REGIONAL MATERIALS

GOAL

Promote use of locally sourced materials to reduce impacts from transportation emissions, reduce fuel costs, and support local economies.

CREDIT REQUIREMENTS

Make an itemized list of all materials, parts, components and products intended for permanent installation on the project including weights, total costs, shipping costs, and location of purchase and/or source of these materials. Using a spreadsheet or table is recommended for documentation of this credit. Show that your project meets the requirements of Option 1 or Option 2 below.

Option 1. Choose local materials and product suppliers.
Compute the total cost of all materials, parts, components and products used for project construction including all shipping and transport costs based on the project bid list. Compute the percentage of this total cost that has been paid to materials suppliers, processors, distributors and producers **within a 50 mile radius** of the geographic center of the project. Points are awarded according to the minimum percentages shown in Table MR-5.1.

Option 2. Minimize travel distance for project construction materials.
Disaggregate each material, part, component or product into its "basic materials" by weight and express as a percentage of the sum of these weights. Compute the cumulative fronthaul distance traveled for each basic material from point of origin to the final endpoint on the project. Note this distance includes all intermediary points, such as assembly or distribution, between the original source and the final placement on the project. Report the total distance in terms of total freight miles (road, air, rail or barge) traveled for each basic material. Show that at least **95%** of these basic materials **by weight** have traveled less than the maximum haul distances shown in Table MR-5.1.

Table MR-5.1: Point Scale*

Credit MR-5 Points	1	2	3	4	5
Option 1 by % of total cost	60	75	84	90	95
Option 2 by maximum fronthaul distance (miles)	500	337.5	225	150	100
Both options assume exponential difficulty associated with achieving this credit.					

Details

A "basic material" used in the project may include (but is not limited to): any and all binders (asphalt, cement products, etc.), aggregate, base and subbase or embankment materials, metal, finished plastic and wood or whole components assembled with these materials. The rule of thumb for determining "basic" is that it cannot be taken apart without changing the chemical composition of the material component itself. For example, typical new asphalt pavement is made of two basic materials: rocks and an asphalt binder. However, existing asphalt pavement is a basic material when used as recycled asphalt pavement (RAP). This is because it is difficult to separate the asphalt binder from the rocks.

Generally, the "origin" or "source" of a basic material means where it came out of the Earth or was initially fabricated. "Fronthaul" means traveling from the origin of

MR-5

1-5 POINTS

RELATED CREDITS

- ✓ PR-2 Lifecycle Cost Analysis
- ✓ MR-1 Lifecycle Assessment
- ✓ MR-2 Pavement Reuse
- ✓ MR-3 Earthwork Balance
- ✓ MR-4 Recycled Materials

SUSTAINABILITY COMPONENTS

- ✓ Ecology
- ✓ Equity
- ✓ Economy
- ✓ Extent

BENEFITS

- ✓ Reduces Fossil Fuel Use
- ✓ Reduces Air Emissions
- ✓ Reduces Greenhouse Gases
- ✓ Improves Local Economies
- ✓ Reduces First Costs
- ✓ Reduces Lifecycle Costs

the basic material and any of the places it has traveled on its way to the final destination in the project. This includes any material that is sourced at the site and taken offsite for reprocessing, such as recycling, later to return at the site in a different form. By contrast, the term "backhaul" is typically used to describe materials taken away from the site, usually destined for landfill, but sometimes is just an empty truck returning to its point of origin for another load. The distance traveled by emptied vehicles leaving the site (backhaul) need not be considered for purposes of this credit. Also, waste materials not intended for reuse or recycling on the project (i.e. they are transported offsite and do not come back) need not be included in calculations. Materials that qualify for credit MR-2 Pavement Reuse may not be counted toward this credit. However, recycled materials that originate from the project site and are transported offsite for reprocessing before being returned to the site are considered. Be sure to track weights of any added or lost materials during such a recycling process.

Two options are available for this credit and projects may elect to demonstrate either of them, whichever is most beneficial. Note that a 50 mile radius has a 100 mile diameter, so the highest potential points available in both Options are essentially consistent. Also, most pavement and structural materials are high in weight, and constitute the majority of most roadway project materials by cost. However, most high value items, such as binders, may not be as easily locally sourced, and represent a limited amount of the total material weight. In some cases, both Options may earn the same number of points, but in most cases one will govern depending on the project location. Also, depending on the location and the types of materials used on the project, one option may be substantially easier to document and track than the other. Option 1, for example, addresses where the project money for materials actually goes. For large projects this may be a less complex approach and simply requires tracking material costs according to the project bid list and picking a nearby materials contractor. On the other hand, Option 2 for this credit intends to minimize the total transportation (and therefore fuel costs, energy and emissions) associated with transportation of materials to the site. This may be easier for smaller projects with limited complexity of materials, or for projects that are not near urban centers. For consistency between all projects, map and compute haul distances using the Google Maps tool (http://maps.google.com). For products that are shipped by air, barge, or rail, use weights and distances reported by shipping agency or organization.

