New England Transportation Consortium

NETC 18-2: Framework of Asphalt Balanced Mix Design (BMD) for New England Transportation Agencies

Technical Memorandum

Task 1: Identify Typical Pavement Distresses in Each of The New England States

Prepared By:

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Prepared For:

New England Transportation Consortium (NETC)
Project 18-2 Technical Committee

I. Background

The main objective of this research project was to synthesize existing information and to develop recommendations for a rational Balanced Mixture Design (BMD) approach for use by New England transportation agencies.

The first action item for this project was to develop a survey to administer to the NETC state agencies asking for information related to pavement distress. Prior to the adoption of any asphalt mixture performance testing program, whether this is simple index testing (tests with pass/fail criteria) or more complicated Balanced Mixture Design (fundamental properties measured to predict performance), it is critical that the selected performance test simulates the observed pavement distress in the area of question. For example, low temperature thermal cracking tests are not appropriate when observed pavement distresses are rutting and alligator cracking.

II. Internet Survey

A list of questions was developed and submitted to the project technical committee for approval prior to the solicitation of responses. Once the list of questions was approved , the internet based survey was developed in Google forms as shown in Appendix A and is available online at https://forms.gle/iRjWUJCgR2kYSf3G8 .

The primary goal of the survey was to identify the predominate distresses observed in New England and how they occur regionally. Additionally, the survey was developed to gather more information about:

- Time period to distress initiation
- How distress measurements are collected and developed into indices
- Weighting of distress indices
- How mixtures are differentiated in reference to distress measurements and inclusion into a pavement management system
- Performance test used in an attempt to mitigate distress
- Percentage of asphalt surface mixtures by type (i.e. Nominal Maximum Aggregate Size)
- Recycled Asphalt Shingle (RAS) usage and practices
- Asphalt binder grades used
- Highly absorptive aggregates

The survey was distributed to the New England state transportation agencies (CT, MA, ME, NH, RI, VT) in May 2019 for responses. The last response was received in September 2019. In total seven response were received. Each New England state transportation agency responded to the survey with Vermont responding twice.

III. Internet Survey Findings

The survey results were reviewed, compiled and analyzed. As shown in Figure 1, the survey indicated the predominate pavement distress noted in New England were:

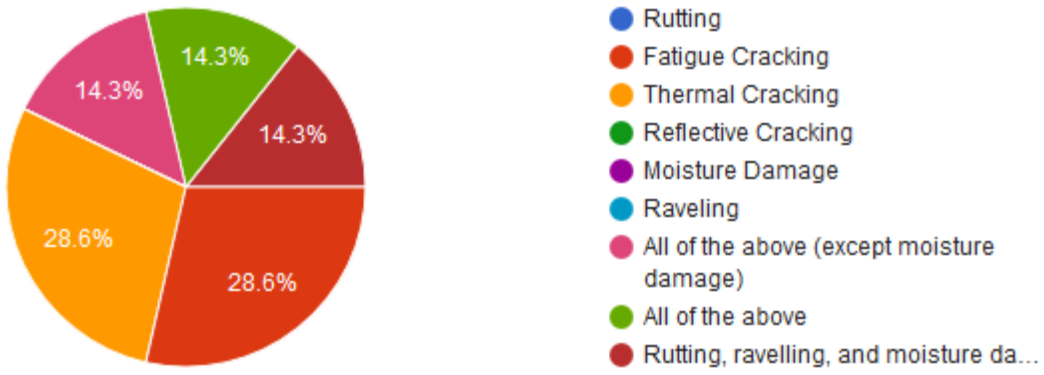


Figure 1: Predominate Distresses Noted by New England State Transportation Agencies

The highest noted distresses at 28.6% (2 responses each) were thermal cracking and fatigue cracking. A combination of rutting, raveling and moisture damage; all distresses, and all distresses except moisture damage all received one response (14.3%). A majority of respondents (71.4%) stated that certain distresses are more commonly observed in different regions of their state with thermal and fatigue cracking being the most commonly observed. Based on these distresses noted in the survey, candidate performance test will be selected in Task 2 of the project.

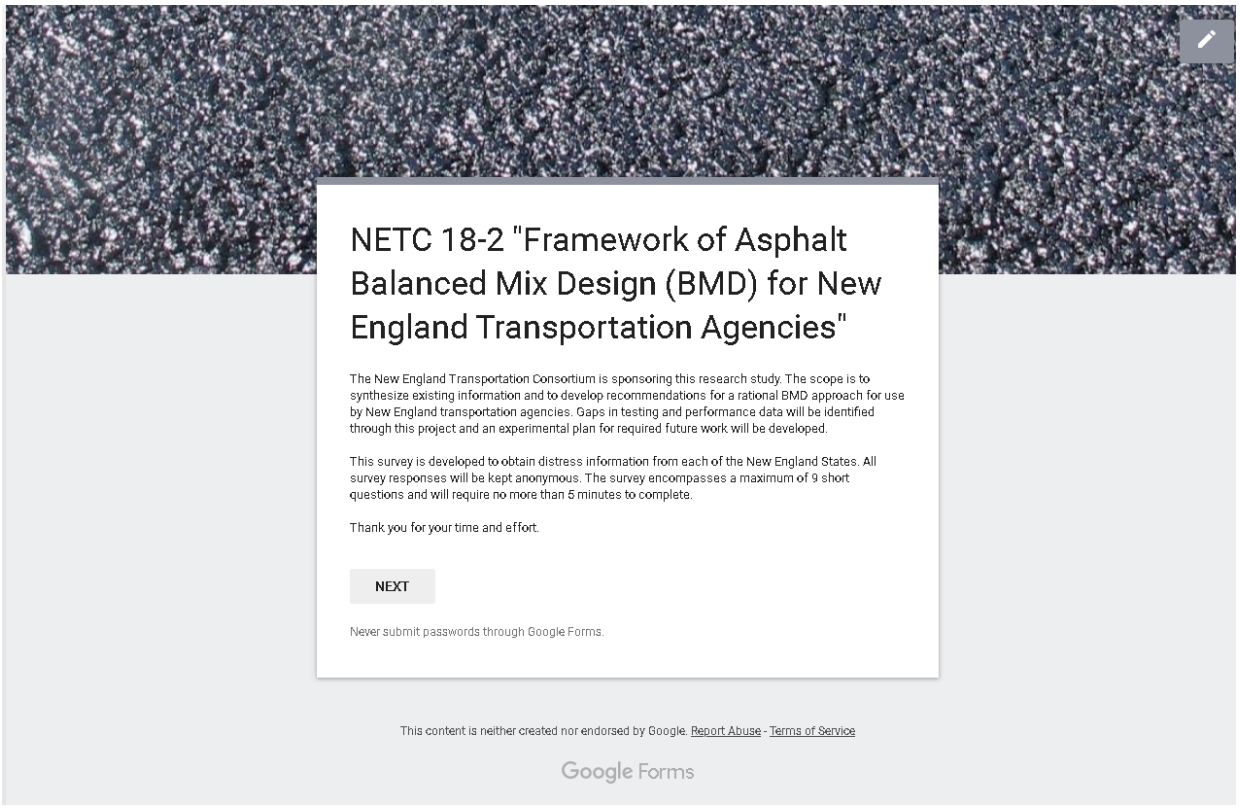
Other noteworthy findings of the survey were:

- There was no consensus among respondents about the time period when certain distresses initiate
- Pavement distress data is measured by automated, manual and both methods
- A majority of respondents use a combined index for pavement treatment selection
- Respondents were split or unsure on if certain distress get weighed more heavily than others
- All respondents indicated that condition index data is available to the research team
- A majority of respondents stated that their pavement management system did not differentiate between mixture types (i.e. all mixture grouped as one pavement type)
- Most respondents are utilizing performance tests during the mixture design phase in an attempt to mitigate the occurrence of specific distresses
- In the New England region, 9.5 mm and 12.5 mm dense graded mixtures comprise a majority of the asphalt pavement surfaces being constructed
- Most respondents do not allow RAS use
- Anywhere from between one to four asphalt binders are specified in an individual state, with two asphalt binders being the most specified
- Most states do not require a different low temperature grade asphalt binder for different regions within the state
- No respondents stated that they deal with highly absorptive aggregates

A detailed copy of the survey results and analysis is available in Appendix B.

Appendix A

Internet Survey



NETC 18-2 "Framework of Asphalt Balanced Mix Design (BMD) for New England Transportation Agencies"

The New England Transportation Consortium is sponsoring this research study. The scope is to synthesize existing information and to develop recommendations for a rational BMD approach for use by New England transportation agencies. Gaps in testing and performance data will be identified through this project and an experimental plan for required future work will be developed.

This survey is developed to obtain distress information from each of the New England States. All survey responses will be kept anonymous. The survey encompasses a maximum of 9 short questions and will require no more than 5 minutes to complete.

Thank you for your time and effort.

