APPENDIX C — EXAMPLE PROJECTS

To illustrate the roadway surfacing selection process, three example projects are presented below. The example projects have been developed using information from actual sites and include a historic parkway, a scenic byway, and a local rural road. Although the example projects are based on actual sites, the selection process has not been used in conjunction with roadway projects at any of these sites, and the output from these examples should not be used to infer the appropriate strategy for these actual sites, since many assumptions have been made for the purposes of illustrating the process. These example projects are fictitious and are provided only to show how the selection process could be utilized, based on typical project situations.

EXAMPLE 1 – HISTORIC SITE

Project Description

Project: "Historic Parkway" in the Eastern U.S.

***Traffic (estimate)*:** AADT = 1,800 (with 2% RVs/buses/trucks)

***History*:** The Colonial Parkway connects some of the most historically significant sites in North America. The Parkway connects Jamestown, Yorktown Battlefield, and Williamsburg. Jamestown is the site of the first permanent English settlement in North America in 1607. The Yorktown Battlefield is the site of the final major battle of the American Revolutionary War and the British surrender. Williamsburg was the capital of colonial Virginia and a hotbed for the colonies liberty movement. Preservationists consider this historic triangle of Williamsburg, Jamestown, and Yorktown to be "sacred shrines of national life and liberty".

***Context/Setting*:** The 37 km (23 mile) parkway is situated on the Virginia peninsula and it connects the above and several other significant historical sites. Here are some excerpts from the Historic American Engineering Record (HAER):

"Colonial Parkway is a meticulously crafted landscape that integrates the region's natural and cultural resources into a memorial roadway of the American colonial experience. It marks an important change in the history of National Park Service (NPS) road-building traditions as the first NPS-designated parkway that unifies dispersed sites as part of a cohesive national park."

The Colonial Parkway Outline of Development from 1933 indicated: "Its function as a unifying factor transcends mere considerations of transportation. Its location and design should contribute, as far as practicable, to the general commemorative purposes of the Monument."

Central to the legislation that created the Colonial NHP and Parkway was a plan for a scenic highway that would link the sites and be free of any modern commercial development. The HAER says, "The parkway was designed to provide continuity to the visitor experience of

motoring through nearly 400 years of American colonial history. Traversing a diverse environment, the parkway provides visitors with dramatic open vistas of rivers and tidal estuaries as well as shady passageways through pine and hardwood forests."

U.S. Representative Louis Cramton, a major supporter and champion of the parkway, had the following vision for the roadway, "I would like the new highway as part of the new park, on a strip sufficiently wide to protect it by trees shutting out all conflicting modern development, this highway not to be a glaring modern pavement but as much as feasible giving the impression of an old-time road."

Because of WWII, restricted funding, and other issues, the construction of the Colonial Parkway stretched out over a 26-year period from 1931 to 1957.

***Stakeholders*:** Stakeholders include numerous historical and environmental preservation groups, the local Chamber of Commerce, the NPS, tourist industry organizations, and the local traveling public that uses the parkway as a daily commuting route.

The NPS has aggressively fought to limit access and visual encroachments along the road. However, rapid regional population growth is placing new demands upon the parkway and its context-sensitive environment. Despite objections by numerous stakeholder groups, the parkway has become a popular commuting route. Safety, durability, and performance of the exposed aggregate concrete pavement have become more significant issues due to the increased traffic. In selecting a roadway surface, a difficult balancing act of retaining the integrity of the parkway's original design as a scenic, rustic, and rural parkway with the necessity to be a safe, efficient, and durable roadway must be accomplished.

***Design Guidelines*:** The roadway section should be designed for a 20 year design life. Design speeds will be 50 km/hr (31 mph). The current vertical alignment has maximum grades of 3%.

Initial Screening Criteria

***Traffic*:** AADT=1,800, so traffic level is classified as High.

Decorative Setting: No information was provided indicating that a decorative surfacing is required; therefore, this screening criterion is not used.

***Historic Setting*:** The roadway is surrounded by a significant historical setting and efforts are being made to preserve the historical context of the area; therefore the historical criterion should be applied.

***Urban or Rural Setting*:** The historical context is the overriding issue with this project, so urban or rural criteria are not used.