DOCUMENTATION

Option 1

- A spreadsheet including an itemized list of all purchased basic materials used on the project and the billing address of the source for each.
- A computation of the total percentage of basic materials sourced within a 50 mile radius of the project.
- A map showing the geographic center (in latitude and longitude) of the project. This may, in many cases, be a milepost or station. The map must show:
  - The name and location of the project.
  - The geographic center of the project. Show the latitude and longitude or mile marker.
  - A clearly drawn circle with a radius of 50 miles drawn to scale.
  - A scale.
  - Labels or icons for each basic material with a billing address that lies within the 50 mile radius.

Option 2

- A spreadsheet showing:
  - The name and location of the project.
  - An itemized list of each basic material and its weight.
  - Cumulative fronthaul distance for each basic material.
  - A list of the locations that the basic material visited during fronthaul.
- A computation showing 95% of the total material weight meets the maximum haul distance requirements to qualify for points in Table MR-5.1. Fuel receipts, mix tickets, dump tickets, and similar supporting documents may be requested to verify spreadsheet calculations.

APPROACHES & STRATEGIES

- Establish a documentation pipeline for materials extraction and fabrication before construction starts.
- Ensure that a local materials clause is written into the special provisions in the construction contract.
- Make sure that the project has local contractors that can perform the work.

Example: Option 1 Calculation – New Roadway in Suburban Neighborhood

A small new road is being constructed in a suburban neighborhood development. The HMA aggregate is mined at the location of the asphalt plant, which is 35 miles away from the project. The asphalt binder is sourced from an out of town supplier that is located 220 miles away from the project site, and the marking paint was shipped from 86 miles north of the geographic center of the project. No electrical or stormwater infrastructure materials are included in the scope of work, because these utilities are already in place.

The bid list costs for all material components or products on the project are:

	HMA Aggregate	Asphalt	Aggregate Base	Paint for Markings
Weight (ton)	21,200	896	17,300	0.21
Distance (mi)	25	220	25	86
Unit Cost ($/ton)	$7.50	$100	$7.50	$153,377
Total Cost ($) with shipping	$159,000	$89,600	$129,750	$32,080

The total cost for materials is **$410,430**. The total cost of the items that originate from within a 50 mile radius of the geographic center of the project (the HMA aggregate and aggregate base) is **$288,750**. This equates to **70.3%** of the materials by cost being located within a 50 mile radius, which would allot **1 point** to the project.

Example: Option 2 Calculation – Rural Overlay with Stormwater Treatment

A new project to overlay two miles of a rural county road will be occurring in the next few months. Stormwater is to be treated in linear ditches along the roadway using compost amended soil provided from a farmer whose plot is approximately 120 miles from the project, where it is produced and mixed. The HMA aggregates are being trucked into a mobile plant located 45 miles from the quarry and 35 miles from the project. The asphalt binder is being trucked via tanker from the nearest refinery which is located 295 miles away to the mobile plant. Paint for markings is provided from the nearest city center which is 410 miles west of the project.

	Aggregate for HMA	Asphalt Binder	HMA	Compost	Soil	Compost Amended Soil	Paint for Markings
Weight (ton)	5,200	200	-	350	325	-	0.25
Distance (mi)	45	295	35	0	0	120	410
% of Total Weight	85.6%	3.3%	*88.9%*	5.8%	5.3%	*11.1%*	0.0%

The total distance travelled by the aggregate from source to plant to project site (front haul only) is 80 miles and this material accounts for 85.6% of the total weight of materials for this overlay. However, since this is less than 95% of the total weight of materials, the critical material component is actually the compost amended soil. The total distance traveled by the compost amended soil is 120 miles, meaning that 96.7% of the total materials by weight have traveled 120 miles or less from point of origin to the project site. This qualifies the project for **4 points** according to table MR-5.1.

For this example, note that the total distance travelled by the asphalt binder from source to plant to project site is 330 miles, but this only accounts for 3.3% of the total weight of materials. The paint materials also did not contribute measurably to the total weight of materials transported to the site. These products are likely to have high unit cost, making it unlikely the project would score as highly according to the Option 1 method.

