APPENDIX A

Survey and Results

Questionnaire

NCHRP PROJECT 20-5 SYNTHESIS TOPIC 41-04 FY2010
SUSTAINABLE PAVEMENT MAINTENANCE

Increasing societal awareness of the environmental effects of the road and pavement infrastructure has lead to new demands on transportation agencies to provide environmentally responsive infrastructure. Pavement preservation and maintenance practices are applied to restore the pavement condition and extend service life. The United States Federal Highway Administration (FHWA) considers pavement preservation as one of the three types of activities that restores the pavement serviceability: pavement maintenance, pavement rehabilitation, and pavement reconstruction. Pavement maintenance treatments usually provide the least expensive pavement preservation strategy available.

This survey is directed at benchmarking current state-of-the-practice in usage and quantification of preservation and maintenance practices in terms of environmental performance utilized by the respondent's agency. Sustainability in the survey refers to promoting environmentally friendly practices that also provide technical and economic benefits. Survey participants will be asked to identify and quantify six Sustainability Impact Factor Areas (SIFA) including: (1) Virgin Material Usage; (2) Alternative Material Usage; (3) Pavement In-Service Monitoring and Management; (4) Noise; (5) Air Quality/Emissions; and (6) Water Quality and their relationship to typical preservation and maintenance practices in their agency. The survey is seeking information on all pavement types including: asphalt, concrete, composite, surface treated and gravel roads and pavements. Second, the survey seeks to quantify whether the selected treatments are being assessed in terms of the six SIFA factors.

The survey is directed to pavement maintenance practitioners in state, provincial, federal, and selected transportation agencies. This survey will take approximately 20 minutes to complete. Those respondents that believe that they have an example project or protocol that would make a good case study to illustrate a particularly successful incorporation of environmental performance invited to indicate their willingness to contribute detailed information about the project, and they will be contacted individually by the researcher to obtain the case study information. The results of this survey will be summarized and incorporated into a synthesis that will be shared and distributed through AASHTO, the FHWA, Transportation Research Board, and others, with the goal of assisting in the development and implementation of preservation and maintenance that improve environmental performance. Should you have any questions or comments in completing the survey, please contact either:

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Question 1

Respondent Information

Point of Contact Name: Agency/Organization: State/Province:
Country: E-mail Address:

Question 2

Type of Agency/Organization:

☐ Federal Agency ☐ State/Provincial Agency ☐ County Agency
☐ Municipal Agency ☐ Private Organization Other, please specify:

1—General Program Information: (Non-agency respondents, please skip to Section 2, question 14)

Question 3

What is the magnitude of your agency's highway maintenance program?

Rural—Local (Total miles or km)	
Rural—Interstate (Total miles or km)	
Urban—Local (Total miles or km)	
Urban—Interstate (Total miles or km)	

Question 4

What is your approximate annual budget for:

Pavement Maintenance:$ Pavement Preservation:$
Funds are not separated: Pavement Maintenance/Preservation combined: $

Question 5

For each of the below pavement types, check those practices that you use for pavement maintenance:

Gravel	☐ Regrading	☐ Regravel	☐ Dust palliative	☐ Otta seal	Other:
Surface Treated	☐ Chip seal ☐ Hot patches	☐ Slurry seal ☐ Cold patches	☐ Microsurfacing ☐ Asphalt level-up	☐ Fog seal ☐ Thin hot mix overlay	☐ Crack seal Other
Asphalt	☐ Chip seal ☐ Hot patches	☐ Slurry seal ☐ Cold patches	☐ Microsurfacing ☐ Asphalt level-up	☐ Fog seal ☐ Thin hot mix overlay	☐ Crack seal Other
Concrete	☐ Diamond grind ☐ Shotblasting	☐ Mill ☐ Mud jacking	☐Thin PCC overlay ☐ Dowel bar retrofit	☐ Joint sealing ☐	☐ Crack seal Other
Composite	☐ Chip seal ☐ Hot patches	☐ Slurry seal ☐ Cold patches	☐ Microsurfacing ☐ Asphalt level-up	☐ Fog seal ☐ Thin hot mix overlay	☐ Crack seal Other