***Low Cost*:** Given the historical significance of this section of road and its uniqueness, low cost is not considered to be a relevant initial screening criterion.

***Unbound or Paved*:** With the traffic level and the existing paved surface, the selected option must be paved, so this criterion is applied. However, in this instance, it eliminates the same options eliminated by the High traffic requirement.

***3R or 4R Project*:** It is assumed that this is a 4R project, especially considering it is more than 45 years old.

Screening Stage

Applying the five initial screening criteria, a total of 32 surfacings can be eliminated, as shown in Table 7, leaving potentially 15 for the selection stage.

Table 7. Example 1 Screening Criteria.

Screening Criteria	High Traffic	Historic	Paved	R4
Number of Surfacings Eliminated	16	17	13	3

In order to rank the 15 remaining surfacings, numerical values were assigned to the scores for each category (A=3, B=2, C=1) and the values for all categories were summed for each surfacing to obtain a total numerical score for each surfacing. The surfacings were then ranked according to the numerical score. A score of 10 was selected as a cutoff for additional evaluation because it reduces the number of qualified surfacings down to a manageable number. Five surfacings had a score of 10 or greater and will be analyzed in the selection stage (Table 8).

Table 8. Example 1 Screening Stage Ranking.

Option No.	Product	Score
1	Synthetic Binder Concrete Pavement	12
2	Unit Pavers	11
3	Exposed Aggregate PCCP	10
4	Pigmented HACP	10
5	Pigmented PCCP	10

Selection Stage

The weighting factors have been assigned to each category and attribute as follows:

***Performance and Durability*:** This road has a high traffic volume, so safety and durability are important. Assign Weighting Factor = 35%.

1. Durability = 9%
2. Life Expectancy = 9%
3. Maintenance Requirements = 5%
4. Safety/Surface Characteristics = 12%

***Constructability and Cost*:** These factors are of secondary importance. The site is close to major urban areas, so experienced contractors and quality materials should be readily available. Lane closures can be managed without significant disruption to users. The project climate is moderate, so there are no unusual climatic conditions to consider. Assign Weighting Factor = 20%.

5. LCC = 10%
6. Availability = 3%
7. Construction Impacts = 4%
8. Weather Limitations = 3%

Context Sensitivity: Over-riding importance is given to the historic context and uniqueness of the site. Therefore, assign Weighting Factor = 45%.

9. Environmental impacts = 9%
10. Visual quality = 18%
11. Context Compatibility = 18%

After weighting factors have been developed for each attribute, assign scoring factors. Rate and compare the 5 surfacing options for the 11 surfacing attributes. The scoring factors have been applied by comparing the 5 options for each attribute (Table 9).

Table 9. Example 1 Scoring Factors.

Option	Scoring Factor										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Synthetic Binder Concrete Pavement	3	4	3	5	1	1	4	3	5	5	5
Unit Paver	3	3	3	2	2	4	2	5	4	3	3
Exposed Aggregate PCCP	3	4	3	3	3	4	3	4	5	4	3
Pigmented HACP	3	4	1	5	3	4	4	3	5	3	2
Pigmented PCCP	4	4	1	5	2	3	3	4	5	3	2
Note: Initial cost used instead of LCC for convenience since LCC information was not available for all alternatives.											

Applying the weighting factors to these scores the following total scores are obtained for each surfacing (Table 10).

Table 10. Example 1 Selection Stage Rating.

Option No.	Product	Total Rating	Rank
1	Synthetic Binder Concrete Pavement	4.01	1
2	Unit Paver	2.83	5
3	Exposed Aggregate PCCP	3.51	2
4	Pigmented HACP	3.30	3
5	Pigmented PCCP	3.25	4

The preferred option is synthetic binder concrete pavement because it has the highest total rating, 4.01, which is significantly higher than the rating for exposed aggregate PCCP. The analysis worksheet for synthetic binder concrete pavement is shown in Figure 5.

