified Wood Material Portion [\%]} = \frac{\text{FSC Certified Wood Products Cost [\$]}}{\text{Total New Wood Based Products Cost [\$]}}$$

Certified Wood Calculation Example:

Cert. Wood Prod.	Prod. Cost	% Certified	$ Certified
Rough Carpentry	$30k	50%	$15k
Roof Structure	$50k	50%	$25k
Furniture	$20k	75%	$15k



Total wood = $100k

TOTAL Certified Wood Cost = $55k
$55k / $100k = 55%

CREDIT 7 ATTAINED

The percentage of sustainable wood must be determined by the ratio of total wood purchased for the project, unlike credits 3-6 which are based on total materials purchased.

There are two types of FSC Certifications awarded for sustainable forestry practices: Forest Management Certification and Chain of Custody (COC) Certification:

Forest Management Certification is awarded to forest managers that operate sustainable forestry practices.

COC Certification is awarded to companies that process, manufacture, and/or sell products made of certified wood and maintain proper accounting of material flows. Each wood product is assigned a chain-of-custody number to record all of the hands that it passes through—if any one party, be it the timber company, mill, lumber yard, etc. isn't verified by FSC than the product chain-of-custody is broken and the product will not be certified.

Slide 20

MR

Materials & Resources

Points Summary

P1 Storage & Collection of Recyclables (prerequisite)

1.	Building Reuse	1-3
2.	Construction Waste Management	1-2
3.	Materials Reuse	1-2
4.	Recycled Content	1-2
5.	Local/Regional Materials	1-2
6.	Rapidly Renewable Materials	1
7.	Certified Wood	1
	TOTAL	**13**

Points Summary