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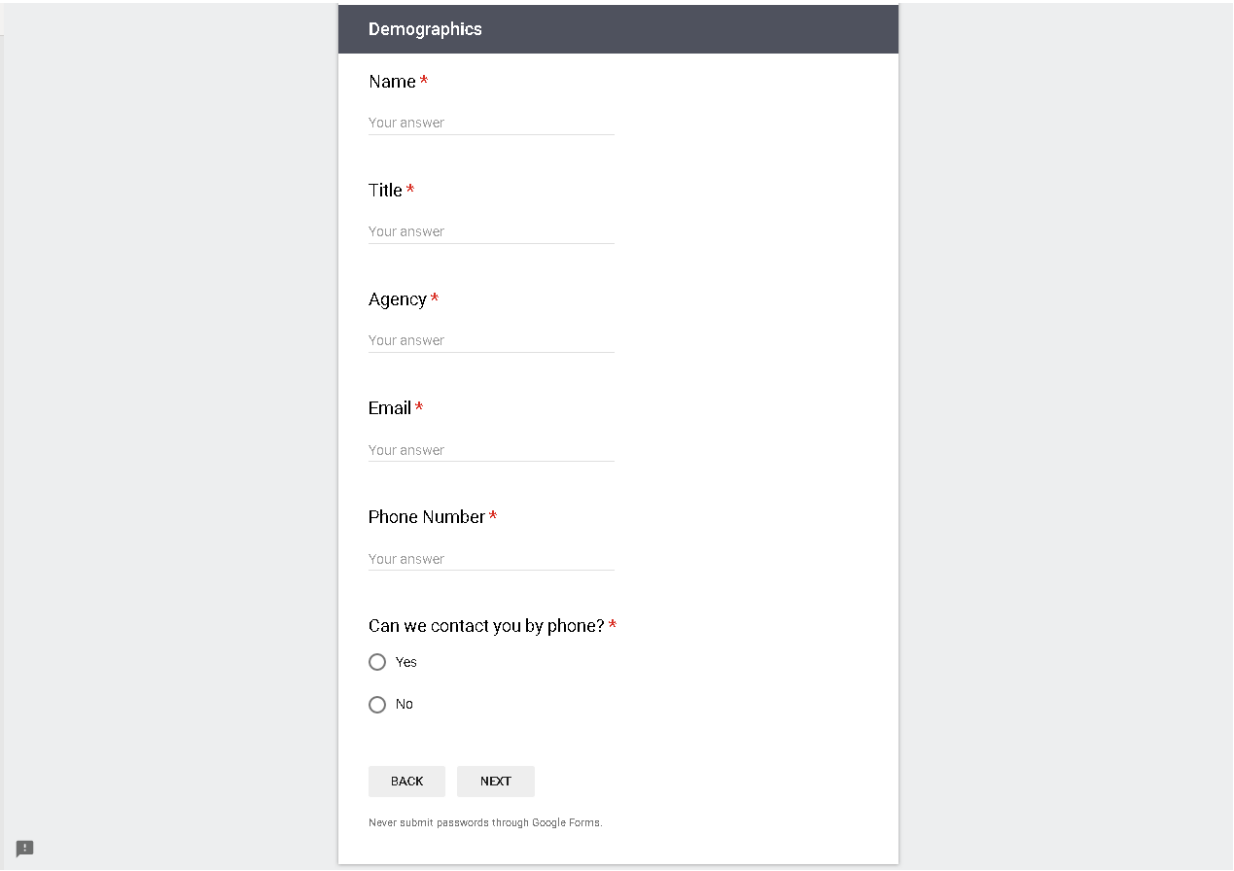

Demographics

Name *

Your answer

Title *

Your answer

Agency *

Your answer

Email *

Your answer

Phone Number *

Your answer

Can we contact you by phone? *

- Yes
- No

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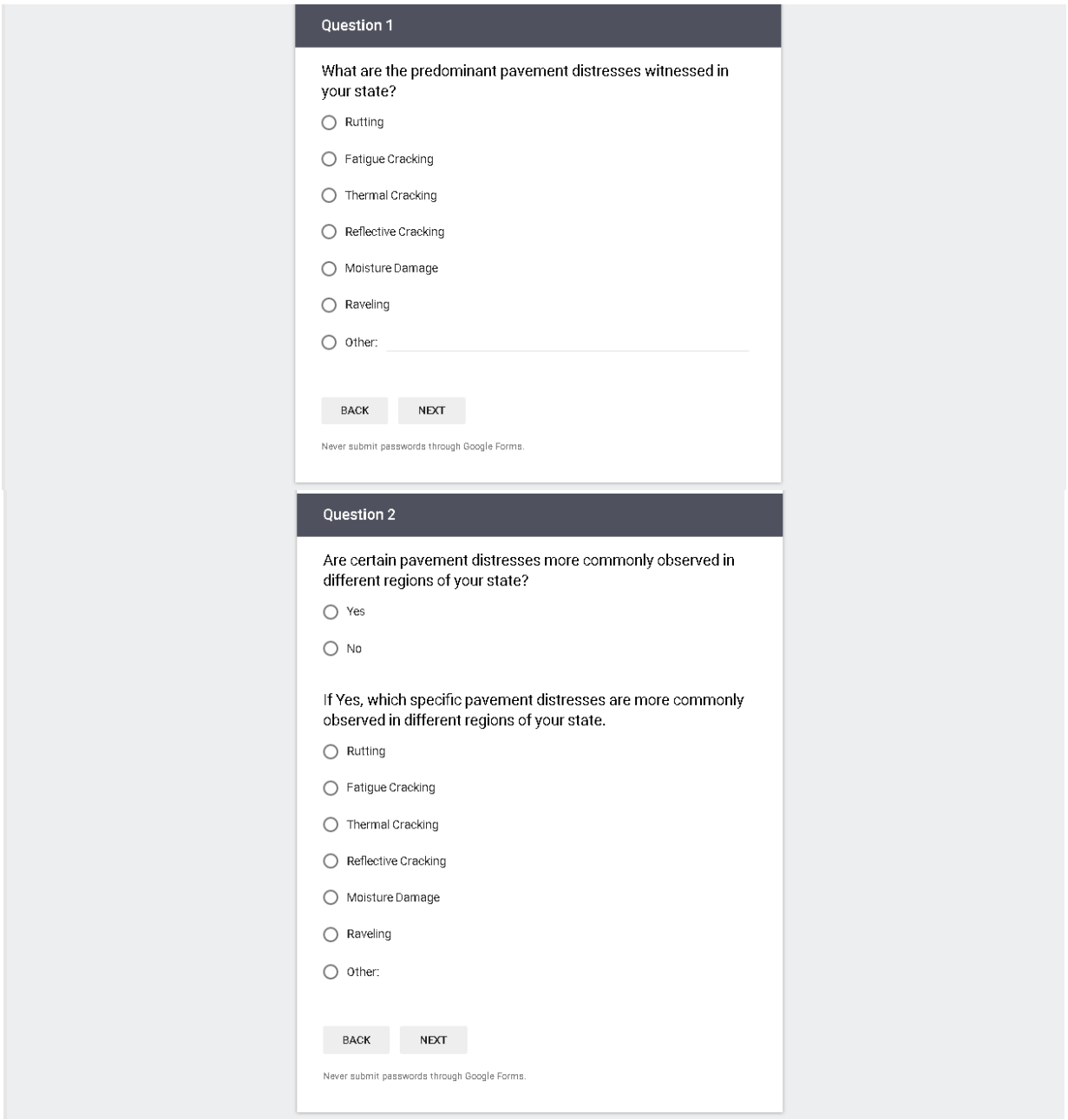
Question 1
What are the predominant pavement distresses witnessed in your state?
Rutting
Fatigue Cracking
Thermal Cracking
Reflective Cracking
Moisture Damage
Raveling
Other:
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Question 2
Are certain pavement distresses more commonly observed in different regions of your state?
Yes
No
If Yes, which specific pavement distresses are more commonly observed in different regions of your state.
Rutting
Fatigue Cracking
Thermal Cracking
Reflective Cracking
Moisture Damage
Raveling
Other:
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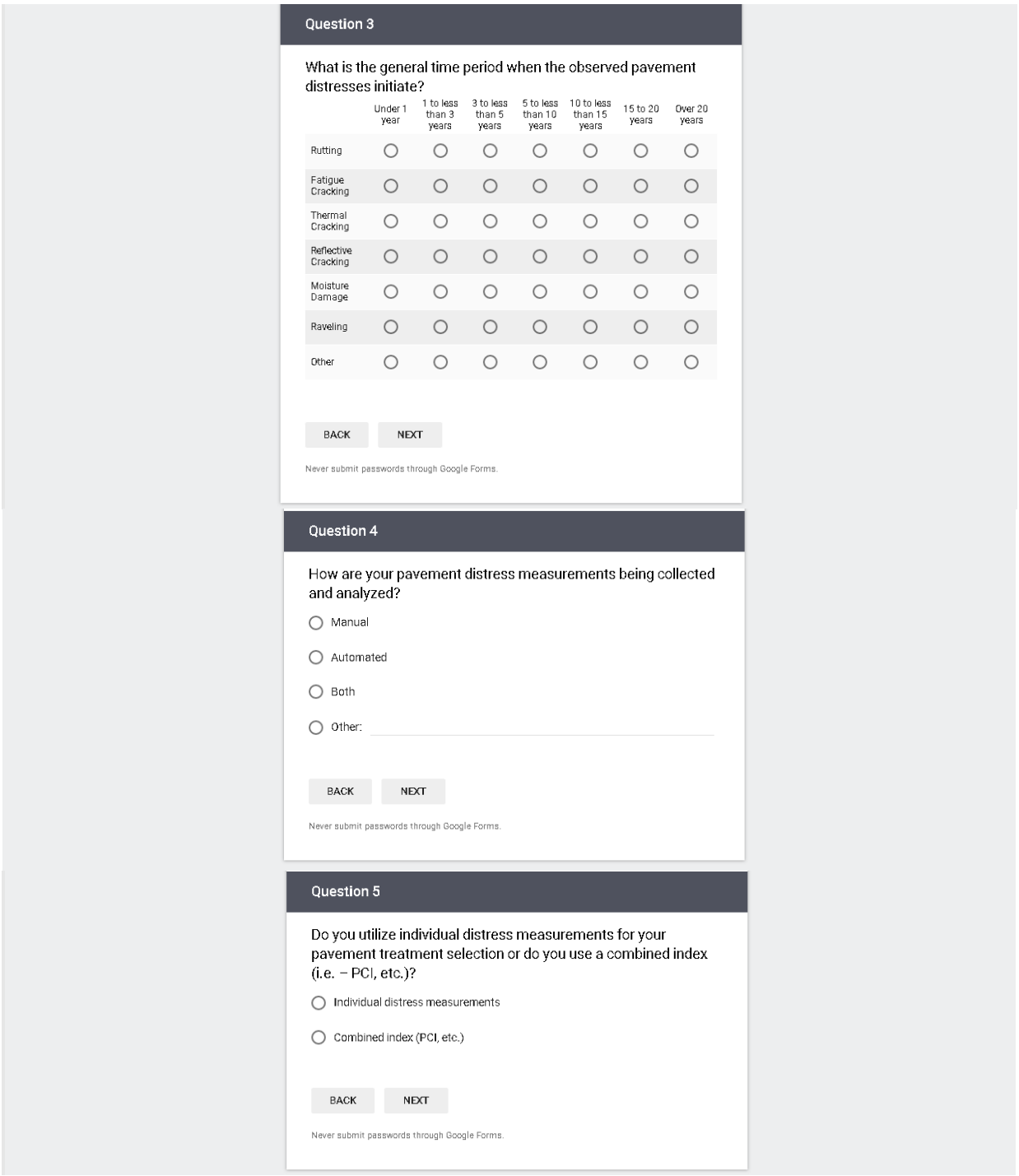

Question 3

What is the general time period when the observed pavement distresses initiate?