Surfacing Selection Analysis Worksheet

Surfacing Type Synthetic Binder Concrete Pavement

WEIGHTING FACTOR				SCORING FACTOR		WEIGHTING FACTOR		SCORE
PERFORMANCE AND DURABLITY ATTRIBUTES			**35%**					
9	%	Durability		3	x	0.09	=	0.27
9	%	Life Expectancy		4	x	0.09	=	0.36
5	%	Maintenance Requirements		3	x	0.05	=	0.15
12	%	Safety/Surface Characteristics		5	x	0.12	=	0.60
CONSTRUCTABILITY AND COST ATTRIBUTES			**20%**					
10	%	Life-Cycle Cost		1	x	0.10	=	0.10
3	%	Availability		1	x	0.03	=	0.03
4	%	Construction Impacts		4	x	0.04	=	0.16
3	%	Weather Limitations		3	x	0.03	=	0.09
CONTEXT SENSITIVITY ATTRIBUTES			**45%**					
9	%	Environmental Impacts		5	x	0.09	=	0.45
18	%	Visual Quality		5	x	0.18	=	0.90
18	%	Context Compatability		5	x	0.18	=	0.90
100	%					**TOTAL RATING**		**4.01**

WEIGHTING FACTOR: PERCENT OF IMPACT ON SURFACING SELECTION (TOTAL = 100%)
SCORING FACTOR: 1 = POOR OR NOT DESIRABLE; 5 = EXCELLENT OR HIGHLY DESIRABLE

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%.

Figure 5. Worksheet. Example 1 Synthetic Binder Concrete Pavement Worksheet.

EXAMPLE #2 – NORTHWEST SITE

Project Description

***Project*:** "Scenic Byway/All-American Road" in the Northwestern U.S.

***Traffic (estimate)*:** SADT (Seasonal Average Daily Traffic) = Currently, 1,000 vehicles (with 5% RVs/buses/trucks). Twenty year design traffic is 2,000 vehicles.

***History*:** The highway, designated as a "Scenic Byway/All-American Road," was initially constructed as a National Park approach road in the 1930s. The original surfacing was hot asphalt concrete pavement with a crushed aggregate base. The section proposed for reconstruction was resurfaced with hot-mix asphalt concrete in the 1960s and a thin layer of microsurfacing was applied in 2000. All other segments of the highway were reconstructed in the 1960s to 1980s. The highway section presently serves as a transportation link between a nearby town and National Park and Forest Service Lands. The highway is also a recreational destination and a scenic driving route.

***Context/Setting*:**
The 29 km (18 mile) highway section provides access to National Park and Forest Service Lands from nearby towns and is designated as a "Scenic Byway/All-American Road." The road is functionally classified as a rural minor arterial. The highway section is in need of reconstruction to improve alignments, grades, and widths to FHWA and state guidelines. The existing highway currently has inadequate drainage features and structural deficiencies. The highway section had a Pavement Condition Index of 40 in 1994, indicating that the pavement is in need of major reconstruction. The reconstructed highway section is expected to generally follow the existing alignment in most areas; alternative alignments may be considered along parts of the highway to avoid wetlands or provide a more consistent alignment.

The identified "Purpose and Need" of the highway section is to: (1) support management of National Forest lands adjacent to the road, including maintaining the Scenic Byway/All-American road qualities; (2) maintain an efficient transportation link between the nearby town and National Park that can safely accommodate projected traffic levels in twenty years; and (3) provide a roadway that could be reasonably maintained by a maintaining agency.

The highway corridor is in a management area that emphasizes rural and roaded natural recreational activities; recreational activities include: driving for pleasure, viewing scenery, picnicking, fishing, hiking, camping, snowmobiling, and cross-country skiing. The "All-American Road" designation under the Scenic Byways program indicates that the road has one-of-a-kind features that do not exist elsewhere. "The … Highway is considered one of the most beautiful drives in the country …" The highway segment has natural and scenic qualities of national significance. Based on the "All-American Road" designation, driving along the highway corridor is often the primary reason for the trip. The highway must also accommodate vehicles whose primary destination is the National Park. In addition, the highway section is used by tour buses and cyclists.

Alpine vegetation, along with rare plant species, is located along the road corridor. The existing alignment runs along or over local streams, lakes, and wetland areas. Surface water quality is generally very high and nearby streams are important trout waters. The road is visible from other recreational areas, making the roadway part of the visual landscape.

Tourism and recreation are significant components of the local economy.

The road is generally open from June to mid-October. The road is closed during the winter and early spring months due to harsh winter weather conditions. Some snow plowing can be required every month that the road is open. The current lane width is 0.3 m (1 ft) narrower than standard snowplow blades, making it unsafe to plow the roads when they are open to traffic.

