CHAPTER 3 — SURFACING SELECTION METHODOLOGY

INTRODUCTION

A selection methodology has been developed to facilitate the process of selecting an appropriate roadway surfacing for a project or a particular segment of a project. The selection process is meant to be transparent, methodical, defensible, and allow aesthetics and context sensitivity to be considered in the selection of roadway surfacing. The selection process is a two stage process consisting of a screening stage and a selection stage. Figure 3 shows the relationship between the PDP and the surfacing selection process.

SCREENING STAGE

The purpose of the screening stage is to identify a manageable number of surfacing types that are best suited for a particular project, based on a set of selected screening criteria. These shortlisted surfacing types are then carried forward for detailed evaluation in the selection stage. Surfacing type suitability is described by one of four designations: highly suitable, acceptable, not ideal, and not applicable. Common screening criteria include traffic volume level, project setting (i.e. urban, rural, historic, decorative), cost, bound or unbound surfacing, and whether the project is for rehabilitation or new construction. The screening stage eliminates from further consideration all those surface types that are clearly not applicable for a particular application. After nonviable surfacings are removed from consideration, the remaining surface types are sorted in preferential order based on suitability for the selected screening criteria.

Choosing Screening Criteria

In the screening stage of the surfacing selection process, selected screening criteria are used to discard from consideration surfacing types that are not applicable and to rank the remaining surfacing options that are applicable. The number of screening criteria selected by the project team for use in the screening stage will depend on the type of roadway application, amount of project information available, and judgement. When available, information collected in the PDP Planning and Programming step and the initial project development activities should be used to help select screening criteria. For projectss in significant historical, cultural, or environmental settings, there may be very specific criteria that are pre-set based on project objectives and needs. In these cases, it is useful to apply all such pre-set criteria to the screening process so the selection stage is streamlined as much as possible. On the other hand, for standard road sections, there may be very few pre-set selection criteria, especially early on in the PDP. In these cases, there may be many surfacings that have the same score. Therefore, a larger number of surfacings will need to be evaluated in the Stage 2 evaluation process or additional criteria (e.g. past experience or local preferred practice) will have to be used to narrow the group of surfacings for Stage 2 evaluation. In general, using several screening criteria (as opposed to fewer) will usually help to differentiate between the surfacings in the screening stage.