Example: Case Study - I-5 James to Olive Project (Mixed Pavement)

The I-5 James to Olive project was constructed in downtown Seattle in 2005. This project consisted of constructing 2 miles of 13 inch concrete pavement over 3 inches of HMA. The HMA was supplied approximately 30 miles from the job site by road. Aggregates for HMA were mined at the batch plant location. Steel was supplied from a local supplier that was approximately 35 miles from the job site. Portland cement concrete aggregates were quarried within a radial distance of 30 miles from the project, but were trucked 25 miles to a concrete batch plant located 12 miles from the project by road. Asphalt was trucked from out of town 150 miles away to the HMA plant. Portland cement concrete and ground granulated blast furnace slag (GGBFS) were produced 5 miles from the concrete batch plant and in a 10 mile radius from the project site.

For Option 1 the materials cost breakdown would look like:

Material or Component	**Aggregate for HMA**	**Asphalt Binder**	**Aggregate for PCC**	**Cement Binder**	**GGBFS**	**Steel**
Weight (ton)	2,400	100	7800	3250	1950	35
Radial Distance (mi)	30	150	30	10	10	35
Cost of Materials ($/ton)	7.50	100.00	7.50	50.00	30.00	650.00
Cost	$18,000	$10,000	$58,500	$162,500	$58,500	$22,750

The total cost for these materials was **$330,250**. The total cost of materials that were located within 50 miles was **$320,250** which amounts to **96%** of the materials cost. This would score **5 points** towards this credit.

For Option 2 the materials breakdown would look like:

Material or Component	**HMA Aggregate**	**Asphalt Binder**	***HMA***	**Aggregate for PCC**	**Cement Binder**	**GGBFS**	***PCC***	**Steel**
Weight (ton)	2400	100	*2500*	7800	3250	1950	*1,000*	35
Travel Distance (mi)	30	180	*30*	37	17	17	*12*	35
Total Weight (ton)			*2500*				*13000*	*35*

The total weight of the materials is **15,535 tons.** The asphalt binder, which traveled farthest (180 miles from source to plant to project site), accounts for 0.6% of the total weight of pavement assembly materials. The remaining **99.3%** of materials traveled less than 100 miles to their final destination on site. This method would also score **5 points**.

Example: Case Study - Mountlake Terrace Freeway Station, Mountlake Terrace, WA

The Mountlake Terrace Freeway Station project began construction in May 2009 to provide I-5 median access to the recently constructed Mountlake Terrace Transit Center. Currently, buses must merge across I-5 to exit and use surface streets to reach the transit center. The freeway station will allow buses to load and unload riders without straying from the HOV lanes. The covered freeway station will connect to the transit center through a pedestrian bridge, and is designed to increase bus speed and reliability. The roadway project consists of underground utility work for infrastructure improvements, sound walls, and also standard pavements.

Option 1 is used to compute the points for this project. The computation is shown in the table on the following page. The project qualifies for **4 points**, with **94%** of materials by cost being sourced from within a 50 mile radius of the project site.

Materials and Components	Quant.	Unit	Unit Cost ($)	Total ($)	% of Total Cost	Origin	Miles to Site	Within 50 miles?
Conc. Class 4000 for retaining wall	2800	cy	576	1,612,800	30.5	Seattle	20	Yes
HMA Cl 1/2 in PG 64-22	15520	ton	83	1,288,160	24.4	Bremerto n	38	Yes
Conc. Class 4000 for station	1407	cy	706	993,342	18.8	Seattle	20	Yes
St. Reinf. Bar for retaining wall	229970	lb	1	229,970	4.4	Seattle	18	Yes
Prestressed Conc. Girder W74G	663	lf	285	188,955	3.6	Spokane	299	No
Crushed Surfacing Base Course	7060	ton	25	176,500	3.3	Monroe	26	Yes
Gravel Backfill for Wall	6060	cy	29	175,740	3.3	Monroe	26	Yes
Quarry Spalls	8686	ton	20	173,720	3.3	Monroe	26	Yes
36in - Cl V. Reinf. Conc. Storm Sewer Pipe	1149	lf	113	129,837	2.5	Spokane	299	No
36in - Ductile Iron Storm Sewer Pipe	456	lf	210	95,760	1.8	Marysville	21	Yes
24in - Corrugated Polyethylene Culv. Pipe	2291	lf	41	93,931	1.8	Edmonds	2	Yes
Profiled Plastic Wide Lane Line	16040	lf	4	64,160	1.2	Edmonds	2	Yes
Cement Conc. Pavement	221	cy	287	63,427	1.2	Seattle	17	Yes
			Total Cost	**$5,286,302**	**% by Cost in 50 mile Radius:**			**94.0%**