***Stakeholders*:** Stakeholders include numerous historical and environmental preservation groups, the local Chamber of Commerce, the NPS, Forest Service, tourist industry organizations, recreational users, and the local traveling public that uses the highway as a daily commuting route.

***Design Guidelines*:** The highway section should be designed for a 20 year design life. Design speeds will be 50 or 60 km/hr (31 to 37 mph), except at switchback curves where the design speed will be 30 km/hr (20 mph). Vertical alignment should have maximum grades of 8%.

Initial Screening Criteria

***Traffic*:** Design AADT=2,000, so traffic level is classified as High.

***Decorative Setting*:** No information was provided indicating that a decorative surfacing is required; therefore, this screening criterion is not used.

***Historic Setting*:** The setting does not have substantial historic significance, so this screening criterion is not used.

***Urban or Rural Setting*:** Since the setting is rural and significance is placed on the special natural surroundings, the rural criterion should be used.

***Low Cost*:** Based on the location, length of roadway to be reconstructed, and available funding, apply low cost criterion.

***Unbound or Paved*:** No specific requirements or preferences with regard to unbound or paved were provided, therefore, this criterion is not used. However, the High design traffic level will eliminate all unpaved surfaces from consideration.

***3R or 4R Project*:** It is assumed that this is a 4R project since pavement condition index data indicated that major reconstruction is needed.

Applying the five initial screening criteria in order, a total of 24 surfacings can be eliminated (Table 11), leaving potentially 23 for the selection stage.

Table 11. Example 2 Screening Criteria.

Screening Criteria	High Traffic	Rural	Low Cost	R4
No. of Surfacings Eliminated	**16**	**3**	**6**	**3**

In order to rank the 23 surfacings, numerical values were assigned to the scores for each category (A=3, B=2, C=1) and the values for all categories were summed for each surfacing to obtain a total numerical score for each surfacing. The surfacings were then ranked according to the numerical score. A score of 10 was selected as a cutoff for additional evaluation because it reduces the number of qualified surfacings down to a manageable number. Eight surfacings had a score of 10 or greater and will be analyzed in the selection stage.

Table 12. Example 2 Screening Stage Ranking.

Option No.	Product	Score
1	Chip Seal	11
2	Multiple Surface Treatments	11
3	Cape Seal	10
4	Open Graded Friction Course	10
5	HACP	10
6	Pigmented HACP	10
7	Resin Modified Pavement	10
8	Recycled HACP	10

Chip seal over HACP was not listed as a separate surfacing in the initial screening table, but will be analyzed in the Stage 2 Selection since both chip seal and HACP are being considered individually; combining the two surfacings may take advantage of desirable properties from each.

Selection Stage

The weighting factors for the categories and individual attributes are as follows:

Performance and Durability: This road has a high traffic volume, so safety and durability are very important. Assign Weighting Factor = 38%.

1. Durability = 9%
2. Life Expectancy = 9%
3. Maintenance Requirements = 7%
4. Safety/Surface Characteristics = 13%

***Constructability and Cost*:** These factors are of lesser importance in relation to the other categories. Assign Weighting Factor = 25%.

5. LCC = 11%
6. Availability = 3%
7. Construction Impacts = 8%
8. Weather Limitations = 3%

***Context Sensitivity*:** Since the highway is designated as a "Scenic Byway/All-American Road" with scenic and environmental value, context sensitivity and environmental impacts are very important. Assign Weighting Factor = 37%.

9. Environmental Impacts = 14%
10. Visual Quality = 14%
11. Context Compatibility = 9%

Rate and compare the 10 options for the 11 surfacing attributes. The scoring factors have been applied by comparing the eight options for each attribute (Table 13).

Table 13. Example 2 Scoring Factors.