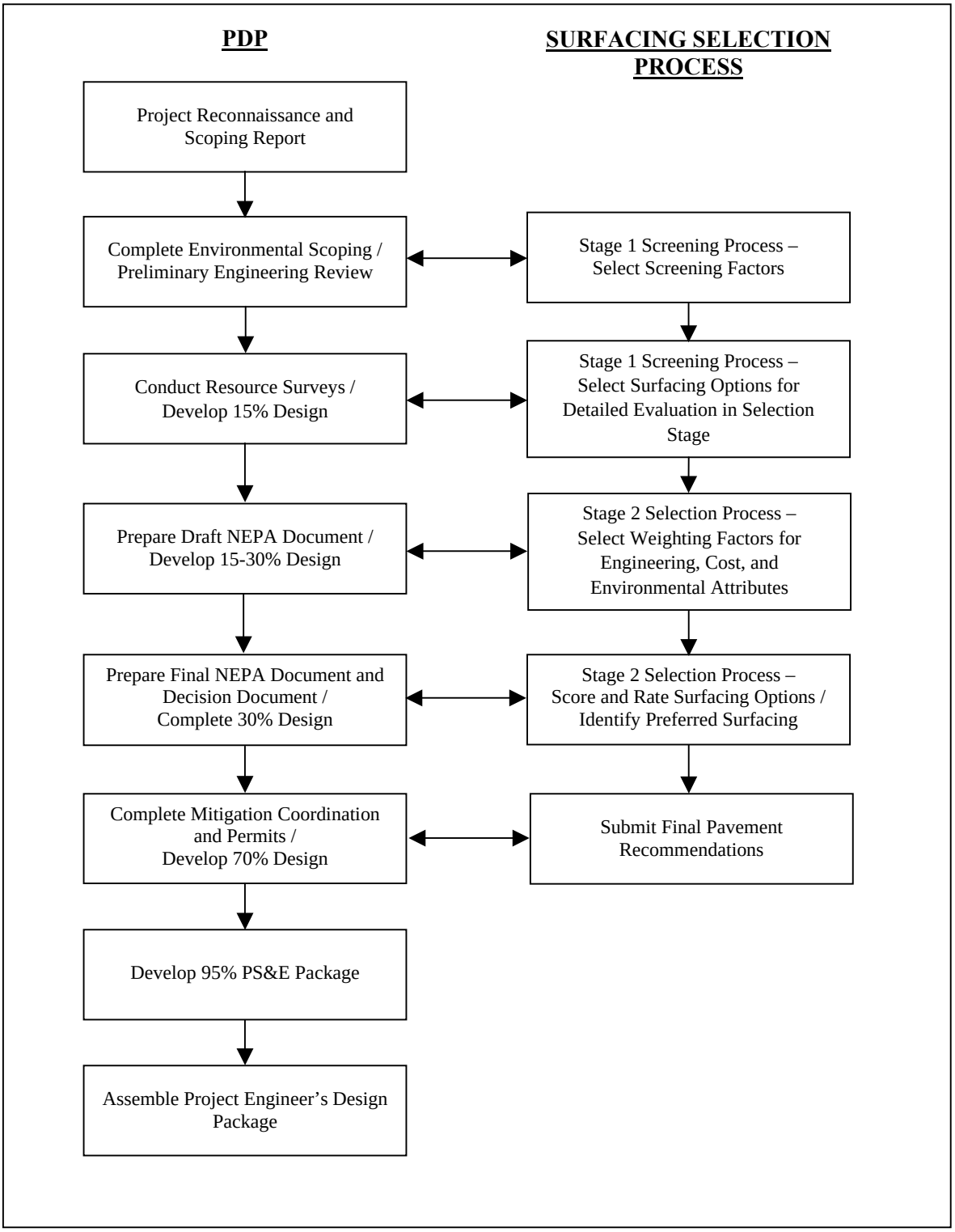

Figure 3. Flowchart. Relationship of the PDP and the Surfacing Selection Process.

Screening Criteria Descriptions

Traffic: From an objective performance perspective, most roadway surface types have maximum traffic ranges for which they are appropriate. Thus, design traffic in terms of AADT should be a basic required input to the screening process. Screening on the basis of traffic is effective for higher traffic volumes but does not reduce the list of options for low traffic volume roads.

A publication entitled, *Park Road Standards* [5] provides some guidance on traffic classifications. For the Principal Park Road and Rural Parkway functional classification it suggests six traffic categories, with corresponding design speeds (assuming flat terrain). These are shown in Table 2.

In the context of this project, six traffic categories are excessive for the purpose of differentiating roadway surface types. Many surfacing types that are suitable for traffic volumes of 1,000 vehicles per day are also suitable for traffic levels greater than 8,000 vehicles per day. Therefore the six traffic categories have been consolidated into four categories which can be described as very low, low, medium and high traffic, as shown in Table 2. In Table 3, 2,500 vehicles per day is used as a representative value for the high traffic screening criteria to determine the suitability of different surfacing types.

Table 2. Traffic Volume Classifications.

Design Volume (Vehicles/day)	Suggested Descriptive Term	Design Speed (mph)	
		Preferred	Minimum
< 200	Very Low	40	30
200 – 400	Low	50	40
400 – 1000	Medium	50	40
1000 – 4000	High	55	45
4000 – 8000		60	50
>8000		60	50

Decorative Setting: Some projects may require a decorative surfacing. For example, a decorative surfacing may be desirable for a high-profile entrance driveway because it is aesthetically pleasing. In another case, a colored surfacing may be desired to delineate a walkway or bicycle path for safety purposes. In many applications decorative surfacings are preferred over conventional PCCP or HACP surfacings, but they generally also have a higher associated cost. Therefore, in general, decorative surfacing should only be used as a screening criterion when aesthetics is a primary factor in initial project scoping, or where only a short section of roadway is involved.

Historic Setting: For roadways within a historically significant setting, aesthetics may be a significant concern, requiring the use of a surfacing with an appearance that is compatible with

the surroundings. In these cases, all conventional asphalt and concrete surfaces would typically be eliminated. Instead, surfacings with an aesthetically compatible appearance, such as stamped and/or pigmented asphalt or concrete, unpaved, or cobblestone surfacings may be more appropriate, depending on the particular historical setting and cost constraints.