Question 6

For each of the below pavement types, check those practices that you use for pavement preservation:

Gravel	☐ Regrading	☐ Regravel	☐ Dust palliative	☐ Otta seal	Other
Surface Treated	☐ Chip seal ☐ Hot patches	☐ Slurry seal ☐ Cold patches	☐ Microsurfacing ☐ Asphalt level-up	☐ Fog seal ☐ Thin hot mix overlay	☐ Crack seal Other
Asphalt	☐ Chip seal ☐ Hot patches	☐ Slurry seal ☐ Cold patches	☐ Microsurfacing ☐ Asphalt level-up	☐ Fog seal ☐ Thin hot mix overlay	☐ Crack seal Other
Concrete	☐ Diamond grind ☐ Shotblasting	☐ Mill ☐ Mud jacking	☐ Thin PCC overlay ☐ Dowel bar retrofit	☐ Joint sealing ☐	☐ Crack seal Other
Composite	☐ Chip seal	☐ Slurry seal	☐ Microsurfacing	☐ Fog seal	☐ Crack

	☐ Hot patches	☐ Cold patches	☐ Asphalt level-up	☐ Thin hot mix overlay	seal Other

Question 7

Which of the following differentiates your pavement maintenance program from your pavement preservation program?

☐ Source of funding ☐ In-house crews vs. contractor-performed ☐ Scheduled versus reactive
☐ No difference ☐ We don't have a formal pavement preservation program

Question 8

Does your agency utilize a formal pavement management system in the daily work?

☐ Yes ☐ No Additional Comment (if you'd like to further explain):

Question 9

Does your agency use performance models/design tools to select and quantify the maintenance or preservation practice?

☐ Yes ☐ No If yes, how are the practices selected?

Question 10

Does your agency use life cycle costing to select the maintenance or preservation practice?

☐ Yes ☐ No If yes, what economic tools are used?

Question 11

Does your agency use environmental performance to select the maintenance or preservation practice?

☐ Yes ☐ No If yes, how is this done?

Question 12

Does your agency use formal specifications in pavement maintenance or preservation activities?

☐ Yes, both ☐ Yes, maintenance only ☐ Yes, preservations only ☐ No

Question 13

Does your agency have its own specifications in pavement materials?

☐ Yes ☐ No Additional comment (if you'd like to further explain):

2—Sustainability Awareness Information:

Question 14

Does your agency have a formal sustainable design and/or construction program?

☐ Yes ☐ No Additional comment (if you'd like to further explain):

- ***Virgin Material Usage***

For purposes of this survey: "Recycled Materials" are defined as those materials that originated in a previously constructed pavement that provide technical, economic, and environmental benefits.

Question 15

Are recycled materials allowed in your current pavement maintenance/preservation specifications?

☐ Yes ☐ No Additional comment (if you'd like to further explain):

Question 16

Which of the following recycled materials does your agency use in its pavement maintenance specifications? If yes, what percentage is allowable?

Recycled Asphalt Pavement (RAP) in Base or Subbase Layers	☐	Allowable percentage:
Recycled Asphalt Pavement (RAP) in Flexible Layer	☐	Allowable percentage:
Recycled Concrete Aggregate in Base or Subbase Pavement Layers	☐	Allowable percentage:
Recycled Concrete Aggregate in Concrete Pavement Layers	☐	Allowable percentage:

Question 17

Does your agency have incentives to encourage virgin material usage reduction or to encourage recycling?

☐ Yes ☐ No If yes, what are these?

Question 18

How would you describe the current virgin material usage in your current pavement maintenance activities?