POTENTIAL ISSUES

1. As written, this credit currently does not include contribution from **backhaul** distances of emptied vehicles because they carry zero materials. Additionally, there is high variability in vehicles used for transport which makes tracking distances (in a meaningful way) travelled based on gas mileage or engine efficiency quite tedious. These two issues may be addressed more comprehensively by pursuing the MR-1 Life Cycle Assessment credit.
2. As written, this credit currently does not track **waste** products leaving the site. This value of such an activity can be addressed in the Custom Credits category. However, material gathered on site and taken offsite for reprocessing (e.g. fill material, recycled asphalt pavement from milling waste, etc.) needs to be considered and has been noted. This recycling activity assumes the initial production stage occurs at the site, goes through additional production at the processing facility, and is later constructed back at the site in a different form.
3. As written, this credit does not require projects to include distances traveled from the extraction sites of raw materials used to make basic material products such as asphalt binder (petroleum extraction).

RESEARCH

Using local materials on projects can not only lower the transportation costs of the project, but will also reduce the amount of emissions associated with transport by reducing transport distances for hauling materials. This practice can therefore decrease the overall greenhouse gas emissions and energy use associated with road construction.

Reducing haul distances decreases emissions and fossil fuel use. According to most lifecycle assessments completed for pavement construction, transportation of materials accounts for 7-38% of energy use and 4-10% of CO_2 emissions on typical roadway projects modeled (Muench & Anderson, Submitted). This means transportation of materials uses about 8 times the energy and produces twice as many CO_2 emissions as the construction processes for the road. Therefore, limiting haul distances has a sizable impact on energy and greenhouse gas emissions, as well as reducing emissions of many other harmful air pollutants from burning fossil fuels that are detrimental to human health (Bilec et al., 2006). (See also Project Requirement PR-3 Life Cycle Inventory).

Local economies also benefit from projects using local materials. Using local suppliers creates or maintains jobs, establishes community identity (Sustainable Sites, 2009), and often supports local small business owners. Typically many paving companies that bid large scale road projects are located less than 100 miles away from a project due to local specification restraints on material properties (e.g. standard binder grades and aggregate quality), and because transportation of heavy materials is fuel-intensive and expensive. Also, most public work paving projects use local material suppliers due to the cost implications of competitive bidding. That being said, using local contractors and suppliers will not always result in the lowest bid. The cost of social externalities for the resultant transportation emissions is not normally included in a bid and can be significant (Bilec et al., 2006).

Both the Leadership in Energy and Environmental Design (LEED™) Rating System and the Sustainable Sites Initiative award credit for minimizing transport distance. In LEED, the radius that determines a “regional” product is established at 500 miles from the site. LEED has experienced issues with their specification due to incorrect reports of haul distances during extraction and manufacture provided by contractors. This is largely a communication issue between the contractor, materials supplier and the project team attempting a LEED certification (Davis Langdon, 2004). There is also some difficulty in understanding the LEED credit calculation requirements for computing supply-chain responsibility by cost: many building products are extracted or produced in one location that may be outside the radius, and then they are assembled locally (Davis Langdon, 2007). In Sustainable Sites (2009), the radius varies depending on the type of product from 50 miles (soils and aggregate) to 500 miles (for specialty products). For this credit, a 50 mile radius is used and calculations are done by weight, because soil and aggregates represent the largest percentage of materials on most paving projects, are typically supplied locally due to cost-effectiveness, and weights of these materials are already tracked. Additionally, weight of materials directly corresponds to total fuel use and thus bid cost for the most common hauling equipment used in construction.

GLOSSARY

Backhaul	The return trip after a good has been delivered
Basic material	A material component that cannot be taken apart without changing the chemical composition of the material component itself
Fronthaul	The trip associated with delivery of a good
Haul distance	The distance a good travels to get to the location of intended use
Waste	Unwanted material produced as a result of construction activity

REFERENCES

Bilec, Melissa; Ries, Robert; Matthews, Scott & Sharrard, Aurora. (2006). Example of a Hybrid Life-Cycle Assessment of Construction Processes. ASCE Journal of Infrastructure Systems, Volume 12, Issue 4. pp 207-215.

Davis Langdon. (2004). Costing Green: A Comprehensive Cost Database and Budgeting Methodology. Available at: http://www.usgbc.org/Docs/Resources/Cost_of_Green_Full.pdf

Davis Langdon (2007). The Cost of Being Green Revisited: Reexamining the feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption. Available at: http://www.davislangdon.com/USA/Research/

Muench, S.T. & Anderson, J.L. (n.d.). *Weighting a Sustainability Performance Metric for Roadways: Greenroads*. Manuscript submitted for publication.

Sustainable Sites Initiative. (2009) *The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009.* Available at http://www.sustainablesites.org/report/

United States Green Building Council (USGBC). (2009) *LEED 2009 for New Construction and Major Renovations Rating System.* Available at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=220