Urban or Rural Setting: The user can use the setting, either rural or urban, as a screening criterion. For example, an urban setting would normally rule out the use of unpaved surfacings. If a rural application were indicated, then more rustic surfacing options may be favored.

Cost: Cost is an important criterion for most projects. Roadway surfacings have a wide range of unit costs, ranging from unpaved, unbound surfacings at the low end to hand placed cobblestones at the high end. In an application involving a small area of specialty pavement, cost may not be a concern. However, for larger projects, such as 30 km (19 miles) of forest access road, low cost may be an important criterion. Cost may also be a primary concern when road construction funding is limited. A detailed cost analysis is not required in the screening stage; surfacings are generally classified by typical unit costs.

Unbound or Paved Surface: *Park Road Standards* [5] suggests that above an AADT of 400 only paved surfaces should be used. At the commencement of a project, it is usually possible to establish whether a particular road needs to have an all-weather paved surface. In addition to functional considerations, unpaved surfaces are often preferred in scenic rural landscapes, based on aesthetics.

3R or 4R Projects: 3R projects involve rehabilitation of the pavement structure and may involve upgrades of safety features. 4R projects involve complete reconstruction of a roadway, which may include widening, new alignment, and/or grade changes. Some surfacing types, such as in-place recycling, are only practical for 3R projects because the in-place material is required. Thus, for 4R projects, some surfacing options can be eliminated in the screening stage.

Climate and Percent Fines (in unbound material): When unbound or stabilized soil/aggregate surfacings are acceptable for a project, climate or percent fines (in unbound material) can be used as screening criteria. These criteria are especially useful when considering stabilized surfaces because the effectiveness of many stabilizing agents is significantly affected by climate (i.e. wet or dry) and percentage of fines in the material to be stabilized.

The roadway surfacings can be sorted by their suitability for the application based on the appropriate selected screening criteria. Each surfacing can be assessed for each of the selected screening criteria listed above. The assessment should assign one of four designations, as follows:

A: Highly suitable,
B: Acceptable for use,
C: Not ideal, but can be used, or
X: Not suitable.

See Table 3 for suggested designations for each surfacing for common screening criteria. Table 3 only includes products that are suitable for use as a permanent surfacing. Although most of the road construction products presented in Table 1 are suitable for use as a roadway surfacing, a few materials, listed in Table 4, are common road base materials. Although these base materials can be used as a temporary roadway surfacing, they are not recommended for use as a permanent surfacing. They have been included in Appendix A since they are commonly used products and their use may allow a wider range of surfacing options to be considered, especially for rehabilitation applications. In addition, non-structural surfacings rely entirely on the underlying strata for structural support; therefore, information on common base materials can be useful when assessing the pavement structure as a whole.

Once all of the surfacings are assessed for each of the selected screening criteria, any surfacing that is designated as not applicable (X) for any of the selected screening criteria is removed from further consideration. The remaining surfacings can be sorted in several ways, including: by most number of highly suitable (A) designations, least number of not ideal (C) designations, or highest total suitability score. When a large number of surfacings are applicable and must be sorted, it is often easiest to sort the surfacings using the highest total suitability score. For each surfacing, the total suitability score is calculated by assigning numerical values to the designations for each screening criterion (A=3, B=2, C=1) and summing up the numerical values to obtain a total score for the surfacing. The surfacings can then be sorted according to their total score. This process lends itself very well to being performed with a spreadsheet, but it can also be performed manually.

Once all the surfacings are sorted, it is up to the project team to determine the number of surfacings to carry forward to the selection stage. In many cases where surfacings are sorted by highest total suitability score, the distribution of scores allows the team to clearly select the top four to eight ranked surfacings for detailed evaluation in the selection stage. However, it is possible, based on the number and which screening criteria are used, for a case to occur where a large number of surfacings have the same score. When this happens, the team must decide if all the surfacings proceed to the selection stage or if the list should be trimmed based on additional considerations (e.g. past experience, agency familiarity with particular surfacings, surfacing on adjacent roadways, etc.). Also, if there is a particular interest in specific surfacings that are not among the top group, they may be evaluated in the selection stage as well, regardless of score.

The intent of the screening stage is to identify the most suitable roadway surfacings for a particular project, based on selected criteria, and reduce the number of roadway surfacings to a manageable number for detailed evaluation. This stage allows the project team to avoid performing a detailed evaluation for each individual surfacing listed in the surfacing catalog and allows the team to focus on the most suitable surfacings.

Table 3. Suggested Suitability Designations for Screening Stage

Road Surfacing Type	Traffic			
	Very Low	Low	Medium	High
Asphalt Surfacing (non-structural)				
Cape Seal	A	A	A	B
Chip Seal	A	A	A	B
Chip Seal over Geotextile	A	A	A	B
Fog Seal	A	A	B	C
Microsurfacing	A	A	A	A
Multiple Surface Treatments (Seals)	A	A	A	B
Open Graded Friction Course	A	A	A	A
Otta Seal	A	A	B	C
Sand Seal	A	A	B	C
Scrub Seal	A	A	A	C
Slurry Seal	A	A	A	B
Ultrathin Friction Course	A	A	A	A
Asphalt Surfacing (structural)				
Cold Mix Asphalt Concrete Pavement	A	A	A	B
Hot Asphalt Concrete Pavement (HACP)	A	A	A	A
Exposed Aggregate HACP	A	A	B	C
Imprinted / Embossed HACP	A	A	B	C
Pigmented HACP	A	A	A	A
Porous HACP	A	A	C	X
Resin Modified Pavement	A	A	A	A
Synthetic Binder Concrete Pavement	A	A	A	A
Portland Cement Concrete (PCC) Surfacings				
Cellular PCC	A	A	B	X
Portland Cement Concrete Pavement (PCCP)	A	A	A	A
Exposed Aggregate PCCP	A	A	A	B
Pigmented PCCP	A	A	A	B
Porous PCCP	A	A	A	C
Stamped PCCP	A	A	B	C
Roller Compacted Concrete	A	A	A	B
Whitetopping	A	A	A	A
Unbound & Mechanically Stabilized Surfacings				
Cellular Confinement	B	B	C	X
Fiber Reinforcement	B	C	X	X
Geotextile/Geogrid Reinforcement	B	C	C	X
Gravel (crushed or uncrushed)	B	C	X	X
Sand	C	X	X	X
Other Stabilized Surfacings				
Chlorides	B	C	X	X
Clay Additives	B	C	X	X
Electrolyte Emulsions	B	C	X	X
Enzymatic Emulsions	B	C	X	X
Lignosulfonates	B	C	X	X
Organic Petroleum Based Emulsions	B	C	C	X
Synthetic Polymer Emulsions	A	B	C	X
Tree Resin Emulsions	A	B	C	X
Unit Surfaces				
Brick Pavers	A	A	B	C
Natural Stone Cobbles	B	B	C	X
Unit Pavers	A	A	A	A
Porous Unit Pavers	B	B	B	C
Recycling Alternatives				
Hot In-Place Recycling	A	A	A	A
Recycled HACP	A	A	A	A

A:	**Highly suitable**
B:	**Acceptable for use**
C:	**Not ideal, but can be used**
X:	**Not suitable**
	Not applicable

Table 3. Suggested Suitability Designations for Screening Stage (cont.)

