

This is a guidance document with sample specification language intended to be inserted into project specifications on this subject as appropriate to the agency's environmental goals. Certain provisions, where indicated, are required for U.S. federal agency projects. Sample specification language is numbered to clearly distinguish it from advisory or discussion material. Each sample is preceded by identification of the typical location in a specification section where it would appear using the SectionFormat™ of the Construction Specifications Institute; the six digit section number cited is per CSI Masterformat™ 2004 and the five digit section number cited parenthetically is per CSI Masterformat™ 1995.

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SECTION 32 10 00 (SECTION 02700) – BASES, BALLASTS, AND PAVING

SPECIFIER NOTE:

resource management: Due to the mass of the material and the corresponding energy/cost to transport, specify locally available sources. Aggregate fabricated from recycled masonry and concrete is available. Fill material fabricated from recycled tires is available. Wheel stops made from recycled plastic are available; refer to Section 06 60 00 (06600) - Plastic Fabrications.

For additional information on scrap tire programs and civil engineering applications refer to the EPA Product Stewardship Program: Tires <http://www.epa.gov/epaoswer/non-hw/reduce/epr/products/tires.html>

toxicity/IEQ: Refer to Section 06 60 00 (06600) - Plastic Fabrications for information on plastic lumber. Toxicity is often a concern when utilizing recycled materials (such as old tires) for aggregate, especially when in contact with surface water or groundwater. For additional information on leachate from scrap tire in civil engineering applications refer to the EPA Product Stewardship Program: Tires and the resource links. Refer to: <http://www.epa.gov/epaoswer/non-hw/reduce/epr/index.htm>

performance: Pervious paving is preferable to solid surfacing with respect to stormwater runoff. Refer to Section 32 12 43 (02795) - Porous Paving.

Recycled porcelain, concrete, or stone may be expected to perform comparably to standard gravel/stone aggregate.

Tire chips, 1" - 2" chips of waste steel and glass belted tires, have a low unit weight of 40 to 60 pcf versus the typical 125 pcf unit weight of gravel. Therefore, tire chip perform well where compressible, lightweight, stable fill is required such as for retaining walls or for embankment construction where there is slope stability or excessive settlement caused by weak foundation soils and/or the weight of the embankment. Tire chips insulate better than gravel in reducing frost penetration. The permeability of tire chips is greater than most gravel aggregate.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Base aggregate.
 - 2. Concrete paving.
 - 3. Asphalt paving.

- B. Related Sections:
 - 1. 03 30 00 (03300) – Cast-In-Place Concrete.

1.2 SUBMITTALS

- A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

SPECIFIER NOTE:

Green building rating systems often include credit for materials of recycled content. USGBC-LEED™ v3, for example, includes credit for materials with recycled content, calculated on the basis of pre-consumer and post-consumer percentage content and it includes credit for use of salvaged/recovered materials. Green Globes US also provides points for reused building materials and components and for building materials with recycled content.

1. Recycled Content:
 - a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
 - d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

SPECIFIER NOTE:

Specifying local materials may help minimize transportation impacts; however it may not have a significant impact on reducing the overall embodied energy of a building material because of efficiencies of scale in some modes of transportation.

Green building rating systems frequently include credit for local materials. Transportation impacts include: fossil fuel consumption, air pollution, and labor.

USGBC-LEED™ v3, for example, includes credits for materials extracted/harvested and manufactured within a 500 mile radius from the project site. Green Globes US also provides points for materials that are locally manufactured.

2. Local/Regional Materials:
 - a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

SPECIFIER NOTE:

On hot summer days, urban air can be 2-10 degrees Fahrenheit hotter than the surrounding rural areas. Not to be confused with global warming, scientists call this phenomenon the "urban heat island effect." Heat islands form as vegetation is replaced by low reflectivity materials such as dark colored paving. These surfaces absorb – rather than reflect – the sun's heat, causing surface temperatures and overall ambient temperatures to rise. The displacement of trees and shrubs eliminates the natural cooling effects of shading and evapotranspiration (a natural cooling process in which water transpires from a leaf's surface and evaporates into the atmosphere, reducing ambient temperature). Refer to the EPA's Heat Island Reduction Initiative for additional information, <http://www.epa.gov/heatisland/index.htm>

USGBC-LEED™ v3 includes credit for reducing the heat island effect. To qualify, vegetated surfaces and/or high-albedo materials are necessary. USGBC identifies high-albedo materials for non-roof areas as materials with a Solar Reflectance Index (SRI) of at least 29. The SRI is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. To calculate the SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980-01. Reflectance is measured according to

ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371.