	Under 1 year	1 to less than 3 years	3 to less than 5 years	5 to less than 10 years	10 to less than 15 years	15 to 20 years	Over 20 years
Rutting	○	○	○	○	○	○	○
Fatigue Cracking	○	○	○	○	○	○	○
Thermal Cracking	○	○	○	○	○	○	○
Reflective Cracking	○	○	○	○	○	○	○
Moisture Damage	○	○	○	○	○	○	○
Raveling	○	○	○	○	○	○	○
Other	○	○	○	○	○	○	○

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Question 4

How are your pavement distress measurements being collected and analyzed?

- ○ Manual
- ○ Automated
- ○ Both
- ○ Other: _____

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Question 5

Do you utilize individual distress measurements for your pavement treatment selection or do you use a combined index (i.e. – PCI, etc.)?

- ○ Individual distress measurements
- ○ Combined index (PCI, etc.)

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Question 6

If you use a combined index, are the individual distress measurements and magnitudes available (for the current year and previous years)?

- ○ Yes
- ○ No
- ○ Other: _____

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Question 7

If you use a combined index, do different distresses get "weighed" more heavily than others?

- ○ Yes
- ○ No
- ○ Other: _____

If you use a combined index, which ones get "weighed" more heavily?

Your answer

Are the individual and/or combined index values available to the Research Team for the current year and multiple years prior?

- ○ Yes
- ○ No

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Question 8

Does your Pavement Management System (PMS) differentiate different asphalt mixture types (i.e. – different nominal aggregate size, polymer vs neat, dense-grade vs SMA, etc.) in the pavement performance curves or is all asphalt mixtures grouped as one material pavement type (i.e. – asphalt, PCC, composite)?

- ○ Differentiated by nominal aggregate size
- ○ Differentiated by binder type (polymer vs neat)
- ○ Differentiated by mixture type (dense graded vs SMA)
- ○ Grouped as one pavement type
- ○ Other: _____

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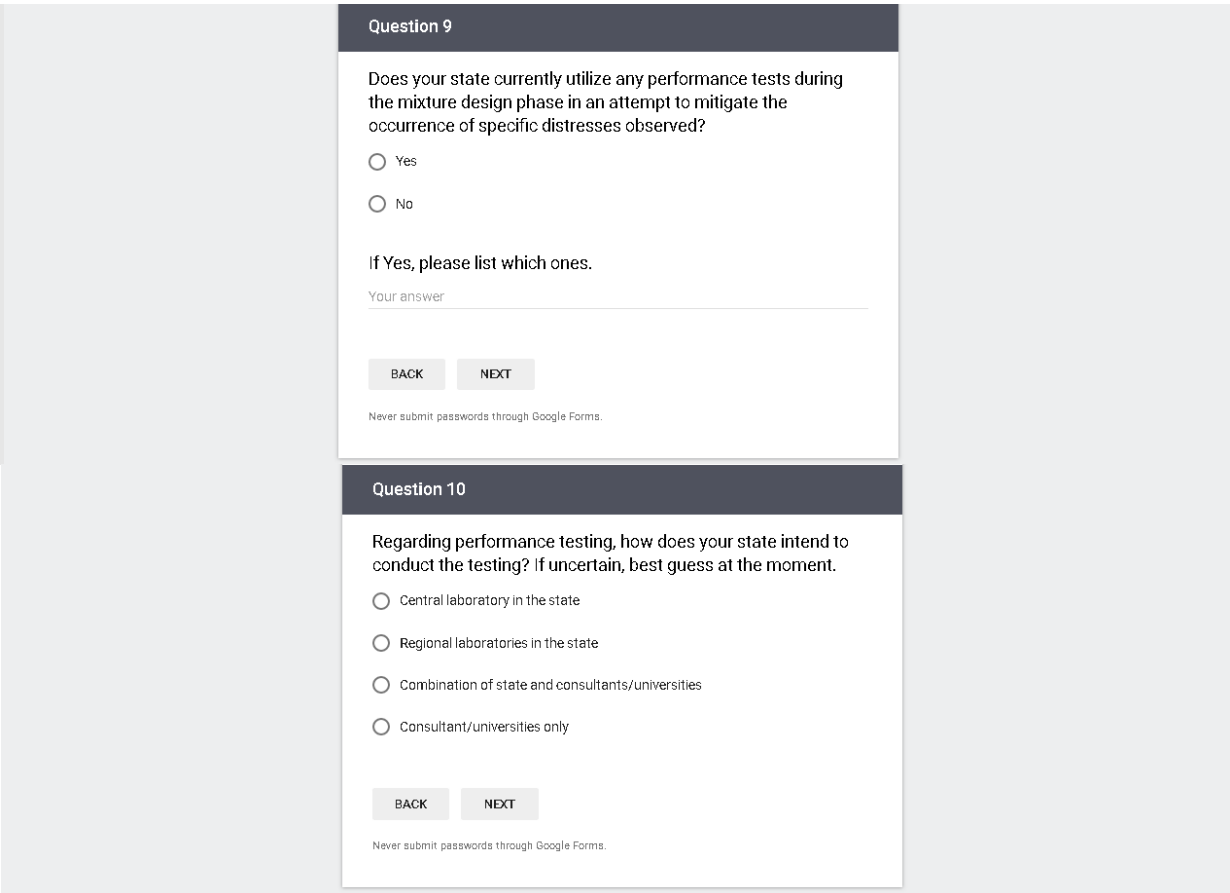
Question 9
Does your state currently utilize any performance tests during the mixture design phase in an attempt to mitigate the occurrence of specific distresses observed?
Yes
No
If Yes, please list which ones.
Your answer
BACK
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Question 10
Regarding performance testing, how does your state intend to conduct the testing? If uncertain, best guess at the moment.
Central laboratory in the state
Regional laboratories in the state
Combination of state and consultants/universities
Consultant/universities only
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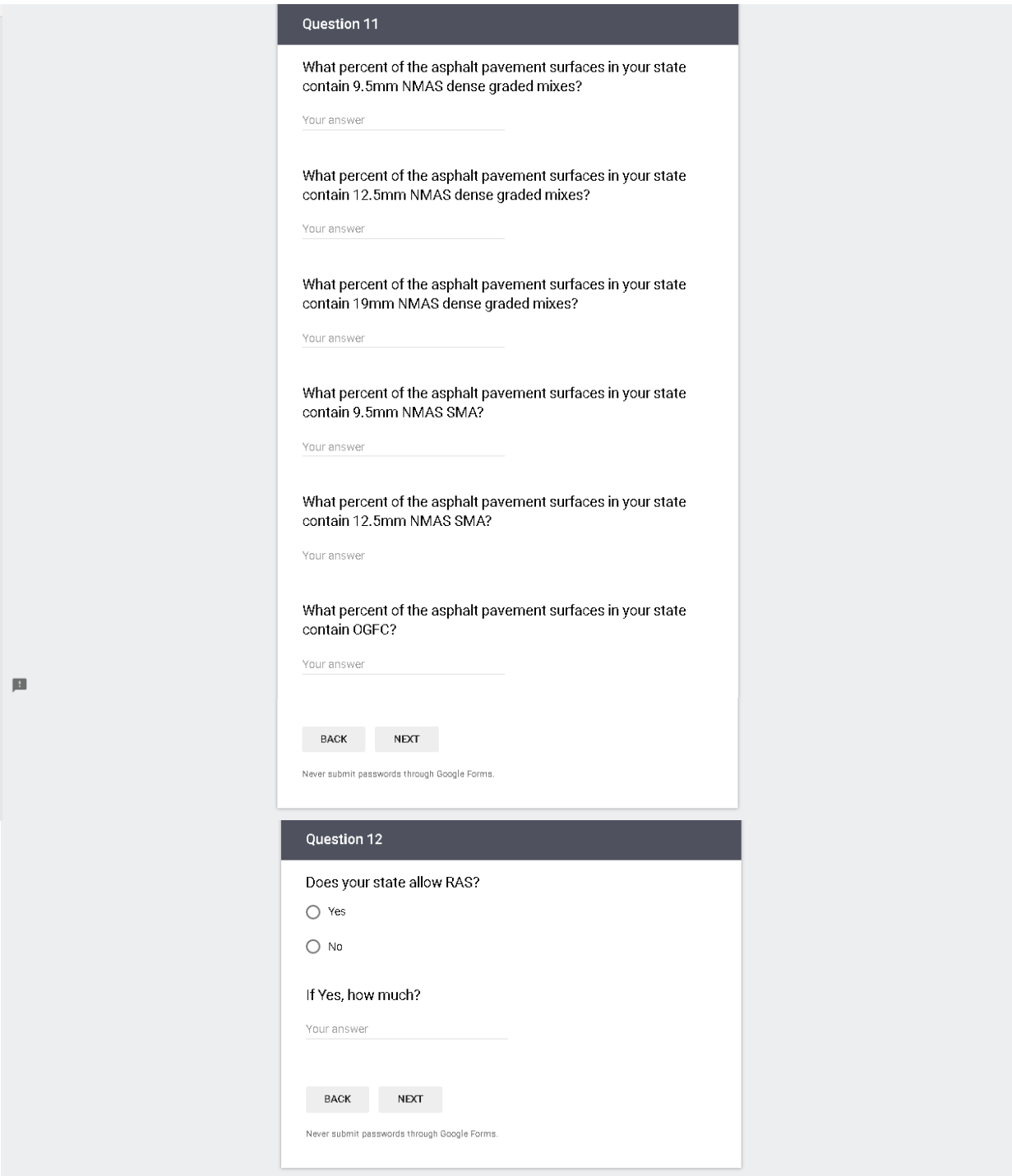
Question 11
What percent of the asphalt pavement surfaces in your state contain 9.5mm NMAS dense graded mixes?
Your answer
What percent of the asphalt pavement surfaces in your state contain 12.5mm NMAS dense graded mixes?
Your answer
What percent of the asphalt pavement surfaces in your state contain 19mm NMAS dense graded mixes?
Your answer
What percent of the asphalt pavement surfaces in your state contain 9.5mm NMAS SMA?
Your answer
What percent of the asphalt pavement surfaces in your state contain 12.5mm NMAS SMA?
Your answer
What percent of the asphalt pavement surfaces in your state contain OGFC?
Your answer
BACK
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Question 12
Does your state allow RAS?
Yes
No
If Yes, how much?
Your answer
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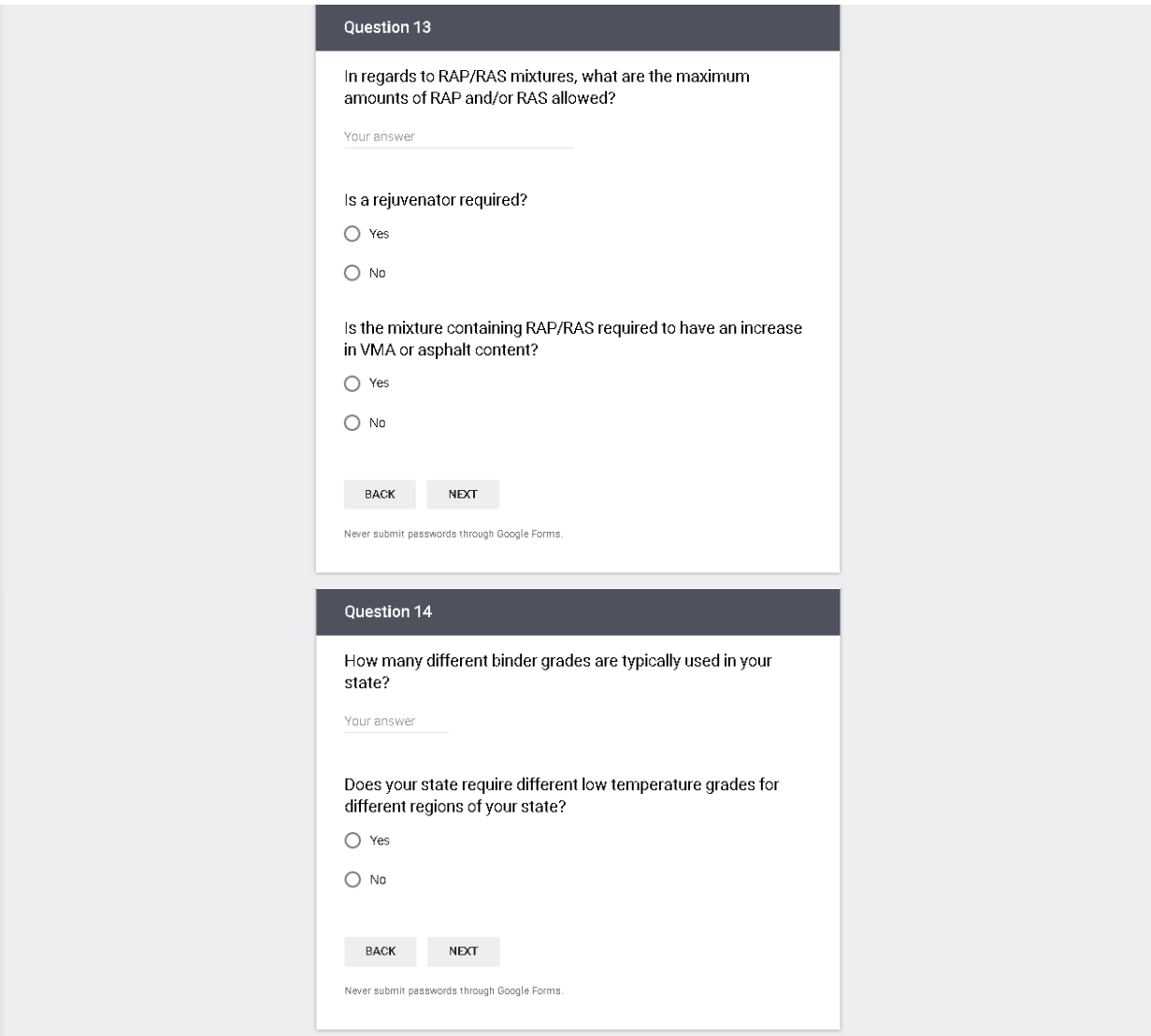

Question 13

In regards to RAP/RAS mixtures, what are the maximum amounts of RAP and/or RAS allowed?

Your answer

Is a rejuvenator required?

- Yes
- No

Is the mixture containing RAP/RAS required to have an increase in VMA or asphalt content?

- Yes
- No

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Question 14

How many different binder grades are typically used in your state?

Your answer

Does your state require different low temperature grades for different regions of your state?

- Yes
- No

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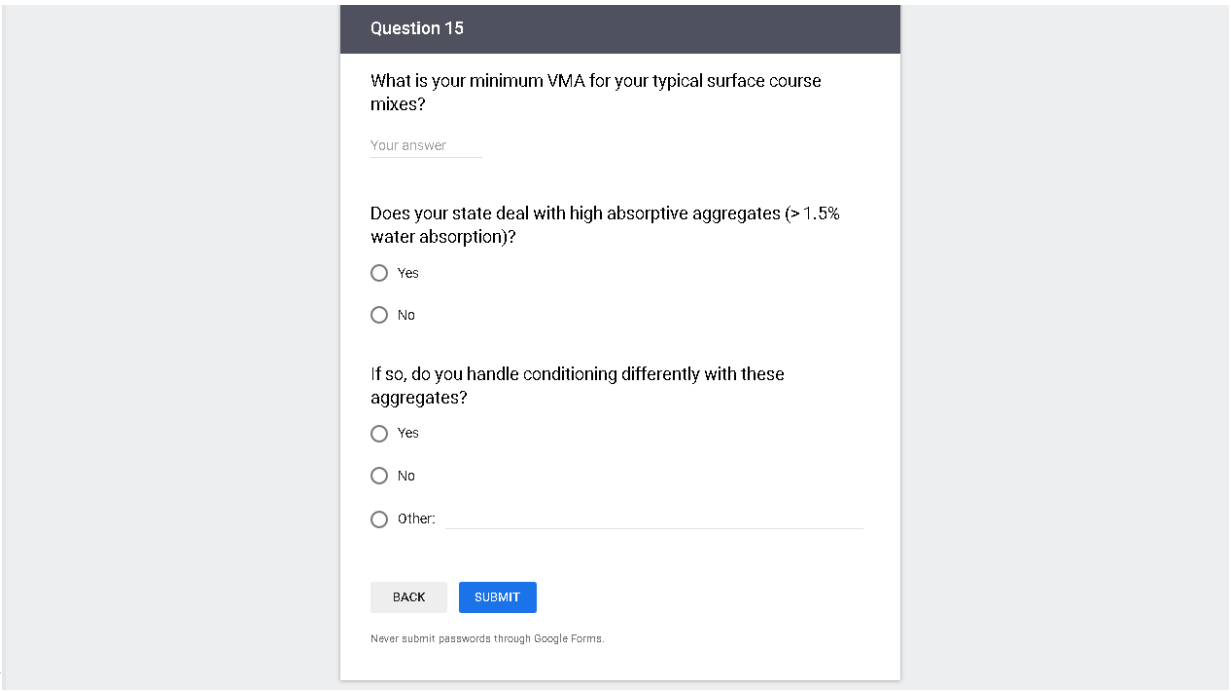


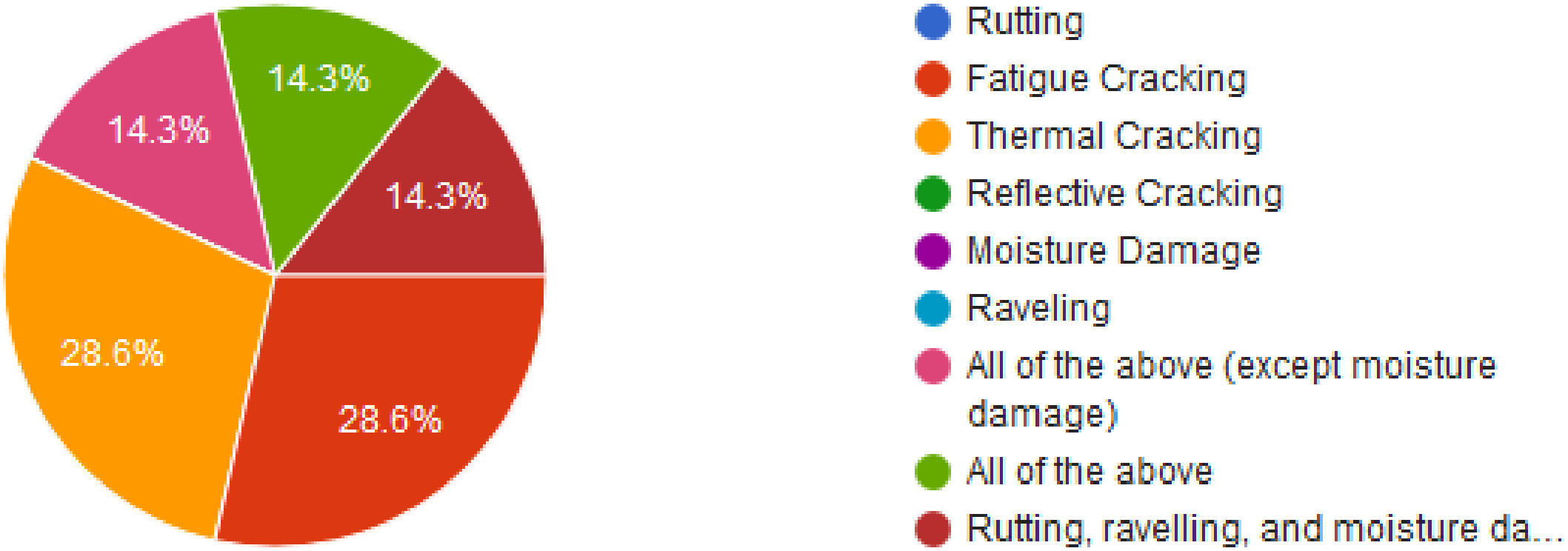
End of Survey

Appendix B

Detailed Survey Results

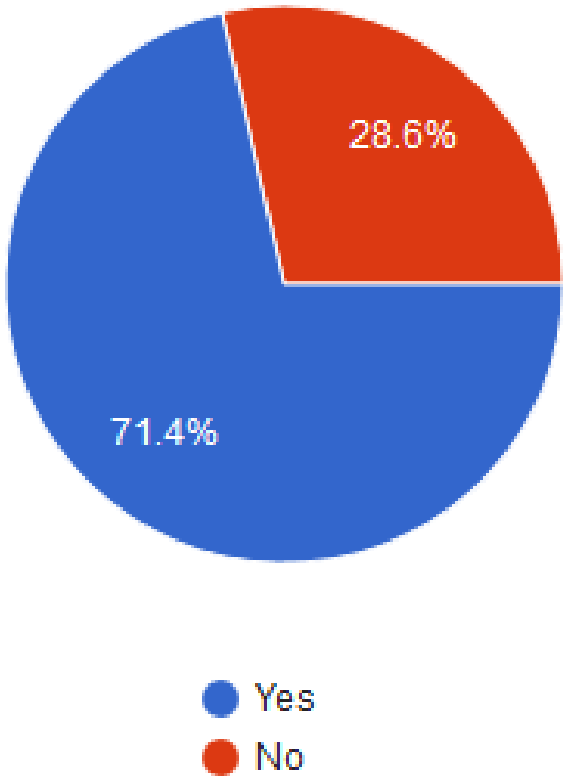
Task 1: Survey Results

What are the predominant pavement distresses witnessed in your state?