Road Surfacing Type	Setting				Surfacing Requirement		
	Decorative	Historic	Urban	Rural	Low Cost	Unbound	Paved
Asphalt Surfacing (non-structural)							
Cape Seal	X	X	A	B	A	X	B
Chip Seal	B	C	B	A	A	X	C
Chip Seal over Geotextile	B	C	B	A	B	X	B
Fog Seal	X	X	A	B	A	X	C
Microsurfacing	C	C	A	B	B	X	B
Multiple Surface Treatments (Seals)	B	C	B	A	A	X	B
Open Graded Friction Course	X	X	A	B	B	X	A
Otta Seal	X	X	B	B	A	X	B
Sand Seal	X	X	A	B	A	X	B
Scrub Seal	X	X	A	B	A	X	B
Slurry Seal	C	C	A	B	A	X	B
Ultrathin Friction Course	X	X	A	B	B	X	A
Asphalt Surfacing (structural)							
Cold Mix Asphalt Concrete Pavement	X	X	A	B	B	X	B
Hot Asphalt Concrete Pavement (HACP)	X	X	A	B	B	X	A
Exposed Aggregate HACP	B	C	A	B	C	X	A
Imprinted / Embossed HACP	A	B	A	C	X	X	B
Pigmented HACP	B	C	A	B	B	X	A
Porous HACP	X	X	A	B	B	X	A
Resin Modified Pavement	X	X	A	B	B	X	A
Synthetic Binder Concrete Pavement	A	A	A	B	X	X	A
Portland Cement Concrete (PCC) Surfacings							
Cellular PCC	X	A	B	C	C	X	B
Portland Cement Concrete Pavement (PCCP)	X	X	A	B	C	X	A
Exposed Aggregate PCCP	A	B	A	B	C	X	A
Pigmented PCCP	A	B	A	B	C	X	A
Porous PCCP	X	X	A	C	C	X	A
Stamped PCCP	A	A	A	B	C	X	B
Roller Compacted Concrete	X	X	A	B	C	X	B
Whitetopping	X	X	A	B	B	X	A
Unbound & Mechanically Stabilized Surfacings							
Cellular Confinement	X	B	X	A	B	A	X
Fiber Reinforcement	X	A	X	A	A	A	X
Geotextile/Geogrid Reinforcement	X	A	X	A	B	A	X
Gravel (crushed or uncrushed)	X	A	X	A	A	A	X
Sand	X	A	X	A	A	A	X
Other Stabilized Surfacings							
Chlorides	X	A	X	A	A	A	X
Clay Additives	X	A	X	A	A	A	X
Electrolyte Emulsions	X	A	X	A	A	A	X
Enzymatic Emulsions	X	A	X	A	A	A	X
Lignosulfonates	X	A	X	A	A	A	X
Organic Petroleum Based Emulsions	X	A	X	A	A	A	X
Synthetic Polymer Emulsions	C	A	C	A	B	A	X
Tree Resin Emulsions	C	A	C	A	B	A	X
Unit Surfaces							
Brick Pavers	A	A	A	X	X	X	B
Natural Stone Cobbles	B	A	A	X	X	X	C
Unit Pavers	A	B	A	X	X	X	A
Porous Unit Pavers	A	A	A	C	X	X	B
Recycling Alternatives							
Hot In-Place Recycling	X	X	A	B	B	X	A
Recycled HACP	X	X	A	B	B	X	A

A:	**Highly suitable**
B:	**Acceptable for use**
C:	**Not ideal, but can be used**
X:	**Not suitable**
	Not applicable

Table 3. Suggested Suitability Designations for Screening Stage (cont.)

Road Surfacing Type	Project Type		Climate			% Fines (in unbound material)		
	3R	4R	Wet	Damp to Dry	Dry	< 5	5 - 30	> 30
Asphalt Surfacing (non-structural)								
Cape Seal	A	A						
Chip Seal	A	A						
Chip Seal over Geotextile	A	C						
Fog Seal	A	B						
Microsurfacing	A	C						
Multiple Surface Treatments (Seals)	A	A						
Open Graded Friction Course	A	A						
Otta Seal	A	A						
Sand Seal	A	B						
Scrub Seal	A	X						
Slurry Seal	A	B						
Ultrathin Friction Course	A	B						
Asphalt Surfacing (structural)								
Cold Mix Asphalt Concrete Pavement	A	A						
Hot Asphalt Concrete Pavement (HACP)	A	A						
Exposed Aggregate HACP	A	A						
Imprinted / Embossed HACP	B	A						
Pigmented HACP	A	A						
Porous HACP	C	A						
Resin Modified Pavement	A	A						
Synthetic Binder Concrete Pavement	A	A						
Portland Cement Concrete (PCC) Surfacings								
Cellular PCC	B	A						
Portland Cement Concrete Pavement (PCCP)	B	A						
Exposed Aggregate PCCP	B	A						
Pigmented PCCP	B	A						
Porous PCCP	C	A						
Stamped PCCP	B	A						
Roller Compacted Concrete	X	A						
Whitetopping	A	X						
Unbound & Mechanically Stabilized Surfacings								
Cellular Confinement	A	A	A	A	A	A	B	X
Fiber Reinforcement	A	A	A	A	A	A	A	B
Geotextile/Geogrid Reinforcement	A	A	A	A	A	A	A	C
Gravel (crushed or uncrushed)	A	A	A	A	A	A	A	C
Sand	A	A	C	A	B	A	B	C
Other Stabilized Surfacings								
Chlorides	A	A	C	A	B	X	A	X
Clay Additives	A	A	X	B	A	A	B	X
Electrolyte Emulsions	A	A	A	A	A	X	A	B
Enzymatic Emulsions	A	A	B	A	A	X	A	B
Lignosulfonates	A	A	X	A	A	X	A	C
Organic Petroleum Based Emulsions	A	A	A	A	A	A	A	C
Synthetic Polymer Emulsions	A	A	A	A	A	C	A	X
Tree Resin Emulsions	A	A	A	A	A	C	A	C
Unit Surfaces								
Brick Pavers	X	A						
Natural Stone Cobbles	X	A						
Unit Pavers	X	A						
Porous Unit Pavers	X	A						
Recycling Alternatives								
Hot In-Place Recycling	A	X						
Recycled HACP	A	A						

