

# PD-19: Reduce, Reuse and Repurpose Materials

1-12 points

**Goal:** Reduce lifecycle impacts from extraction and production of virgin materials by recycling materials.

## Sustainability Linkage

Reducing and reusing materials supports the environmental and economic principles of the triple bottom line by reducing the consumption of raw materials, reducing landfill waste, and encouraging cost savings.



## Background and Scoring Requirements

### Background

This criterion focuses on reducing and reusing materials while *PD-20: Recycle Materials* focuses on efforts to recycle materials per the descriptions and definitions provided below.

When pavements are originally constructed, the best materials available at the time are usually sourced and used during construction. As resources diminish, that often means that the best materials available for reconstruction are already in place in the existing infrastructure. In addition to reducing waste, recycling pavements allows us to reclaim the best materials that were originally available for construction.

Programs for waste reduction in the United States have generally taken on the concept of the 3Rs: reduce, reuse, and recycle. For the purposes of this criterion, as well as to *PD-20: Recycle Materials*, the key terms are defined as follows:

- **“Reducing”** is used in this tool to refer to processes that reduce the need for virgin paving and structural materials. Examples include soil stabilization methods to reduce the need for structural backfill or to reduce the required thickness of a new pavement or overlay; pavement preservation technologies that extend the life of existing pavements and reduce the need for new materials; bridge preservation technologies that extend the life of existing bridges and reduce the need for new structures and materials; retrofitting existing bridge structures to reduce the need for new structures and materials; or processes that incorporate existing pavement structures into new pavement structures (such as crack-and-seat and rubblization) to reduce the need for new materials and avoid the transportation of the existing used materials which would otherwise be removed from a project.
- **“Reusing”** is the reuse of a material or by-product from another industry for a new function in a transportation application. Examples of the beneficial use of industrial by-products include the incorporation of materials such as coal ash, fly ash, foundry sand, slag, asphalt shingles, construction and demolition materials, or other materials into a transportation project. These reused materials replace traditional materials with similar properties in specific applications. The reuse of these materials should assure that the engineering properties of the final product or mixture are equal to or better than obtained from using traditional materials, and that their economic value is demonstrated in accordance with the FHWA Recycling Policy. Reused materials provide environmental benefit by reducing the unnecessary landfilling of these materials. With proper engineering, these materials can be successfully incorporated into transportation applications and provide economic value to our projects.

- **“Recycling”** is the use of old materials for a new and similar use in a transportation application, or the salvaging and reprocessing of previously used materials from other transportation applications into a new transportation project. See PD-20: Recycle Materials for examples.
- **“Retrofit”** is defined as the addition of new features or technology to an older or existing facility. For INVEST purposes, a project would include retrofit components in order to reinforce structures to become more resistant and resilient to the forces of natural hazards and other environmental factors such as aging and weathering. It involves the consideration of changes in the mass, stiffness, damping, load path, and ductility of materials, as well as radical changes such as the introduction of energy absorbing dampers and base isolation systems.
- **“Existing pavement material”** is defined as all material within the project limits in the existing pavement structure (including surfacing and base material). This includes travelled lanes and shoulders, and pavement structures for physically separated bicycle and pedestrian pathways.
- **“Existing structural material”** is defined as all material within the project limits in existing non-pavement structures such as bridges (including overpasses), retaining walls, and stormwater infrastructure, such as vaults, pipes, and culverts. All existing structural materials include their foundations, for which volumes may be difficult to estimate. Where actual weights are not available, reasonable estimates may be used or volume may be estimated. To compute volume of hollow structural sections such as prefabricated members or corrugated steel, estimate the mass of the material and adjust for material density to determine volume. Note that for typical reinforced concrete sections, the steel does not need to be separated from the composite section for purposes of volume calculations and a composite density may be used.

## Scoring Requirements

Implement one or more of the methods listed below. **Points for different scoring requirements are cumulative; however, this criterion shall not exceed a total of 12 points.**

### Requirement PD-19.1

#### **2-4 points. Pavement Preservation**

Perform pavement preservation activities such as crack sealing, chip sealing, slurry sealing, microsurfacing, or thin ACP overlays that extend the remaining service life of pavements. This scoring requirement applies to pavement preservations and not rehabilitation or reconstruction activities. FHWA’s *ACTION Pavement Preservation Definitions Memo*<sup>1</sup> defines pavement preservation as "a program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations."

Points are awarded based on increase in remaining service life per Table PD-19.1.A.

**TABLE PD-19.1.A. POINTS AWARDED FOR PAVEMENT PRESERVATION ACTIVITIES**

Points	Increase in Remaining Service Life <sup>1</sup>
1	1 to 2 years
2	2 to 5 years
3	5 to 7 years
4	7 to 10 years

<sup>1</sup> More than 10 years is considered rehabilitation and isn’t eligible for this scoring requirement.

## **Requirement PD-19.2**

### **1-3 points. Reduce Pavement Materials**

Reduce the amount of new pavement materials needed through soil stabilization methods to reduce the required thickness of a new pavement or processes that incorporate existing pavement structures into new pavement structures. Points are awarded per Table PD-19.2.A based on the percentage of pavement area treated. The area treated is calculated based on the entire area of existing pavement materials that are preserved or reconstructed.