☐ Use virgin materials only
☐ Use a combination of virgin materials and recycling
☐ Prefer to use recycling;
☐ Always try to minimize the use of virgin materials
☐ Don't know/no opinion

Question 19

Do you agree with this statement "The utilization of recycled material can reduce the cost of pavement maintenance activities and preserve the virgin aggregate resource"?

☐ Agree ☐ Somewhat agree ☐ Neutral ☐ Somewhat disagree ☐ Disagree ☐ No opinion

Question 20

Do you have any other comments regarding virgin material usage in your agency?

☐ Yes ☐ No If yes, what are they?

- ***Alternative Material Usage***

For purposes of this survey: "Alternative Materials" are defined as those materials that would be added to a pavement structure that provide technical, economic, and environmental benefits. Examples would include: coal tar materials, recycled asphalt shingles, recycled glass, reclaimed carbon from copier toner, etc.

Question 21

Are alternative materials allowed in your current pavement maintenance/preservation specifications?

☐ Yes ☐ No Additional Comment (if you'd like to further explain):

Question 22

Which of the following recycled materials does your agency use in its pavement maintenance specifications? If yes, what percentage is allowable, if applicable?

Asphalt shingles in asphalt maintenance mixes	☐	Allowable percentage:
Coal tar in asphalt maintenance mixes	☐	Allowable percentage:
Warm mix asphalt in asphalt maintenance mixes	☐	Allowable percentage:
Emulsion binders in lieu of hot AC binders	☐	Allowable percentage:
Glass cullet in asphalt maintenance mixes	☐	Allowable percentage:
Recycled tire rubber in asphalt maintenance mixes	☐	Allowable percentage:
Recycled tire rubber in chip seal binder	☐	Allowable percentage:
Reclaimed carbon in asphalt maintenance mixes	☐	Allowable percentage:
Foundry sand in asphalt maintenance mixes	☐	Allowable percentage:

Fly ash in asphalt maintenance mixes	☐	Allowable percentage:
Foundry sand in concrete maintenance mixes	☐	Allowable percentage:
Fly ash in concrete maintenance mixes	☐	Allowable percentage:
Glass cullet in concrete maintenance mixes	☐	Allowable percentage:
Fly ash grouts for sealing voids beneath pavement slab sections	☐	Allowable percentage:

Question 23

Does your agency have incentives to encourage the use of alternative materials that provide environmental benefits?

☐ Yes ☐ No If yes, what are these?

Question 24

How would you describe the current alternative material usage in your current pavement maintenance activities?

☐ Use conventional materials only ☐ Use a combination of conventional and alternative materials
☐ Prefer to use alternative materials ☐ Always try to maximize the use of alternative materials where appropriate ☐ Don't know/no opinion

Question 25

Do you agree with this statement "The utilization of alternate material can reduce the cost of pavement maintenance activities and preserve the virgin aggregate resource"?

☐ Agree ☐ Somewhat agree ☐ Neutral ☐ Somewhat disagree ☐ Disagree ☐ No opinion

Question 26

Please check which of the following are applicable to your agency when an alternative material is proposed?

☐ Carry out agency-specific testing to ensure alternative material meets standard
☐ Use contractor data only to ensure alternative material meets standard ☐ Don't know

Question 27

Do you have any other comments regarding alternative material usage in your agency?

☐ Yes ☐ No If yes, what are they?

3—Pavement Monitoring and Management Information:

Question 28

Does your agency utilize Pavement Management System (PMS) software for pavement maintenance purposes?

☐ Yes ☐ No If yes, what is its name?

Question 29

Does your agency utilize Pavement Management System (PMS) software to monitor environmental performance?

☐ Yes ☐ No If yes, in what way?

Question 30

Do you think PMS is a valuable tool in planning for pavement maintenance?

☐ Yes ☐ No ☐ No opinion/don't know

Question 31

Do you think PMS could be used to monitor environmental performance of maintenance?

☐ Yes ☐ No ☐ No opinion/don't know If yes, what should be monitored?