	Scoring Factor										
Option	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Chip Seal	1	2	2	3	3	3	4	3	4	4	3
Multiple Surface Treatments	2	2	2	3	3	3	4	3	4	4	3
Cape Seal	2	3	2	4	3	2	4	3	4	3	3
Open Graded Friction Course	2	3	1	4	2	1	3	3	5	2	2
HACP	4	4	3	5	2	1	3	3	5	2	2
Pigmented HACP	3	4	3	5	1	1	3	3	5	4	3
Resin Modified Pavement	5	5	4	2	2	1	2	3	4	1	1
Recycled HACP	4	4	3	5	3	1	3	3	5	2	2
Chip Seal over HACP	3	4	4	4	1	1	3	3	4	4	3
Note: Initial cost used instead of LCC for convenience since LCC information was not available for all alternatives.											

By applying the weighting factors to these scores, the following total ratings are obtained for each surfacing:

Table 14. Example 2 Selection Stage Rating.

Option No.	Product	Total Score	Rank
1	Chip Seal	3.02	7
2	Multiple Surface Treatments	3.11	6
3	Cape Seal	3.16	5
4	Open Graded Friction Course	2.78	8
5	HACP	3.32	3
6	Pigmented HACP	3.49	1
7	Resin Modified Pavement	2.73	9
8	Recycled HACP	3.43	2
9	Chip Seal over HACP	3.29	4

The preferred option is Pigmented HACP with a rating of 3.49. The analysis worksheet for this product is shown in Figure 6. Recycled HACP is a close second with a rating of 3.43.

Surfacing Selection Analysis Worksheet

Surfacing Type Pigmented HACP

WEIGHTING FACTOR				SCORING FACTOR		WEIGHTING FACTOR		SCORE
PERFORMANCE AND DURABLITY ATTRIBUTES			**38%**					
9	%	Durability		3	x	0.09	=	0.27
9	%	Life Expectancy		4	x	0.09	=	0.36
7	%	Maintenance Requirements		3	x	0.07	=	0.21
13	%	Safety/Surface Characteristics		5	x	0.13	=	0.65
CONSTRUCTABILITY AND COST ATTRIBUTES			**25%**					
11	%	Life-Cycle Cost		1	x	0.11	=	0.11
3	%	Availability		1	x	0.03	=	0.03
8	%	Construction Impacts		3	x	0.08	=	0.24
3	%	Weather Limitations		3	x	0.03	=	0.09
CONTEXT SENSITIVITY ATTRIBUTES			**37%**					
14	%	Environmental Impacts		5	x	0.14	=	0.70
14	%	Visual Quality		4	x	0.14	=	0.56
9	%	Context Compatability		3	x	0.09	=	0.27
100	%					**TOTAL RATING**		3.49

WEIGHTING FACTOR: PERCENT OF IMPACT ON SURFACING SELECTION (TOTAL = 100%)
SCORING FACTOR: 1 = POOR OR NOT DESIRABLE; 5 = EXCELLENT OR HIGHLY DESIRABLE

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%.

Figure 6. Worksheet. Example 2 Pigmented HACP Worksheet.

EXAMPLE 3 – RURAL HIGHWAY

Project Description

***Project*:** "Rural Local Road" in the Western U.S.

***Traffic (estimate)*:** Current AADT of 200 vehicles (with 5% RVs/buses/trucks). Twenty-year design AADT is 300. Peak use occurs from June to September with traffic levels double the AADT. Summer weekend traffic levels are 3.5 times the AADT.

***History*:** The last major construction work on the road was completed in the 1960s. The roadway surfacing of the segment being considered is currently gravel/dirt. Adjacent sections of the roadway have gravel/dirt, chip seal, or asphalt concrete surfacings. The road has been designated as a State Scenic and Historic Byway and as a National Forest Scenic Byway.

***Context/Setting*:** The 5-km (3-mile) roadway section provides access to Forest Service Lands from nearby towns and is designated as a "Scenic Byway." The primary use of the roadway is recreational (90% of traffic) with secondary use for short, local trips and local access. The road is functionally classified as a rural local road. The roadway section is in need of reconstruction to improve alignments, grades, and widths to FHWA and state guidelines. The existing roadway currently has inadequate drainage features and structural deficiencies. The reconstructed road section is expected to generally follow the existing alignment in most areas.

The identified objectives of the project are: (1) provide a roadway width and surface capable of accommodating the 20-year design traffic volumes; (2) improve safety by providing consistent roadway geometry and providing reasonable protection from unsafe conditions; (3) accommodate and control access to Forest Service facilities located along the road; (4) reduce the anticipated maintenance costs to the counties and town maintaining the road; (5) repair roadway drainage problems; (6) repair existing unvegetated slopes; (7) avoid, minimize, or mitigate adverse impacts to the environment by considering key issues identified through the public and agency involvement process (social environment, water resources, visual quality, recreational resources, plants and animals, and construction impacts); and (8) maintain the rural and scenic character of the road.

The road provides primary access to National Forest Lands and Forest Service facilities and a privately owned resort. The area is used for sightseeing, hiking, hunting, fishing, camping, wildlife viewing, bicycling, cross country skiing, and other recreational activities. The road is a popular destination for viewing fall foliage.

The road corridor consists of alpine and montane forests with meadows and wetlands. It passes through rock and talus slopes and areas rich in wildlife. The existing road section runs along a creek. During high runoff years, the creek can overflow its banks and inundate portions of the roadway. Surface water quality is generally very high. The existing gravel road surface leads to significant amounts of dust generated from traffic and spreading and erosion of gravel material into adjacent environmentally sensitive areas. The road is visible from other recreational areas,

making the roadway part of the visual landscape.

Tourism and recreation are significant components of the local economy.

The roadway is not snowplowed year-round and will be closed for portions of the winter. Local maintaining agencies do not have the funds for frequent dust suppressant application or regrading the road surface.

***Stakeholders*:** Stakeholders include numerous environmental preservation groups, the local Chamber of Commerce, Forest Service, tourist industry organizations, recreational users, and the local traveling public that uses the roadway as a daily commuting route.

***Design Guidelines*:** The roadway section should be designed for a 20 year design life. Design speeds will be 50 km/hr (31 mph), except at switchback curves where the design speed will be 20 km/hr (13 mph). The current vertical alignment has maximum grades of 3%.

Initial Screening Criteria

***Traffic*:** Design AADT=300, so traffic level is classified as Low, although summer traffic levels are Medium. Low traffic level criterion is used, keeping in mind that unbound surfaces may have higher maintenance requirements due to summer traffic levels.

***Decorative Setting*:** No information was provided indicating that a decorative surfacing is required; therefore, this screening criterion is not used.

***Historic Setting*:** The setting does not have substantial historical significance, so this screening criterion is not used.

***Urban or Rural Setting*:** Since the setting is rural and significance is placed on the special natural surroundings, the rural criterion should be used.

***Low Cost*:** Based on available funding, apply low cost criterion.

***Unbound or Paved*:** Do not apply this criterion; allow for either bound or unbound surfacing.

***3R or 4R*:** It is assumed that this is a 4R project.

***Climate*:** The climate is damp to dry with significant frost depth.

***% Fines in Unbound Material*:** Assume that unbound materials contain 5% to 30% fines.

Applying the 6 initial screening criteria in order, only 10 surfacings can be eliminated (Table 15), leaving potentially 37 for the selection stage, as follows:

Table 15. Example 3 Screening Criteria.

Screening Criteria	Low Traffic	Rural	Low Cost	R4	Damp to Dry	5 -30% Fines
No. of Surfacings Eliminated	**1**	**3**	**6**	**3**	**0**	**0**

In order to rank the 37 surfacings, numerical values were assigned to the scores for each category (A=3, B=2, C=1) and the values for all categories were summed for each surfacing to obtain a total numerical score for each surfacing. Bound surfacings were given a score of 3 for the "Climate" and "% Fines in Unbound Material" categories. The surfacings were then ranked according to the numerical score. Four surfacings had a score of 17 or above and 12 surfacings had a score of 16. All surfacings with a score of 17 or above were selected for additional evaluation. To select more surfacings for detailed evaluation without choosing all 12 surfacings with a score of 16, only the products with a score of 16 and with an "A" score for the Rural Setting screening criteria were considered. The Rural Setting screening criteria was chosen due to its importance to the project's context/setting and project objectives. This additional consideration added 2 more surfacings, synthetic polymer emulsions and tree resin emulsions, to the list for detailed evaluation. Therefore, 6 surfacings will be analyzed in the selection stage, as shown in Table 16.

Table 16. Example 3 Screening Stage Ranking.