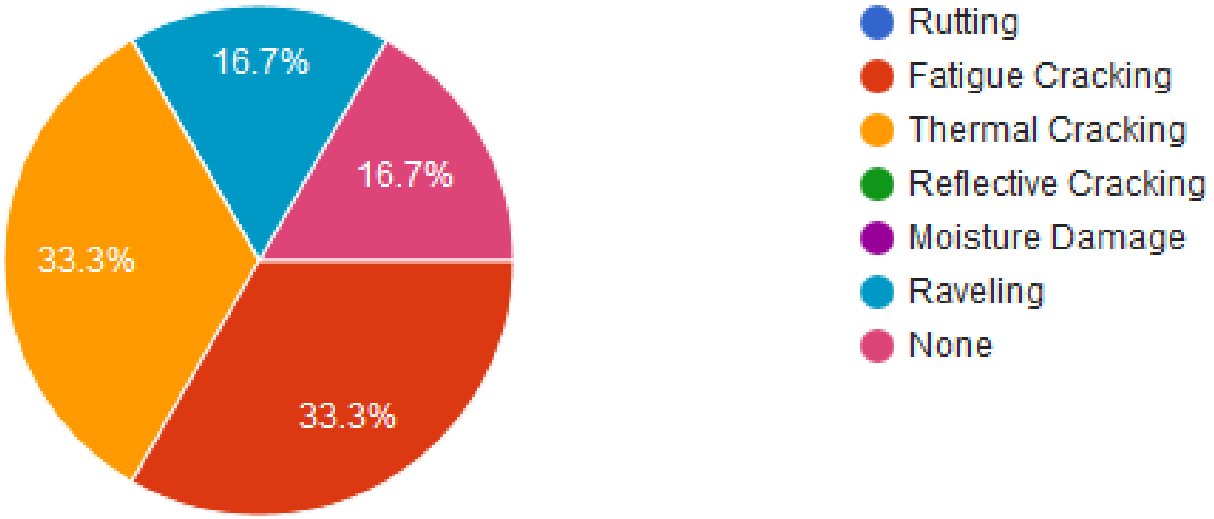
Task 1: Survey Results

Are certain pavement distresses more commonly observed in different regions of your state?



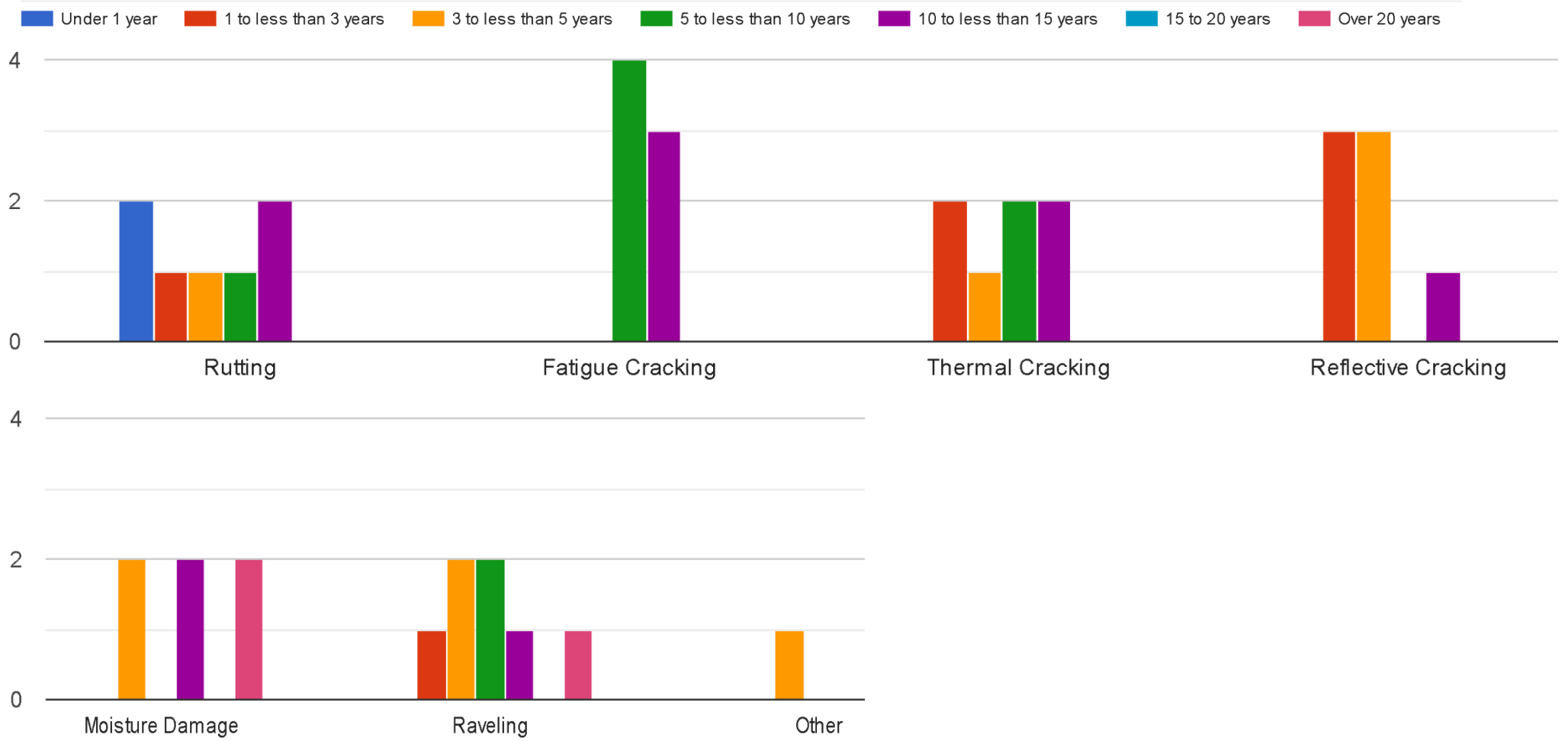
If Yes, which specific pavement distresses are more commonly observed in different regions of your state.

6 responses



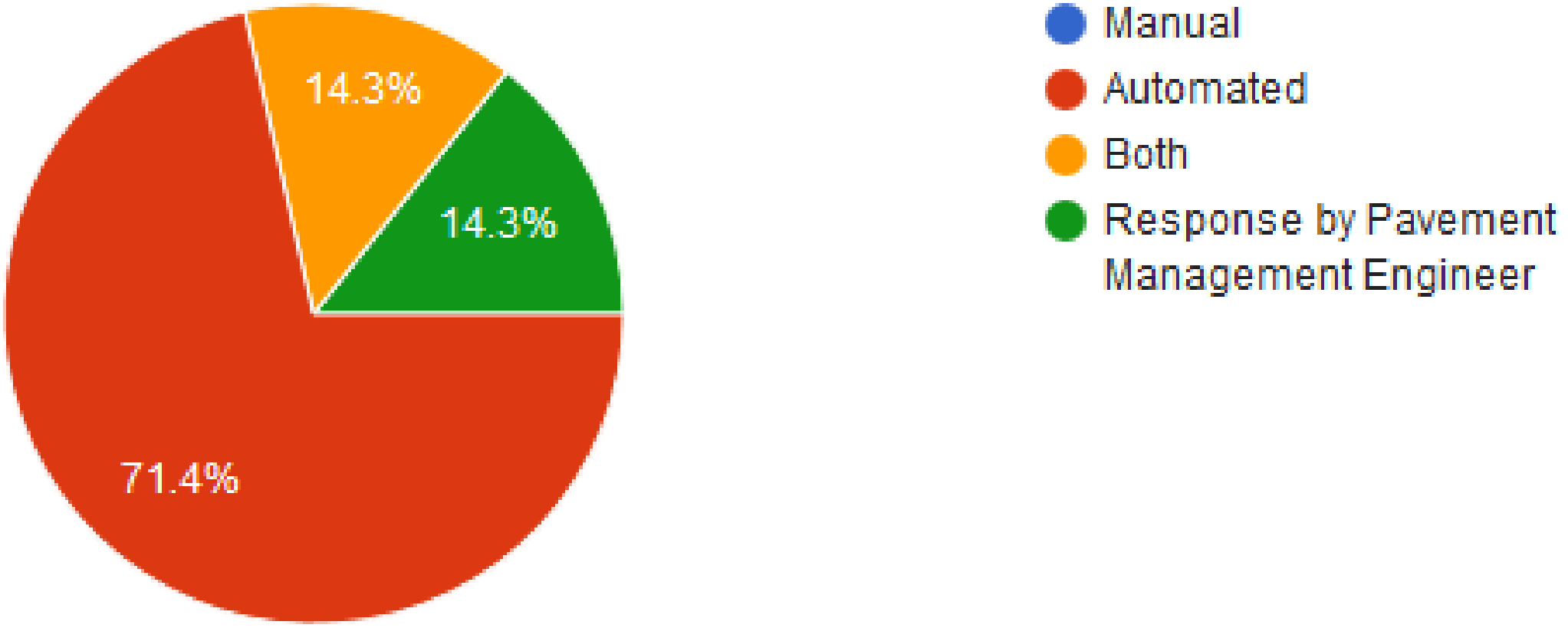
Task 1: Survey Results

What is the general time period when the observed pavement distresses initiate?