Soil stabilization methods may include the use of geosynthetics (geogrids and fabrics) to reduce the thickness of aggregate required for stabilization of subgrade; the use of geosynthetics to reduce the thickness of aggregate above the geosynthetics that would have been required for structural support when subgrade soils are susceptible to pumping and base course intrusion; the use of portland cement and/or cementitious by-product materials for soil stabilization for pavement construction, if it can be demonstrated that this process will reduce the use of natural aggregate (virgin aggregate or material hauled from off-site source) use for stabilization; other chemical stabilization; and fractured slab techniques, including crack-and-seat, and rubblization.

**TABLE PD-19.2.A. POINTS AWARDED FOR REDUCING PAVEMENT MATERIALS**

<b>Points</b>	<b>Percentage Pavement Area Treated</b>
1	50–74%
2	75–99%
3	100%

## **Requirement PD-19.3**

### **2-4 points. Bridge Preservation**

Perform bridge preservation activities such as deck overlays, crack sealing, joint sealing, removing channel debris, lubricating bearings, cathodic protection, electrochemical chloride extraction and cleaning, and painting that extend the remaining service life of bridges. This scoring requirement applies to bridge preservations and not rehabilitation or reconstruction activities. For definitions and examples of bridge preservation, see the FHWA [Bridge Preservation Guide](#)<sup>2</sup>. Points are awarded based on increase in remaining service life per Table PD-19.3.A.

**TABLE PD-19.3.A. POINTS AWARDED FOR BRIDGE PRESERVATION ACTIVITIES**

<b>Points</b>	<b>Increase in Remaining Service Life</b>
2	2 to 5 years
3	5 to 7 years
4	7 to 10 years

## **Requirement PD-19.4**

### **1-3 points. Retrofitting Bridges**

Retrofit existing bridge structures to reduce the need for new structures and materials. This could include methods such that improve or add: stainless steel wire mesh composites, full height steel jackets, elastomeric bearings,

steel restrainer cables, shear keys, fiber reinforced polymers wraps, shape memory alloy devices, metallic and viscoelastic dampers, or pipe seat extenders. Points are awarded based on increase in remaining service life per Table PD-19.3.A above.

**Requirement PD-19.5**

**1-3 points. Repurpose Pavements or Structures**

Reuse existing pavements, structures, or structural elements for a new use by repurposing them for a use that requires equal or less loading. The purpose of this scoring requirement is to maintain and leverage existing pavements, structures, and structural elements for new uses where possible instead of using new materials (as long as the existing elements meet the performance requirements of the new use). One method is to maintain existing pavements when new alignments are proposed and use the existing pavement for a new use, such as realigning a highway but maintaining the old one as a frontage road, cycle path track, or multiuse path. Another method is to convert existing pavement to a different use, such as converting parking to travelled lanes (or vice versa) or converting pavement to multiuse paths or plazas.

Pavement to be repurposed shall not be processed or moved in any way; it shall remain in-place. Points are awarded per Table PD-19.5.A based on the percentage of existing pavement material (by area) reused and repurposed calculated based on the entire area of existing pavement materials included in the project.

**TABLE PD-19.5.A. POINTS AWARDED FOR REUSING AND REPURPOSING PAVEMENTS IN PLACE**

<b>Points</b>	<b>Percentage Pavement Reused and Repurposed</b>
1	25–49%
2	50–74%
3	75% or more

**Requirement PD-19.6**

**1-3 points. Reuse Industrial By-Products**

Scoring for this requirement is based on the following, cumulative requirements:

- **Requirement PD-19.6a**

**1 point. Use By-Products for Pipe Bedding or Backfill**

Using foundry sand or other industrial by-products in pipe bedding and backfill.

- **Requirement PD-19.6b**

**2 points. Use By-Products in Roadway Elements**

Reuse industrial by-products in pavement materials, ancillary structures, and other roadway elements. These could include one or more of the following: coal ash, fly ash, foundry sand, slag, tires, asphalt shingles, and construction and demolition materials.

**Requirement PD-19.7**

**1 point. Recycling and Reuse Plan**

Develop and implement a project-specific plan for the innovative reuse of waste materials other than the methods listed in PD-19.1 through PD-19.6.

## Resources

The following resources are referenced in this criterion and consolidated here:

1. FHWA, *ACTION Pavement Preservation Definitions Memo*, <http://www.fhwa.dot.gov/pavement/preservation/091205.cfm>
2. FHWA, *Bridge Preservation Guide*, <http://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf>

## Scoring Sources

The project is considered to have met this criterion if the requirements above can be reasonably substantiated through the existence of one or more following documentation sources (or equal where not available):

1. Calculations showing the remaining service life of pavements or bridges expected before the project and after, and clearly demonstrating an extended service life as a result of the treatments applied.
2. Calculation of the percentage pavement area treated, including the area of pavement treated and the existing pavement area preserved and retrofitted.
3. The approved mix design for the pavement materials.
4. Recycling and Reuse Plan.