For roofing, USGBC provides credit for low-slope roofs with a minimum SRI of 78 and for steep-slope roofs with a minimum SRI of 29.

Green Globes – US also requires measures to reduce heat build-up on the roof (i.e. either high-albedo roofing materials (reflectance of at least 0.65 and emissivity of at least 0.9), OR a green roof, OR a combination of both high-albedo materials and green roof).

To qualify for an Energy Star label:

- Low Slope roofs must have an initial solar reflectance of ≥ 0.65 . After 3 years, the solar reflectance must be ≥ 0.50 .
- Steep Slope roofs must have an initial solar reflectance of ≥ 0.25 . After 3 years, the solar reflectance must be ≥ 0.15 .

3. Albedo data: Provide information identifying the reflectance of the following products provided under work of this Section:
 - a. Pavement.

B. Operating And Maintenance Manuals Submittals:

SPECIFIER NOTE:

The marking system indicated below is intended to provide assistance in identification of products for making subsequent decisions as to handling, recycling, or disposal.

Society of Plastic Inc. resin codes are easily recognized by the consumer. These are the numerical designations within chasing arrows. At the present time there is not a separate resin code for PLA (bio-resins). PLA (bio-resins) are classified as #7 (Other). Nor are there specific indications for additives or blends. The Society of Plastics resin code symbols are common for plastic packaging materials; for example:



ASTM D1972 standard specifies a resin code that provides substantially more information regarding the plastic resin, including blends and additives. ASTM D1972 labeling protocols are not common for packaging materials; however, they are recognized and utilized in the construction industry and other industry sectors. Many construction products are labeled according to ASTM D1972. Such detailed information is anticipated to be necessary data for future deconstruction (and recycling) efforts. Therefore, plastic construction products and plastic components of assemblies should be labeled in accordance with ASTM D1972. Example for a polypropylene containing 30 mass percentage of mineral powder use:

>PP-MD30<

- a. Verify that plastic products, including plastic components in assemblies, to be incorporated into the Project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.
 - 1) Products made from compositions containing a single filler, reinforcing, or other modifying material in a concentration of more than one percent by mass shall be marked with the

abbreviated term for the polymer, followed by a dash, then the abbreviated term or symbol for the additive, with its percentage by mass, arranged as shown in the example and set off with brackets. For example, a polypropylene containing 30 mass percentage of mineral powder use would be labeled: >PP-MD30<

PART 2 - PRODUCTS

SPECIFIER NOTE:

EO 13423 includes requirements for Federal Agencies to use “sustainable environmental practices, including acquisition of biobased, environmentally preferable, energy-efficient, water-efficient, and recycled-content products”

Specifically, under the Sustainable Building requirements per Guiding Principle #5 Reduce Environmental Impact of Materials, EO13423 directs Federal agencies to “use products meeting or exceeding EPA’s recycled content recommendations” for EPA-designated products and for other products to “use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the project.”

Executive Order 13514; *Federal Leadership in Environmental, Energy, and Economic Performance*; was signed on October 5, 2009. <http://www.ofee.gov/execorders.asp> It expands upon the environmental performance requirements of EO 13423.

http://www1.eere.energy.gov/femp/regulations/printable_versions/eo13423.html

EO 13514 sets numerous federal requirements in several areas, including sustainable buildings and communities. Federal agencies must implement high performance sustainable federal building design, construction, operation and management, maintenance, and deconstruction, including:

- Ensuring all new Federal buildings, entering the design phase in 2020 or later, are designed to achieve zero net energy by 2030.
- Ensuring all new construction, major renovations, or repair or alteration of Federal buildings comply with the Guiding Principles of Federal Leadership in High Performance and Sustainable Buildings <http://www1.eere.energy.gov/femp/pdfs/mouhighperfsustainfedfac.pdf>
- Ensuring at least 15% of existing agency buildings and leases (above 5,000 gross square feet) meet the Guiding Principles by fiscal year 2015 and that the agency makes annual progress towards 100% compliance across its building inventory.