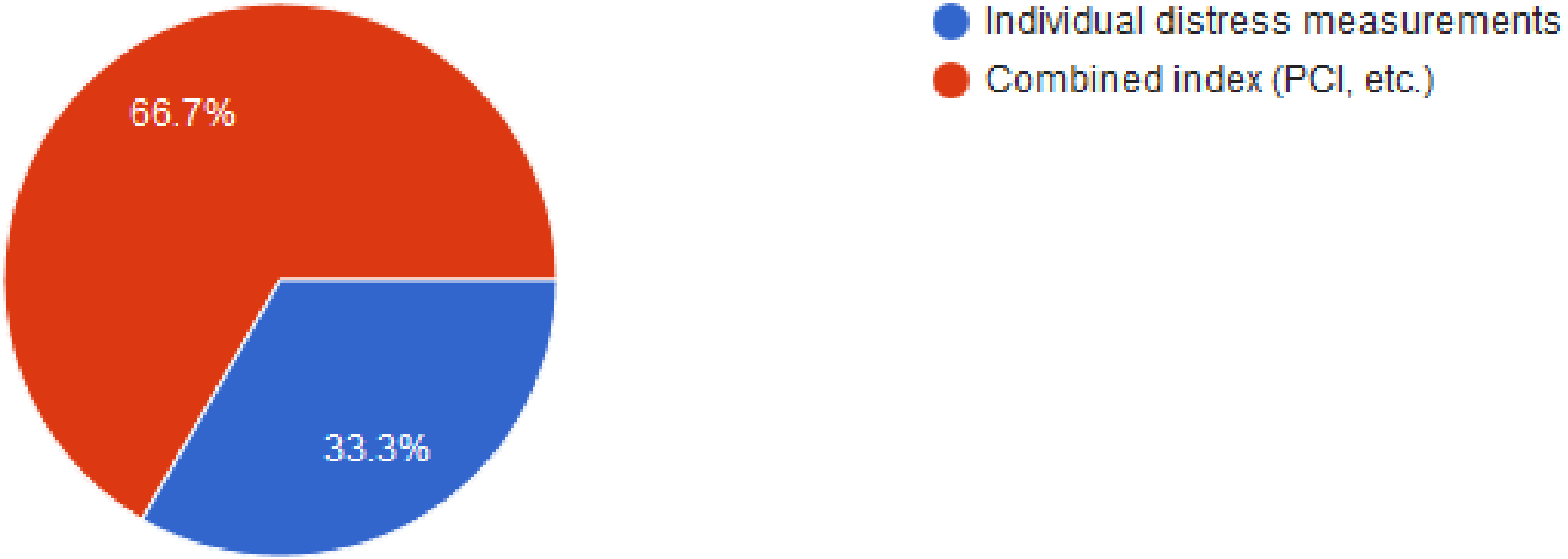
Task 1: Survey Results

How are your pavement distress measurements being collected and analyzed?



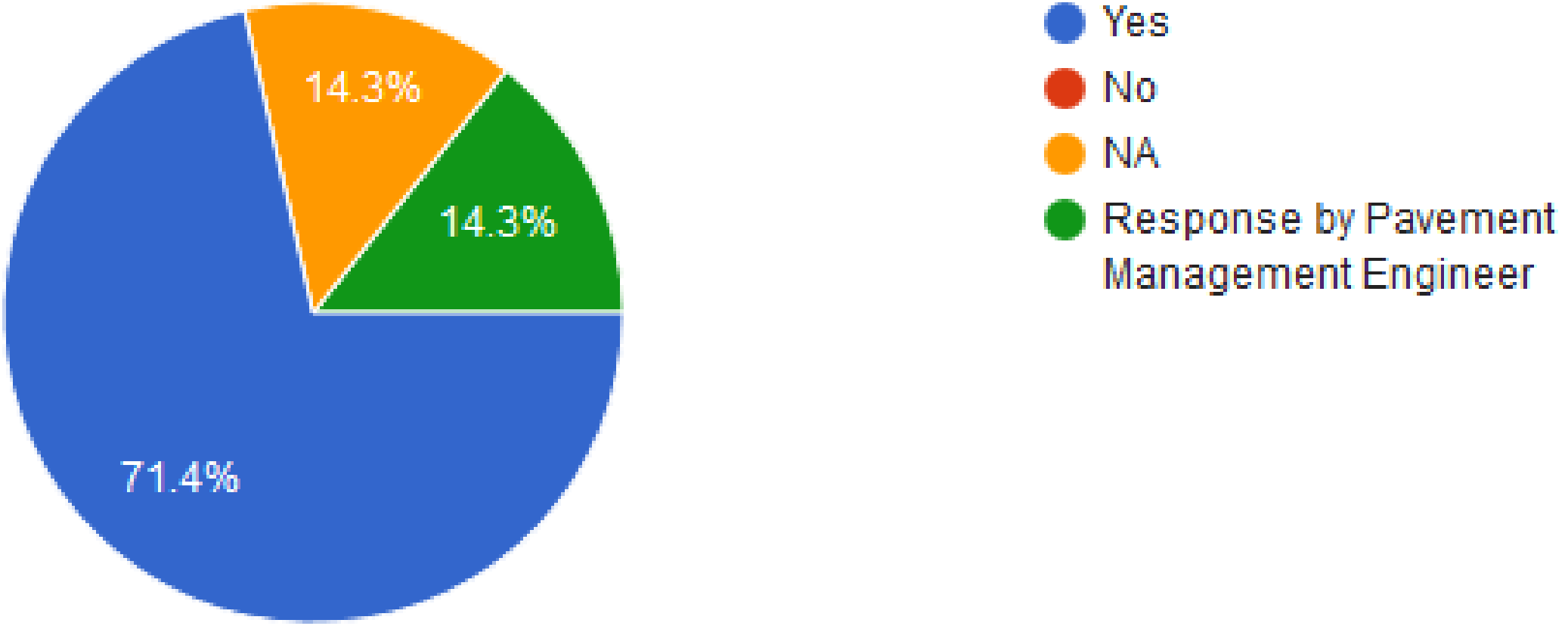
Task 1: Survey Results

Do you utilize individual distress measurements for your pavement treatment selection or do you use a combined index (i.e. – PCI, etc.)?



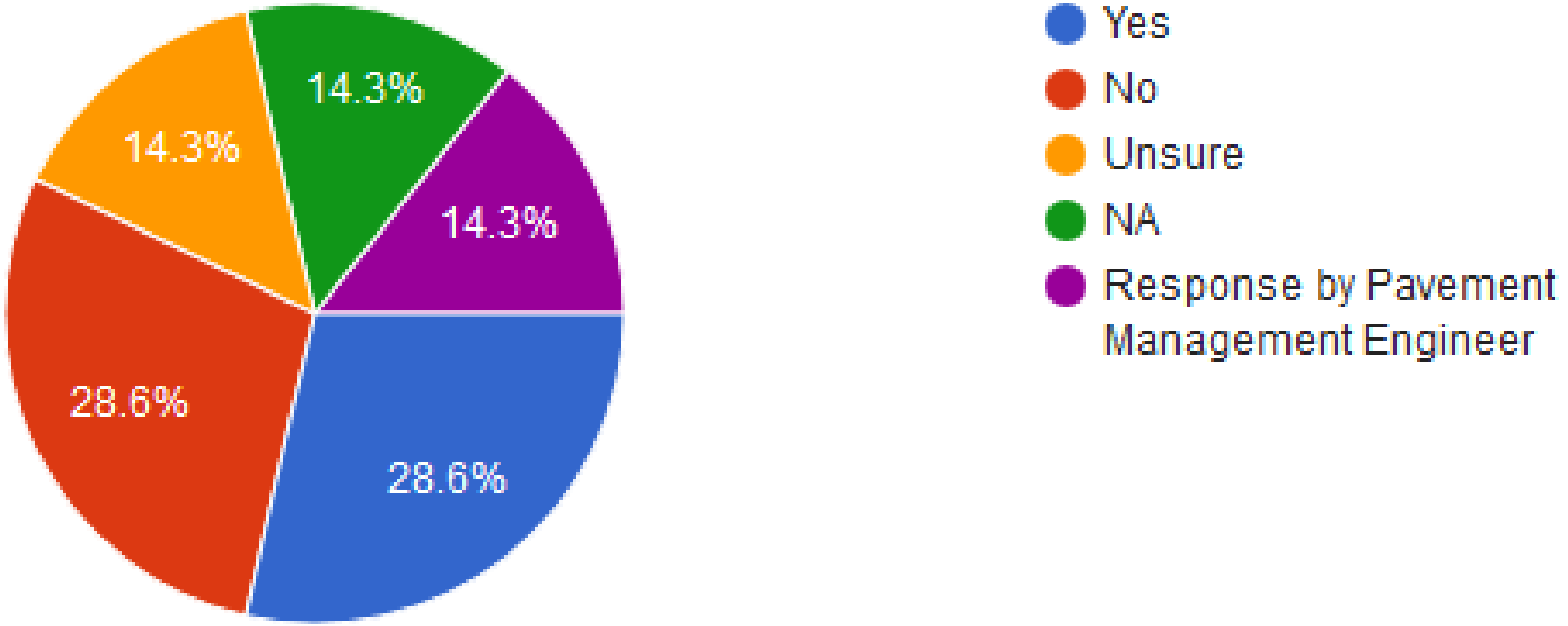
Task 1: Survey Results

If you use a combined index, are the individual distress measurements and magnitudes available (for the current year and previous years)?



Task 1: Survey Results

If you use a combined index, do different distresses get "weighed" more heavily than others?



Task 1: Survey Results

If you use a combined index, do different distresses get “weighed” more heavily than others?

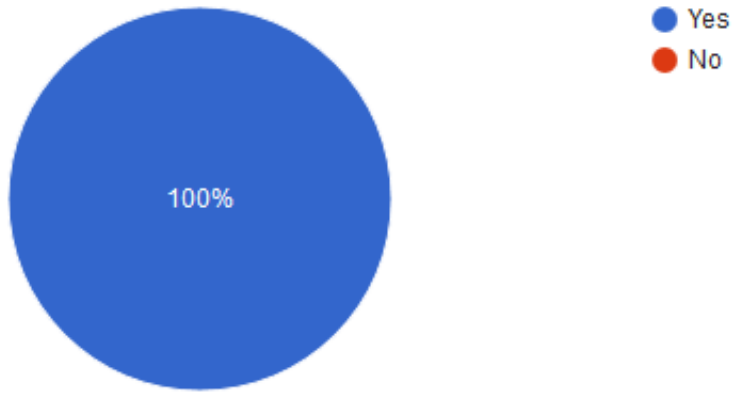
If you use a combined index, which ones get "weighed" more heavily?

4 responses

Disintergration, Index Cracking
NA
IRI, Patching
Response by Pavement Management Engineer

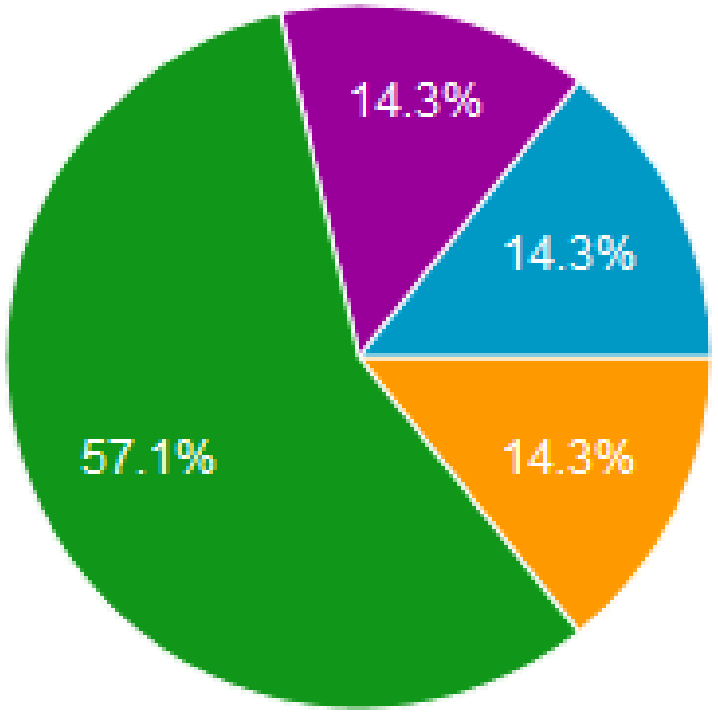
Are the individual and/or combined index values available to the Research Team for the current year and multiple years prior?

7 responses



Task 1: Survey Results

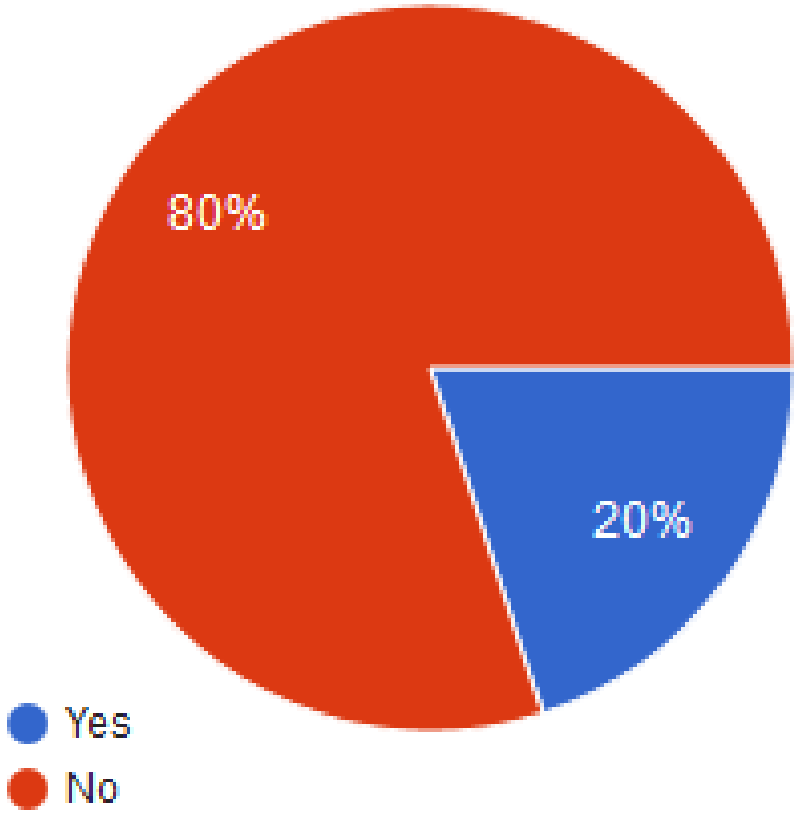
Does your Pavement Management System (PMS) differentiate different asphalt mixture types (i.e. – different nominal aggregate size, polymer vs neat, dense-grade vs SMA, etc.) in the pavement performance curves or is all asphalt mixtures grouped as one material pavement type (i.e. – asphalt, PCC, composite)?



- Differentiated by nominal aggregate size
- Differentiated by binder type (polymer vs neat)
- Differentiated by mixture type (dense graded vs SMA)
- Grouped as one pavement type
- Unsure; I believe they're grouped as one pavement type altogether
- Response by Pavement Managem...

Task 1: Survey Results

Does your state currently utilize any performance tests during the mixture design phase in an attempt to mitigate the occurrence of specific distresses observed?



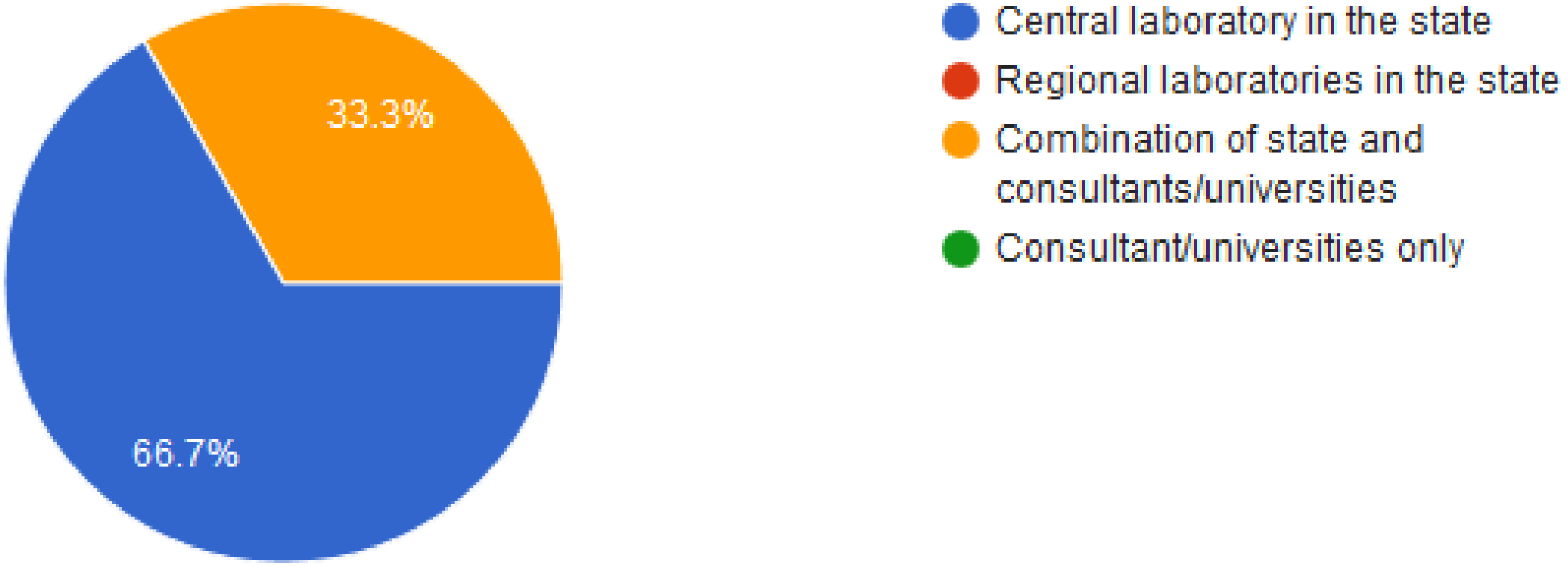
If Yes, please list which ones.

4 responses

Currently piloting a BMD specification with pass/fail criteria using the Hamburg and I-FIT tests; will soon require that test results (regardless of whether they pass or fail) be provided for informational purposes across-the-board.
HWT on certain projects
NA
Response by Pavement Management Engineer/Research and Materials Engineer

Task 1: Survey Results

Regarding performance testing, how does your state intend to conduct the testing? If uncertain, best guess at the moment.



Task 1: Survey Results

What percent of the asphalt pavement surfaces in your state contain 9.5mm NMAS dense graded mixes?

Unsure, at least 80%
48%
75%
-
18%
15%
-

What percent of the asphalt pavement surfaces in your state contain 12.5mm NMAS dense graded mixes?

Unsure
50%
25%
-
81%
55%
-

Task 1: Survey Results

What percent of the asphalt pavement surfaces in your state contain 19mm NMAS dense graded mixes?

Unsure
2%
0%
-
0%
0%
-

What percent of the asphalt pavement surfaces in your state contain 9.5mm NMAS SMA?

0% (Exploring use of SMA on Project in 2020)
0%
0%
-
0%
5%
-

Task 1: Survey Results

What percent of the asphalt pavement surfaces in your state contain 12.5mm NMAS SMA?

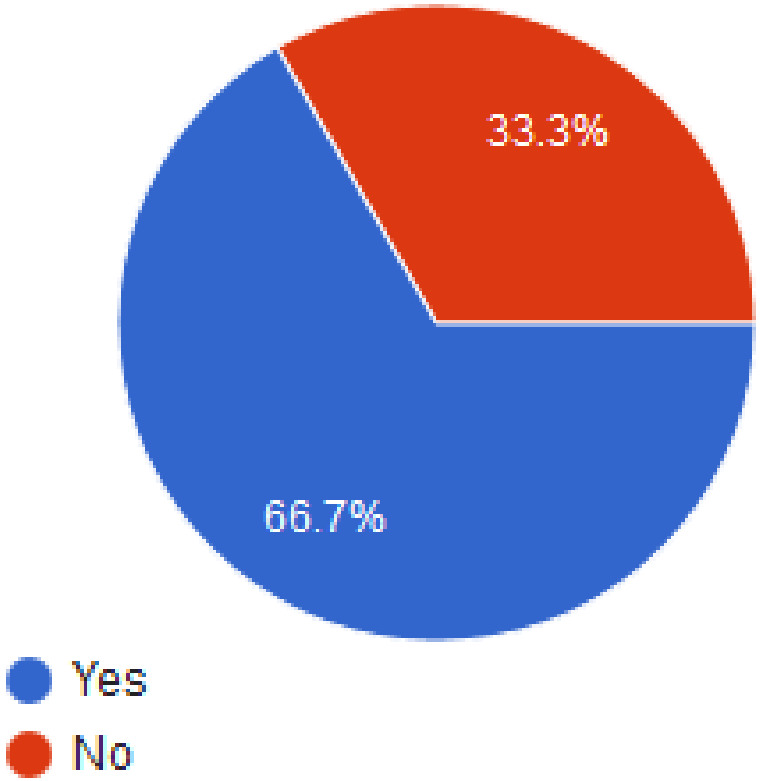
0%
0%
0%
-
0%
0%
-

What percent of the asphalt pavement surfaces in your state contain OGFC?

0
0
<1%
-
0%
25% Gap Graded Friction
-

Task 1: Survey Results

Does your state allow RAS?



If Yes, how much?

5 responses

No more than 3.0% by mass of total aggregate weight
Only 3% in maintenance/sand mxies that are not designe dper superpave
max 3% only asphalt base layers
NA
5% max in intermediate & base courses

Task 1: Survey Results

In regards to RAP/RAS mixtures, what are the maximum amounts of RAP and/or RAS allowed?

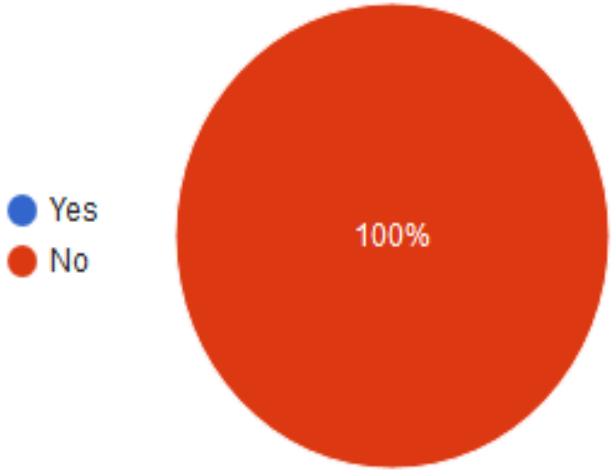
50% RAP, 3% RAS; when combined as RAM, 1.2% total binder replacement
20%
3% RAS asphalt base 20% RAP in any layer
0% RAS and 18 to 28% RAP
0
RAP - 10% Asphalt Rubber Surface 15% intermediate 40% intermediate & base crs

Task 1: Survey Results

In regards to RAP/RAS mixtures

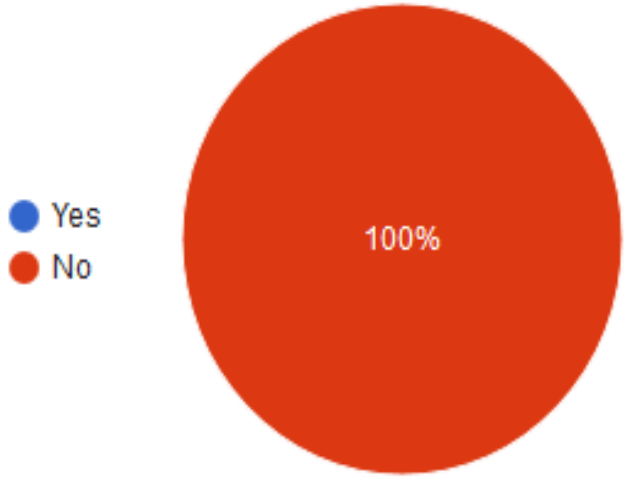
Is a rejuvenator required?

6 responses



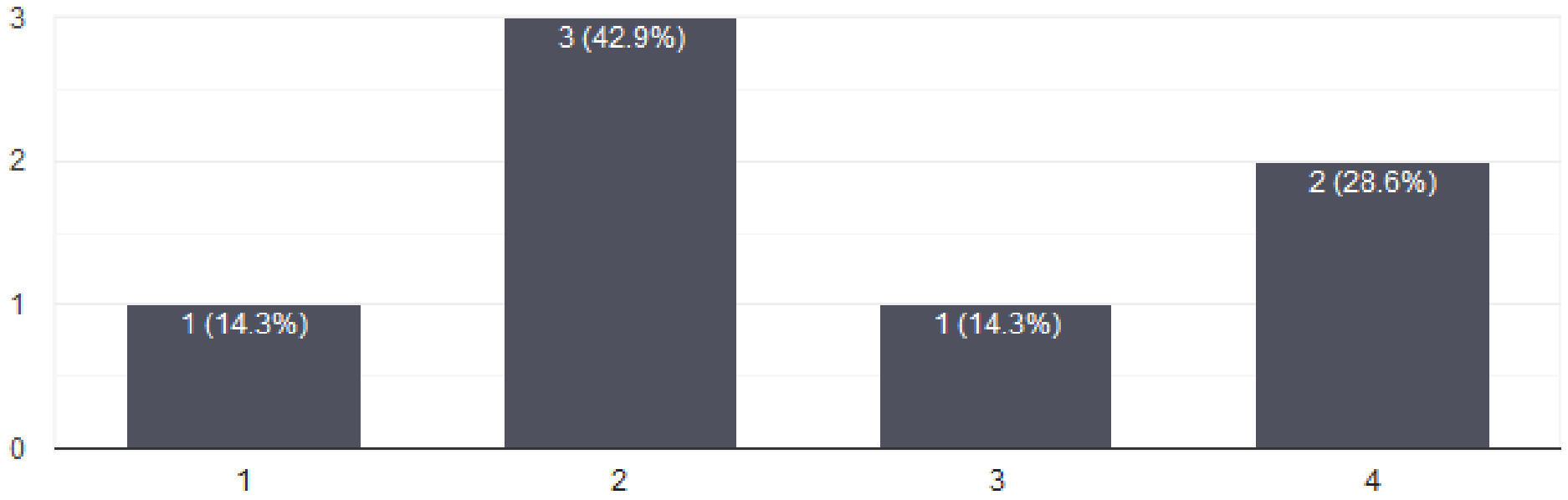
Is the mixture containing RAP/RAS required to have an increase in VMA or asphalt content?

6 responses



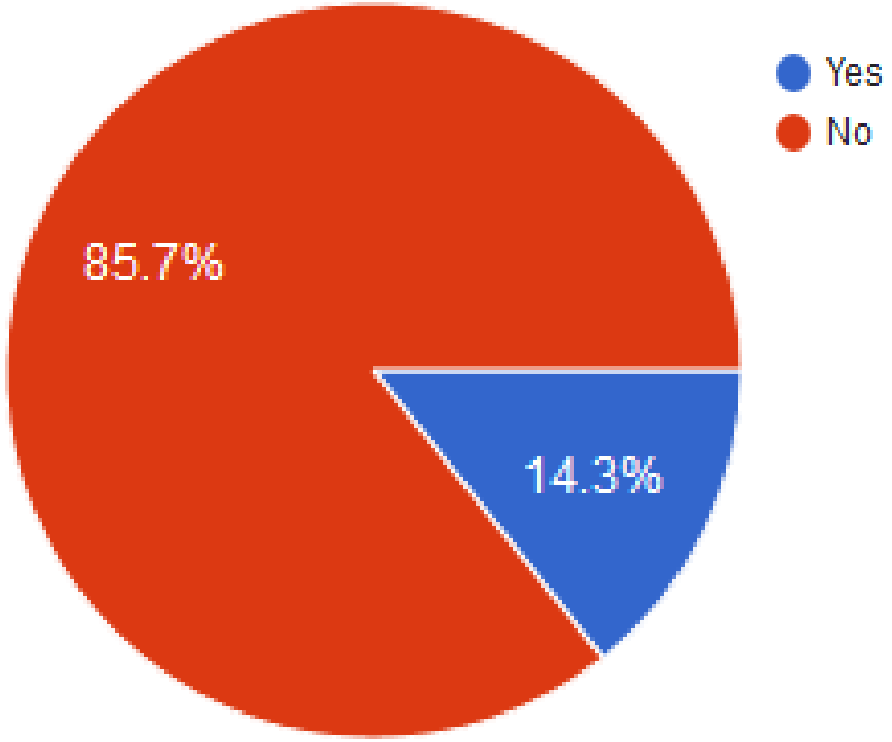
Task 1: Survey Results

How many different binder grades are typically used in your state?



Task 1: Survey Results

Does your state require different low temperature grades for different regions of your state?



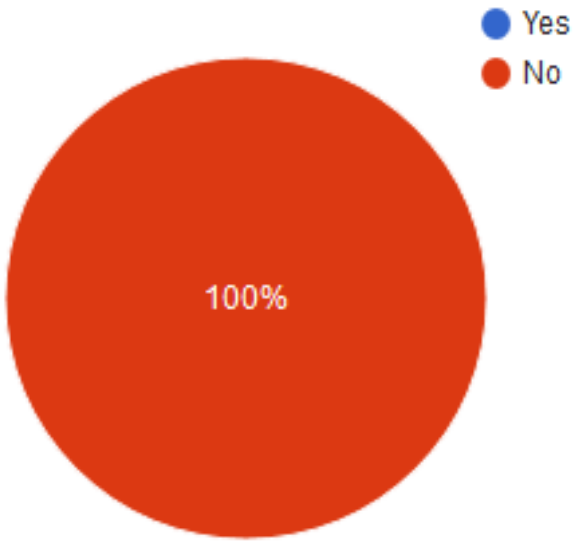
Task 1: Survey Results

What is your minimum VMA for your typical surface course mixes?

16.5
16
14
14
15516.5

Task 1: Survey Results

Does your state deal with high absorptive aggregates (> 1.5% water absorption)?



If so, do you handle conditioning differently with these aggregates?

6 responses