A:	**Highly suitable**
B:	**Acceptable for use**
C:	**Not ideal, but can be used**
X:	**Not suitable**
	Not applicable

Table 4. Products not Suitable for Use as a Permanent Roadway Surfacing.

CLASSIFICATION	SUB-CATEGORIES	ROAD PRODUCT
AGGREGATE AND SOIL SURFACES	Stabilized Aggregate and Soil	Fly Ash Lime Portland Cement
RECYCLING AND RECLAMATION ALTERNATIVES	Recycling Alternatives	Cold In-Place Recycling PCCP Recycling and Rehabilitation
	Full Depth Reclamation (FDR)	FDR-Cementitious FDR-Emulsified Asphalt Foamed Asphalt Pulverization

SELECTION STAGE

The purpose of the selection stage is to subject a shortlist of suitable surfacing options to a detailed evaluation that considers a wide range of criteria and desirable attributes, including durability, aesthetics, safety, performance, functionality, and life-cycle costs. In the selection stage, it is assumed that the options evaluated are functionally acceptable, but that it is necessary to identify the option that best meets a series of sometimes competing criteria. In the selection stage, a more detailed selection process is applied. The selection methodology is similar to and based on a procedure presented by Hicks, Seeds, and Peshkin.[6] However, the attributes and factors included in the process have been customized to meet the intended objectives of this Guide.

The surfacing evaluation involves selection attributes, scoring factors, and weighting factors. The selection attributes are properties or characteristics of roadway surfacings that are important and should be considered in the selection process. Scoring factors represent how well a particular surfacing ranks for each selection attribute. Weighting factors represent the relative importance of each attribute to the selection process. These three components are used to calculate a total score that can be used to compare different surfacings and to facilitate the selection of a surfacing for a particular road section.

Selection Attributes and Scoring Factors

A total of eleven selection attributes have been identified. Provisions can be made to include a twelfth specific user-defined attribute. For example, an attribute related to compatibility with an adjoining road section or compatibility to the existing road surface on the alignment may be desirable in some cases. The selection attributes are subdivided under three categories as follows:

Performance and Durability Attributes

Durability: Durability refers to a surfacing's probability to last over the expected life of the surfacing without premature defects. All surfacings show signs of distress and defects over time; preventative maintenance techniques are utilized at scheduled intervals to prevent, minimize, or control these defects. However, a surfacing with low durability will require numerous unscheduled repairs to correct defects, such as potholes and washboarding.

Life Expectancy: Life expectancy is the period of time over which the road surface provides an acceptable level of performance with only preventative maintenance activities required.

Maintenance Requirements: Maintenance requirements refers to the frequency that scheduled maintenance interventions are required. Significant maintenance requirements may be acceptable for agencies that have their own maintenance crews, but not for agencies that must contract out maintenance work or for agencies that have limited annual budgets for road maintenance. In addition, surfacings with high maintenance requirements may be undesirable on roads with high traffic volumes because they cause frequent traffic disruptions and user delays.

Safety/Surface Characteristics: Surface characteristics affect the safety of a surfacing with respect to skid resistance, hydroplaning potential, visibility, windshield hazards, and ability to be striped with lane demarcations. Different surfacings provide different levels of safety; however, all surfacings considered for a particular project should meet or exceed all minimum safety design standards for the class of road. Any surfacing that does not meet minimum safety requirements for a particular project should be removed from consideration in the selection process. Surface characteristics can also impact ride quality and road noise levels. Surface characteristics can be a significant consideration in recreational areas where the road must support pedestrians, bicycles, and/or in-line skaters in addition to vehicular traffic.

Constructability and Cost Attributes

Life-Cycle Cost: Life-cycle cost is the net present value of a surfacing for a specified analysis period, taking into consideration initial construction costs, user costs, expected maintenance costs, any required rehabilitation, and the time value of money. The value of life-cycle costs is that they provide a relative comparison of long-term costs for different surfacing types. Often, a rough estimate of life-cycle cost can be determined quickly based on available information and may be adequate for the purposes of comparing a range of surfacing options.

Availability: Availability refers to the availability of materials, equipment, and qualified contractors in the project area. In remote areas, batch plants may not be located within an adequate distance of the project site to provide portland cement concrete or hot mix asphalt concrete. Therefore, a mobile plant would have to be assembled near the site to provide these materials. Similarly, specialty equipment or qualified contractors may not be locally available, requiring mobilization from distant areas. Conversely, some areas may have an abundance of certain materials or qualified contractors, making their use advantageous.

Construction Impacts: Construction impacts refer to impacts on the surrounding community during initial road construction. Impacts include: road closures that lead to user delays, limited access, and reduced revenue for nearby businesses; required construction staging areas, equipment laydown areas, and material storage areas; increased construction traffic; and construction noise.

Weather Limitations: Weather limitations address the temperature and precipitation limitations on when a surfacing can be constructed. Depending on the surfacing type and local climate, construction may be limited to a short construction season due to minimum temperature requirements for product placement. Also, some stabilized soil/aggregate surfacings require a certain period of time without precipitation after construction.

Context Sensitivity and Environmental Attributes

Environmental Impacts: Environmental impacts include a wide range of impacts, such as short term environmental impacts during construction and long term environmental impacts during service. Impacts to be considered include water quality, aquatic species, plant quality, and air quality. Other issues include leachate generation, surface runoff, erosion, heat generation, source of raw materials, energy requirements, manufacturing/placement process, hauling requirements, and road noise. Some indirect environmental impacts may also need to be considered, such as increased traffic volumes as a consequence of improving a roadway surfacing standard.

Visual Quality: Visual quality refers to the surfacing's appearance and whether or not it is aesthetically pleasing. Visual quality should be considered from a range of perspectives, including that of a driver using the road and tourists who will mainly see the road as part of an overall scenic vista.

Context Compatibility: Context compatibility refers to how well a surfacing fits into the environmental, cultural, historical, and/or visual context of the surrounding environment.

Assigning Scores

Each surfacing option is given a score for each of the above attributes. Scoring factors are determined from information presented in the catalog of surfacing types, past experience, and engineering judgment. The assigned score is between 1 and 5, with 1 indicating the worst or least desirable qualities and 5 indicating the best or most desirable qualities with regard to that particular attribute (see Table 5). Surfacings are scored relative to the other surfacings under consideration because it allows for greater differentiation between surfacings. Some scoring factors will be heavily influenced by specific site conditions. Therefore, designers are discouraged from using "default" scoring factors and should give considerable attention to specific site conditions when assigning scoring factors to surfacings.

Weighting Factors

Weighting factors are assigned in terms of percentages with the total adding to 100 percent; the higher the assigned weighting factor, the more important that attribute is considered to be in the overall selection process for that application. Weighting factors can be assigned in different ways. On smaller non-controversial projects, the project engineer or designer can select them. On larger, more controversial projects, they should be determined by the entire project team so as to obtain consensus on the relative importance of the various attributes and to document the rationale used in assigning the weightings. Stakeholders' comments and concerns should be collected prior to the selection process and used to help determine the relative importance of the attributes. Weighting factors can (1) initially be assigned to each of the three attribute categories (i.e. Performance and Durability, Constructability and Cost, and Context Sensitivity and Environmental) and then subdivided among the attributes within the category, or (2) be directly assigned to each of the attributes. Either way, the weighting factors should be appropriately distributed in the end. As a check, the cumulative weighting factor for each category should be compared to the other categories; comparing the cumulative weighting factors for the different categories shows which category is of primary importance. In addition, the weighting factor for each attribute should be compared to all other attributes to ensure that the relative importance of each attribute is appropriate. It is expected that a few iterations and some debate will be required for the project team to achieve consensus on the weighting factors to use. However, it is these revisions and this debate that makes the surface selection process transparent.

For most situations, no category should have a weighting factor less than 20% or greater than 50% and no individual attribute should have a weighting factor greater than 20%. Although some attributes may be assigned a low weighting factor, the designer should always ensure that all surfacings meet minimum functional and safety requirements for the project. **It is difficult to assign default weighting factors for each of the attributes because each project has unique requirements that should be fully considered when assigning weighting factors.** The most effective approach to assigning weighting factors is to initially assign all weighting factors based on project objectives and goals and then begin adjusting the factors, through discussion among the project team and by continuous comparison of weights between different attributes and categories, until consensus is achieved. By involving a group of people with individual perspectives on the project, such as engineering design, environmental impacts, and operations/maintenance, and facilitating discussion to reach consensus among the group, there is a high probability that the weighting factors selected will adequately balance, to the extent possible, the various objectives of the project. As project team members become familiar with the selection process over time, it may be possible to develop additional guidelines and rules of thumb for assigning weighting factors.

Table 5. Scoring Factors for Surfacing Attributes

ITEM	ATTRIBUTE	SCORE OF 1 INDICATES	SCORE OF 5 INDICATES
	PERFORMANCE AND DURABILITY		
1	Durability	Low or questionable durability	Similar to high quality HMAC or PCC
2	Life Expectancy	Short	Long
3	Maintenance Requirements	Frequent intervention	Minimal requirements
4	Safety, Ride / Surface Quality	Driver safety concerns or very poor frictional characteristics and/or rough ride	High frictional characteristics and/or smooth ride
	CONSTRUCTABILITY AND COST		
5	LCC	Highest LCC	Lowest LCC
6	Availability of Materials and Qualified Contractors	Materials need to be transported long distance and/or no contractors in State	Materials and contractors readily available locally
7	Impacts during construction	Construction process is very slow and / or disruptive	Fast and efficient construction process with minimal disruption
8	Weather limitations during construction	Significant restrictions	Minimal restrictions
	CONTEXT SENSITIVITY		
9	Environmental Impacts	Significant	Minimal
10	Visual Quality	Very conventional	Highly pleasing appearance
11	Context Compatibility	Inappropriate for surroundings	Very appropriate
12	Other		

Rating the Surfacing Options

Once all scoring and weighting factors have been assigned, the surfacings can be rated to identify one or more preferred surfacings. The total rating for each surfacing option is calculated by summing the totals of the product of the scoring factor and the weighting factor for each attribute. This can be done conveniently using a spreadsheet. An example rating worksheet is included in Appendix B. The option receiving the highest rating should represent the surfacing option that best meets the overall project objectives. In some cases, the top two or three options may have a relatively close rating. It should be kept in mind that the selection process is just a tool for comparing different surfacings in a rational manner and providing the project team with

additional information to help in the decision-making process. If the project team is not comfortable with the surfacing selected by the selection process, it may be an indication that the weighting factors assigned do not truly reflect the objectives and goals of the project and may require additional scrutiny.

In some instances, it may be appropriate to re-run the selection stage after adjusting the weighting factors. The use of this approach to evaluate how sensitive the final selection is to the weighting of a particular factor may be useful in arriving at the best option and does not necessarily invalidate the process. However, any adjustments to weighting factors at this stage must be defensible, transparent, and not arbitrarily applied to force a desired solution.

EXAMPLE PROJECTS

The surfacing selection process has been used to determine the most suitable surfacings for three example projects. A summary of project information and the selection process for each example is included in Appendix C. To illustrate the capabilities of the selection process for different project conditions, the examples include a historic parkway, a scenic byway, and a local rural road. The examples go through the selection process step-by-step and provide some commentary on the reasoning that the project team used to make certain choices or decisions. The example cases show that the surfacing selection process is robust and can be used for a wide range of projects.