2.1 AGGREGATE

SPECIFIER NOTE:

Green building rating systems often include credit for materials of recycled content and may distinguish allowable credit for post-consumer and post-industrial (or pre-consumer) recycled content. USGBC-LEED™ v3, for example, factors 100 percent of post-consumer recycled content but only 50 percent of pre-consumer (post-industrial) recycled content into calculations for its recycled content materials credit. LEED v3 grants one credit to a project for using materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10 percent of the total value of the materials in the project; 10% (post-consumer + 1/2 post-industrial). It grants an additional point for 20% (post-consumer + 1/2 post-industrial).

Green Globes US also provides points for reused building materials and components and for building materials with recycled content.

Recycled content is typically determined by calculating the weight of the recycled material divided by the total weight of the product and expressed as a percentage by weight. (The recycled content “value” of a product as assessed under LEED is determined by multiplying the recycled content percentage and the cost of the product.)

Verify with manufacturer for product availability and recycled content.

- A. Coarse Aggregate: Crushed concrete or blast furnace slag complying with ASTM D692; Recycled porcelain or other non-traditional aggregate material complying with ASTM D6155.
 - 1. Recycled Content: Minimum [5] [10] [xxxx] percent post-consumer recycled content, or minimum [20] [40] [xxxx] percent pre-consumer recycled content at contractor's option.
- B. Tire: Comply with ASTM D6270; [Class I Fill] [Class II Fill].
 - 1. Recycled Content: Minimum [5] [10] [xxxx] percent post-consumer recycled content, or minimum [20] [40] [xxxx] percent pre-consumer recycled content at contractor's option.
- C. Fine Aggregate: Steel slag complying with ASTM D5106.
 - 1. Recycled Content: Minimum [5] [10] [xxxx] percent post-consumer recycled content, or minimum [20] [40] [xxxx] percent pre-consumer recycled content at contractor's option.

2.2 CONCRETE PAVING

- A. Concrete: As specified in Section 03 30 00 (03300) – Cast-in-Place Concrete and as follows:
 - 1. Albedo:
 - a. Pavement: Minimum Solar Reflectance of 0.3.

SPECIFIER NOTE:

Cement is 10 percent to 15 percent of concrete, but is more energy intensive than the other constituents. Use the minimum amount of cement required for a project to produce quality concrete. USGBC-LEED v2.1 includes an interpretation credit for using less cement or substituting cement for recycled-content cementitious materials.

Fly ash is not commonly used as a replacement for portland cement at the 40 percent level and needs to be tested extensively for compatibility and performance if used in this manner

- B. Cementitious Material
 - 1. Use 40 percent less Portland cement than a traditional concrete by using less cement, or substituting 40 percent of the cementitious material with slag cement or other recycled cementitious material. If fly ash is used as a replacement for portland cement at the 40 percent level, provide test data demonstrating compatibility and performance satisfactory to Engineer.

2.3 ASPHALT PAVING

- A. Asphalt Cement:
 - 1. Recycled Content: Minimum [5] [10] [xxxx] percent post-consumer recycled content, or minimum [20] [40] [xxxx] percent pre-consumer recycled content at Contractor's option.
- B. Recycling Agents: Comply with ASTM D5505; Class ER [1] [2] [3].
 - 1. Hot recycling agents: Comply with ASTM D 4552 for hot recycling; Grade RA [1] [5] [25] [75] [250] [500]. Evaluate blends in accordance with ASTM D 4887.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Tire Aggregate: Install in accordance with ASTM D6270.

END OF SECTION