Question 32

Does your agency perform pavement condition surveys on your road network?

☐ Yes, annually ☐ Yes, biannually ☐ Yes, no specific frequency ☐ No

Question 33

In order to achieve effective pavement maintenance and/or preservation, what do you think is the most important (Check one only)?

☐ Proactive planning ☐ Proper investigation ☐ Maintenance timing ☐ Workmanship
☐ Material quality and selection ☐ Quality control/quality assurance

Question 34

Please furnish your opinion as to how the following practices promote sustainable pavement maintenance and/or preservation in your agency?

	Promotes	Neutral	Does not promote	No opinion
Proactive Planning	☐	☐	☐	☐
Proper Investigation	☐	☐	☐	☐
Maintenance Timing	☐	☐	☐	☐
Workmanship	☐	☐	☐	☐
Material Quality and Selection	☐	☐	☐	☐
Quality Control	☐	☐	☐	☐
Quality Assurance	☐	☐	☐	☐

Question 35

Do you have any other comments regarding the relationship between pavement monitoring and management and sustainability in your agency?

☐ Yes ☐ No If yes, what are they?

4—Noise Information:

Question 36

How important do you consider noise disturbance during pavement maintenance in your agency?

☐ Very important ☐ Important ☐ Neutral ☐ Not important ☐ Not even considered ☐ No opinion

Question 37

For which of the following does your agency develop pavements noise standard?

☐ Daytime Construction Noise ☐ Nighttime Construction Noise ☐ Daytime Maintenance Noise
☐ Nighttime Maintenance Noise ☐ Daytime Traffic Noise ☐ Nighttime Traffic Noise
☐ No noise standards in effect Other, please specify:

Question 38

Does your agency promote noise planning program to mitigate noise during maintenance activities?

☐ Yes ☐ No ☐ Don't know

Question 39

Does your agency use surface treatments/materials that reduce noise?

☐ Yes ☐ No ☐ Don't know

Question 40

Does your agency use any of the following surface materials to reduce noise?

☐ Open Friction Courses ☐ Smaller Aggregate Materials ☐ Variable tine spacing
☐ Microsurfacing ☐ Rubberized asphalt ☐ Inverted chip seals

Question 41

Do you have any other comments regarding noise?

☐ Yes ☐ No If yes, what are they?

5—Air Quality/Emissions Information:

Question 42

Is there an air quality monitoring program/system regulated by an environmental agency in the geographic location of the highway network in your jurisdiction?

☐ Yes ☐ No ☐ Don't know

Question 43

Does your agency have regulations on construction emission that contractors must comply for construction?

☐ Yes ☐ No ☐ Don't know

Question 44

Does your agency attempt to mitigate harmful pollutant released into the atmosphere during pavement construction or maintenance activities?

☐ Yes ☐ No ☐ Don't know

Question 45

If the answer to the previous question is Yes, for which of the following do you have a mitigation program?

☐ CO_2 ☐ CO ☐ NOx ☐ SO ☐ Ozone ☐ Don't know Other, please specify:

Question 46

Do you have any other comments regarding air quality/emissions?

☐ Yes ☐ No If yes, what are they?

6—Water Quality Information:

Question 47

Does your agency consider water quality in routine decision making?

☐ Yes ☐ No ☐ Don't know

Question 48

Are you aware if governmental regulations that exist for transportation maintenance?

☐ Yes ☐ No ☐ Don't know

Question 49

How important do you think to have control plan construction water discharge?

☐ Very Important ☐ Somewhat Important ☐ Neutral ☐ Not Important

Question 50

Does your agency provide guidelines in controlling pavement maintenance practices that could impact water quality?

☐ Yes ☐ No ☐ Don't know

Question 51

Do you have any other comments regarding Water Quality and Maintenance?

☐ Yes ☐ No If yes, what are they?

