Context Sensitive Roadway Surfacing Selection Guide

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Who is Federal Lands Highway?
• Operate like DOT’s
• Design and Construction on public land
• Direct Construction Division for FHWA
• Three Divisions
  – Sterling, Virginia
  – Denver, Colorado
  – Vancouver, Washington

Public Land / Clients
• National Park Service
• National Forest Service
• Fish and Wildlife Service
• Department of Defense

Purpose and Need
• Traditional Pavement Design
  – Highest Level of Performance
  – Lowest Cost
• New Approach
  – Include Visual Impacts
  – Environmental Impacts
  – Road Context

Purpose and Need
• No Existing Guidance for Context Sensitive Surfacing Approach
• Facilitate Consultation
  – Public
  – Client
  – Interest groups
• Only used when necessary

Development of Guide
• Golder Associates – Consultant
• Federal Lands Highway
Key Components of Guide

- Introductory section on pavement design and CSS for non-technical project stakeholders
- Surfacing Selection Methodology
  - Screening Stage
  - Selection Stage
- Supporting Tools
  - Product Summary Table
  - Photo Album
  - Brochure

Balancing / Selection

- 3 Areas of Consideration
  - Performance and Durability
  - Constructability and Cost
  - Context Sensitivity and Environmental Attributes
- Rated by scoring system
- Surface type selected

Implementation

- Publication (~500 copies)
- Develop workshops and manuals
- Provide training opportunities

Typical Surfacing Information

- Traffic Levels
- Life Expectancy
- General Unit Price
- Appearance
- Advantages
- Limitations
- Product Description

Photo Album

- Includes over 50 Surface Types
- Asphalt Surfacing (Non-Structural)
- Asphalt Surfacing (Structural)
- Soil / Aggregate
- Stabilized
- PCC Surfaces
- Unit Pavers

4.4 Gravel (Crushed and Uncrushed)

- Traffic Range
  - Best suited for AADT<250.
- Life Expectancy
  - Many gravel roads will last indefinitely with regular regrading and reapplication of gravel. Some require reconstruction after 6 to 10 years, even with regular maintenance.
- Unit Price
  - Material & Installation: $22.20 to $32.70/m³ ($17.00 to $25.00/yd³).
- Appearance
  - The color will depend on the material type and source. Texture depends on aggregate gradation and maximum particle size.
- Pros
  - Low initial cost; Widely available; Rustic appearance.
- Cons
  - Requires more frequent maintenance than if material was stabilized.
Gravel (Crushed and Uncrushed)

Product Description: Organic petroleum products include asphalt emulsions, asphalt emulsions, modified asphalt emulsions, and asphaltic cements. These products bind soil particles together due to the adhesive properties of the asphalt component of the products.

Traffic Range: Low to medium
Life Expectancy: 3 to 5 years
Unit Price: $0.90 to $1.80/m2
Appearance: Black color with fine surface texture
Advantages: Turns the aggregate material black
Disadvantages: Black color with fine surface texture

Tree Resin Emulsions

Product Description: Tree resin emulsions are derived from tree resins (mainly pine, fir, and spruce) combined with other additives to produce an emulsion. At low application rates, tree resin emulsions are used for dust suppression. At higher application rates, tree resin emulsions can be used to stabilize soils.

Traffic Range: Low to medium
Life Expectancy: 3 to 5 years
Unit Price: $0.75 to $1.50/yd2
Appearance: Black color with fine surface texture
Advantages: Turns the aggregate material black
Disadvantages: Black color with fine surface texture

Cape Seal

Product Description: A Cape seal is a thin surface treatment constructed by applying a slurry mix or slurry slurry in a newly constructed chip seal. The design is to be an integral system where the primary purpose of the slurry is to fill voids in the chip seal.

Traffic Range: Low to medium
Life Expectancy: 3 to 5 years
Unit Price: $2.25 to $3.00/yd2
Appearance: Black color with fine surface texture
Advantages: Turns the aggregate material black
Disadvantages: Black color with fine surface texture

Slurry Seal

Product Description: Slurry seal is a cold-mixed thin surface treatment constructed at a mixture of slurry slurry. Slurry seal consists of fine aggregate, mineral filler or other additives, and water. Slurry seals are applied at the thickness of the largest aggregate in the mix. A minimum of 1.1 in. for Type I, 1.5 in. 2 in. for Type II, and 3 in. 4 in. for Type III slurry.

Traffic Range: Low to medium
Life Expectancy: 3 to 5 years
Unit Price: $21.40 to $53.60/m2
Appearance: Black color with fine surface texture
Advantages: Turns the aggregate material black
Disadvantages: Black color with fine surface texture

Organic Petroleum Emulsions

Product Description: Organic petroleum products include asphalt emulsions, asphalt emulsions, modified asphalt emulsions, and emulsified oils. These products can be used for dust suppression or to stabilize soils. These products bind soil particles together due to the adhesive properties of the asphalt component of the products.

Traffic Range: Low to medium
Life Expectancy: 3 to 5 years
Unit Price: $2.50 to $3.30/yd2
Appearance: Black color with fine surface texture
Advantages: Turns the aggregate material black
Disadvantages: Black color with fine surface texture

Gravel (Crushed and Uncrushed)

Product Description: Gravel surfacing can be designed to be an integrated system where the primary purpose of the slurry is to fill voids in the chip seal.

Traffic Range: Low to medium
Life Expectancy: 3 to 5 years
Unit Price: $2.70 to $3.60/m2
Appearance: Black color with fine surface texture
Advantages: Turns the aggregate material black
Disadvantages: Black color with fine surface texture
**1.11 Slurry Seal**

Slurry seal placement.

Photo Source: FHWA-CFLHD

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**1.2 Chip Seal**

Traffic Range:
- Typical AADT < 1,000 when placed on aggregate base.
- Typical AADT < 2,000 when placed on existing HACP.

Life Expectancy:
- 3 to 7 years (average 5 years).

Unit Price:
- Material & Installation: $1.00 to $1.50/m2 ($0.80 to $1.25/yd2).

Appearance:
- Appearance is influenced by the binder and aggregate chip color.
- Surface texture is influenced by the aggregate size, but is generally coarse.

Advantages:
- Lower initial cost than many other surface treatments;
- Durable;
- Widely available.

Limitations:
- Loose chips can be a windshield hazard.

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**2.5 Pigmented HACP**

Traffic Range:
- No limitations on traffic volumes. High traffic volumes will cause any surface coating to wear away faster.

Life Expectancy:
- 15 to 20 years. Surface applied coatings commonly last 1 to 6 years.

Unit Price:
- Material & Installation: $4.00 to $6.70/m2 ($3.30 to $5.60/yd2) for spray coating.
- $18.00 to $24.00/m2 ($15.00 to $20.00/yd2) for pigment for 25 mm (1 in.) thick HACP layer.

Appearance:
- Numerous pigment colors are available; Earth tones are most common.

Advantages:
- Surfacing color can be selected to fit the application and surrounding environment.

Limitations:
- High cost for the pigments or surfacing coating.

Product Description: Pigmented HACP is constructed by one of two methods: (1) the color is incorporated into the HACP surface mixture during mixing at the batch plant, or (2) a colored surface coating can be applied to the HACP surface after construction. Surface color can be achieved by applying a cement-modified acrylic, thermoplastic, or epoxy based coating.

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2 Pigmented HACP

Traffic Range:
No limitations on traffic volume.

Life Expectancy:
15 to 20 years expected.

Appearance:
The appearance of the pavement will be dominated by the color of the coarse aggregate used. Pigments can be mixed with the synthetic binder.

Advantages:
Color can be controlled with careful aggregate selection; Properties similar to hot-mix asphalt concrete.

Limitations:
Very new technology in the United States; Cost will be higher than HACP.

2.5 Asphalt Surfacings

Traffic Range:
No limitations on traffic volume, except for areas with AADT>1,000.

Life Expectancy:
15 to 20 years expected.

Appearance:
The appearance of the pavement will be dominated by the color of the coarse aggregate used. Pigments can be mixed with the synthetic binder.

Advantages:
Color can be controlled with careful aggregate selection; Properties similar to hot-mix asphalt concrete.

Limitations:
Very new technology in the United States; Cost will be higher than HACP.

2 Synthetic Binder Concrete Pavement

Traffic Range:
No limitations on traffic volume, except for areas with AADT>1,000.

Life Expectancy:
15 to 20 years expected.

Appearance:
The appearance of the pavement will be dominated by the color of the coarse aggregate used. Pigments can be mixed with the synthetic binder.

Advantages:
Color can be controlled with careful aggregate selection; Properties similar to hot-mix asphalt concrete.

Limitations:
Very new technology in the United States; Cost will be higher than HACP.

2.8 Asphalt Surfacings

Traffic Range:
No limitations on traffic volume, except for areas with AADT>1,000.

Life Expectancy:
15 to 20 years expected.

Appearance:
The appearance of the pavement will be dominated by the color of the coarse aggregate used. Pigments can be mixed with the synthetic binder.

Advantages:
Color can be controlled with careful aggregate selection; Properties similar to hot-mix asphalt concrete.

Limitations:
Very new technology in the United States; Cost will be higher than HACP.

2 Exposed Aggregate HACP

Traffic Range:
No limitations on traffic volume, except for areas with AADT>1,000. For higher traffic volumes, color and imprint wear will increase.

Life Expectancy:
15 to 20 years expected.

Appearance:
The appearance of the pavement will be dominated by the color of the coarse aggregate used. Pigments can be mixed with the synthetic binder.

Advantages:
Color can be controlled with careful aggregate selection; Properties similar to hot-mix asphalt concrete.

Limitations:
High initial cost; Imprinted pattern can cause rough surface.

2.2 Asphalt Surfacings

Traffic Range:
No limitations on traffic volume, except for areas with AADT>1,000. For higher traffic volumes, color and imprint wear will increase.

Life Expectancy:
15 to 20 years expected.

Appearance:
The appearance of the pavement will be dominated by the color of the coarse aggregate used. Pigments can be mixed with the synthetic binder.

Advantages:
Color can be controlled with careful aggregate selection; Properties similar to hot-mix asphalt concrete.

Limitations:
High initial cost; Imprinted pattern can cause rough surface.

2.4 Imprinted/Embossed HACP

Traffic Range:
Typical AADT<1,300. For higher traffic volumes, color and imprint wear will increase.

Life Expectancy:
15 to 20 years expected.

Appearance:
The appearance of the pavement will be dominated by the color of the coarse aggregate used. Pigments can be mixed with the synthetic binder.

Advantages:
Durable; Aesthetically pleasing appearance; Can simulate some more expensive surfacings.

Limitations:
High initial cost; Imprinted pattern can cause rough surface.
2.4 Imprinted/Embossed HACP

Traffic Range: 0 - 40 mph
Life Expectancy: 10 to 15 years
Product Description: Imprinted asphalt concrete is a paved surface of asphalt concrete and gravel or crushed aggregate formed in a manner that results in a permeable surface. Stormwater that passes through the asphalt may partially or completely infiltrate the underlying soil; the excess is collected and routed through underdrain pipes.

Appearance: Appearance is generally gray/black with a coarse surface texture.
Advantages: Significantly reduces stormwater runoff.
Limitations: Not suitable for high traffic volumes or heavy truck traffic; Frequent maintenance required to clean asphalt pores.

2.6 Porous HACP

Traffic Range: Traffic suitably designed to have an AADT < 400.
Life Expectancy: 10 to 15 years
Product Description: Porous asphalt concrete is a paved surface and subbase comprised of asphalt concrete and gravel or crushed aggregate formed in a manner that results in a permeable surface. Stormwater that passes through the pavement may partially or completely infiltrate the underlying soil; the excess is collected and routed through underdrain pipes.

Appearance: Appearance is black with a very fine surface texture.
Advantages: Provides excellent skid resistance; Reduces tire/road noise and vehicle splash/spray; Provides a very durable riding surface for high volume roads.
Limitations: Relatively new technology in United States; High initial cost; Specialty paver required.

1.12 Ultrathin Friction Course

Traffic Range: No limitations. Typically used for AADT > 1,000.
Life Expectancy: Typically 10 to 12 years.
Product Description: Ultrathin friction course is constructed of a thin layer of gap-graded, surface course hot-mix asphalt concrete that provides a smooth, durable, and skid-resistant surface. The hot mix asphalt layer is bound to the existing surface with a polymer modified emulsion that is specifically designed to resist the existing surface and bond the new mix to the existing surface.

Appearance: Appearance is gray/black with a smooth surface texture.
Advantages: Provides excellent skid resistance; Reduces tire/road noise and vehicle splash/spray; Provides a very durable riding surface for high volume roads.
Limitations: Relatively new technology in United States; High initial cost; Specialty paver required.
7.2 Natural Stone Pavers

Traffic Range:
Typical AADT < 200. Natural stone pavers are commonly used for low-speed, low-traffic applications with speeds less than about 24 km/hr (15 mph).

Life Expectancy:
100 years.

Unit Price:
Material & Installation: $300 to $360/m² ($250 to $300/yd²).

Appearance:
Natural stone pavers can be produced in various shapes and natural colors (brown, red, gray, etc.), and can be placed in various patterns.

Advantages:
Long lasting; Appearance compatible with historic settings.

Limitations:
Initial cost is higher than for other unit surfacings; Poor ride quality; Limited to lower traffic speeds than other unit surfacings; May pose a trip hazard for pedestrians.

Product Description:
Natural stone pavers consist of irregularly sized, smooth natural stones or rock that is cut and shaped into regular sizes. Natural stone pavers fit together to form a road surfacing. They are supported on a layer of bedding sand or a layer of lean concrete mix.

Photo Source: Golder Associates Inc.

Natural stone paver surfacing.

7.4 Unit Pavers

Traffic Range:
No limitations on traffic volume. Unit pavers are normally limited to traffic applications with speeds less than about 80 km/hr (50 mph).

Life Expectancy:
20 to 40 years.

Unit Price:
Material & Installation: $36 to $48/m² ($30 to $40/yd²), including leveling sand.

Appearance:
Unit pavers are available in numerous shapes and natural colors and can be placed in various patterns.

Advantages:
Can accommodate heavy traffic loads; Applicable to higher speed applications than other unit surfacings; Durable in all climatic conditions.

Limitations:
Can become unsightly if not properly maintained.

Product Description:
Unit pavers are accurately dimensioned dense and durable concrete products that fit together to form a road surfacing. Unit pavers are typically used on a layer of bedding sand, which is in turn used to fill the gaps between the pavers. Concrete pavers are available in a range of colors and patterns.

Photo Courtesy of: Golder Associates Inc.

Concrete unit paver surfacing.

Questions???

Thank You!

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