Option No.	Product	Score
1	Chip Seal	18
1	Multiple Surface Treatments	18
3	Cape Seal	17
4	Otta Seal	17
5	Synthetic Polymer Emulsions	16
6	Tree Resin Emulsions	16

Selection Stage

The weighting factors have been assigned to each category and attribute as follows:

***Performance and Durability*:** Safety and durability have been identified as very important parameters. Assign Weighting Factor = 38%.

1. Durability = 9%
2. Life Expectancy = 9%
3. Maintenance Requirements = 7%
4. Safety/Surface Characteristics = 13%

***Constructability and Cost*:** These factors are of secondary importance. Assign Weighting Factor = 24%.

5. LCC = 10%
6. Availability = 3%
7. Construction Impacts = 8%
8. Weather Limitations = 3%

***Context Sensitivity*:** Since the highway is designated as a "Scenic Byway" with scenic and environmental value, context sensitivity and environmental impacts are very important. Assign Weighting Factor = 38%.

9. Environmental Impacts = 14%
10. Visual Quality = 14%
11. Context Compatibility = 10%

Rate and compare the 6 options for the 11 surfacing attributes. The scoring factors have been applied by comparing the seven options for each attribute (Table 17).

Table 17. Example 3 Scoring Factors.

Option	Scoring Factor										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Chip Seal	3	4	2	4	3	3	4	3	4	3	3
Multiple Surface Treatments	4	4	3	4	3	3	4	3	4	3	3
Cape Seal	4	4	3	4	3	2	4	3	4	1	1
Otta Seal	4	4	3	3	3	3	4	3	4	2	2
Synthetic Polymer Emulsions	2	4	2	3	2	3	3	3	4	5	5
Tree Resin Emulsions	2	3	2	2	1	3	3	3	4	5	5
Note: Initial cost used instead of LCC for convenience since LCC information was not available for all alternatives.											

By applying the weighting factors to these scores, the following total ratings are obtained for each surfacing (Table 18):

Table 18. Example 3 Selection Stage Ranking.

Option No.	Product	Total Rating	Rank
1	Chip Seal	3.37	3
2	Multiple Surface Treatments	3.53	1
3	Cape Seal	3.02	7
4	Otta Seal	3.16	6
5	Synthetic Polymer Emulsions	3.45	2
6	Tree Resin Emulsions	3.22	5

The preferred option is Multiple Surface Treatments with a rating of 3.53. The analysis worksheet for this product is shown in Figure 7. Synthetic Polymer Emulsion is a close second with a rating of 3.45.

Surfacing Selection Analysis Worksheet												
Surfacing Type			Multiple Surface Treatments									
	WEIGHTING FACTOR						**SCORING FACTOR**		**WEIGHTING FACTOR**			**SCORE**
PERFORMANCE AND DURABLITY ATTRIBUTES						**38%**						
	9	%	Durability				**4**	x	**0.09**	=		**0.36**
	9	%	Life Expectancy				**4**	x	**0.09**	=		**0.36**
	7	%	Maintenance Requirements				**3**	x	**0.07**	=		**0.21**
	13	%	Safety/Surface Characteristics				**4**	x	**0.13**	=		**0.52**
CONSTRUCTABILITY AND COST ATTRIBUTES						**24%**						
	10	%	Life-Cycle Cost				**3**	x	**0.10**	=		**0.30**
	3	%	Availability				**3**	x	**0.03**	=		**0.09**
	8	%	Construction Impacts				**4**	x	**0.08**	=		**0.32**
	3	%	Weather Limitations				**3**	x	**0.03**	=		**0.09**
CONTEXT SENSITIVITY ATTRIBUTES						**38%**						
	14	%	Environmental Impacts				**4**	x	**0.14**	=		**0.56**
	14	%	Visual Quality				**3**	x	**0.14**	=		**0.42**
	10	%	Context Compatability				**3**	x	**0.10**	=		**0.30**
	100	%							**TOTAL RATING**			**3.53**
WEIGHTING FACTOR:			PERCENT OF IMPACT ON SURFACING SELECTION (TOTAL = 100%)									
SCORING FACTOR:			1 = POOR OR NOT DESIRABLE; 5 = EXCELLENT OR HIGHLY DESIRABLE									
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%.												

Figure 7. Worksheet. Example 3 Multiple Surface Treatments Worksheet.