7—Other Factors of Sustainability:

Question 52

Does your agency consider energy consumption when selecting maintenance or preservation treatments (i.e. emulsions versus hot mix, warm mix, etc)?

☐ Yes ☐ No ☐ Don't know

Question 53

Does your agency consider other factors that promote environmental benefits?

☐ Yes ☐ No ☐ Don't know If yes, what are they?

8 – General Maintenance/Preservation Program Information:

Question 54

How often does your agency revise or update its maintenance/preservation/material specifications?

☐ Specifications have been reviewed and updated within the past 5 years
☐ Specifications have been reviewed and updated within past 6 to 10 years
☐ Specifications have not been reviewed and updated for the past 10 years or more
☐ Don't know

Question 55

Does your agency perform routine maintenance activities with in-house staff?

☐ Yes ☐ No If no, skip to question 60

Question 56

Does your agency stockpile of pavement maintenance materials?

☐ Yes ☐ No

Question 57

Does your pavement maintenance specification provide instructions on material storage and stockpiling?

☐ Yes ☐ No ☐ No pavement maintenance specifications

Question 58

Does your agency monitor the quality of material and storage environment of the material being used in pavement maintenance activities?

☐ Yes ☐ No

Question 59

Do you think that monitoring stockpile of material quality would allow better utilization of the material (such as providing easier construction, better performance in field)?

☐ Yes ☐ No ☐ No opinion

Question 60

How important to environmental protection is cleaning maintenance equipments at the end of pavement maintenance activity?

☐ Very important ☐ Important ☐ Neutral ☐ Not important ☐ Not even considered ☐ No opinion

Question 61

Does your agency provide written guidelines in maintaining or cleaning construction/maintenance equipment?

☐ Yes ☐ No ☐ Don't know

Question 62

Which of the below lists of pavement performance indicators, does your agency use to govern its maintenance/preservation program? (Check all that apply.)

☐ International Roughness Index (IRI)	☐ Pavement Condition Index (PCI)
☐ Distress Manifestation Index (DMI)	☐ Riding Comfort Index (RCI)
☐ Pavement Quality Index (PQI)	☐ Structural Adequacy Index (SAI)
☐ Surface Distress Index (SDI)	☐ Friction/skid number
Other, please specify:	

Question 63

Please rate the following treatments with regard to your perception of its sustainability.

	Very Sustainable	Sustainable	Neutral	Not Sustainable	No Opinion	ot Used
Asphalt Treatments						
Crack seal	☐	☐	☐	☐	☐	☐
Hot patch pothole repairs	☐	☐	☐	☐	☐	☐
Cold patch pothole repairs	☐	☐	☐	☐	☐	☐
Fog seal	☐	☐	☐	☐	☐	☐
Slurry seal	☐	☐	☐	☐	☐	☐
Microsurfacing	☐	☐	☐	☐	☐	☐
Chip seal	☐	☐	☐	☐	☐	☐
Thin hot mix overlay	☐	☐	☐	☐	☐	☐
Asphalt level-up	☐	☐	☐	☐	☐	☐
Concrete Treatments						
Ultra-thin white topping	☐	☐	☐	☐	☐	☐
Concrete crack sealing	☐	☐	☐	☐	☐	☐
Concrete joint sealing	☐	☐	☐	☐	☐	☐
Diamond grinding	☐	☐	☐	☐	☐	☐
Milling/grooving	☐	☐	☐	☐	☐	☐
Shotblasting	☐	☐	☐	☐	☐	☐
Partial depth concrete repair	☐	☐	☐	☐	☐	☐
Slab mud jacking	☐	☐	☐	☐	☐	☐
Dowel bar retrofit	☐	☐	☐	☐	☐	☐

Question 64

Would you be filling to share a case study on one or more sustainable maintenance/preservation treatments with which your agency has had either a success or failure?

☐ Yes ☐ No ☐ Don't know

Do you have any other comments on sustainable pavement maintenance/preservation that you would like to share with the research team?

Additional comments: