

**NCHRP Project 20-05
Synthesis Topic 48-02
Tack Coat Specifications, Materials,
and Construction Practices**

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What Exactly Is a Synthesis?

- **A report that assembles and disseminates information on a topic of current highway practice.**
- **Prepared by a consultant who has expertise in the topic area, with assistance provided by a technical panel.**

Asphalt Institute's Expertise

Tack Coat Best Practices

FHWA Cooperative Agreement Subtask

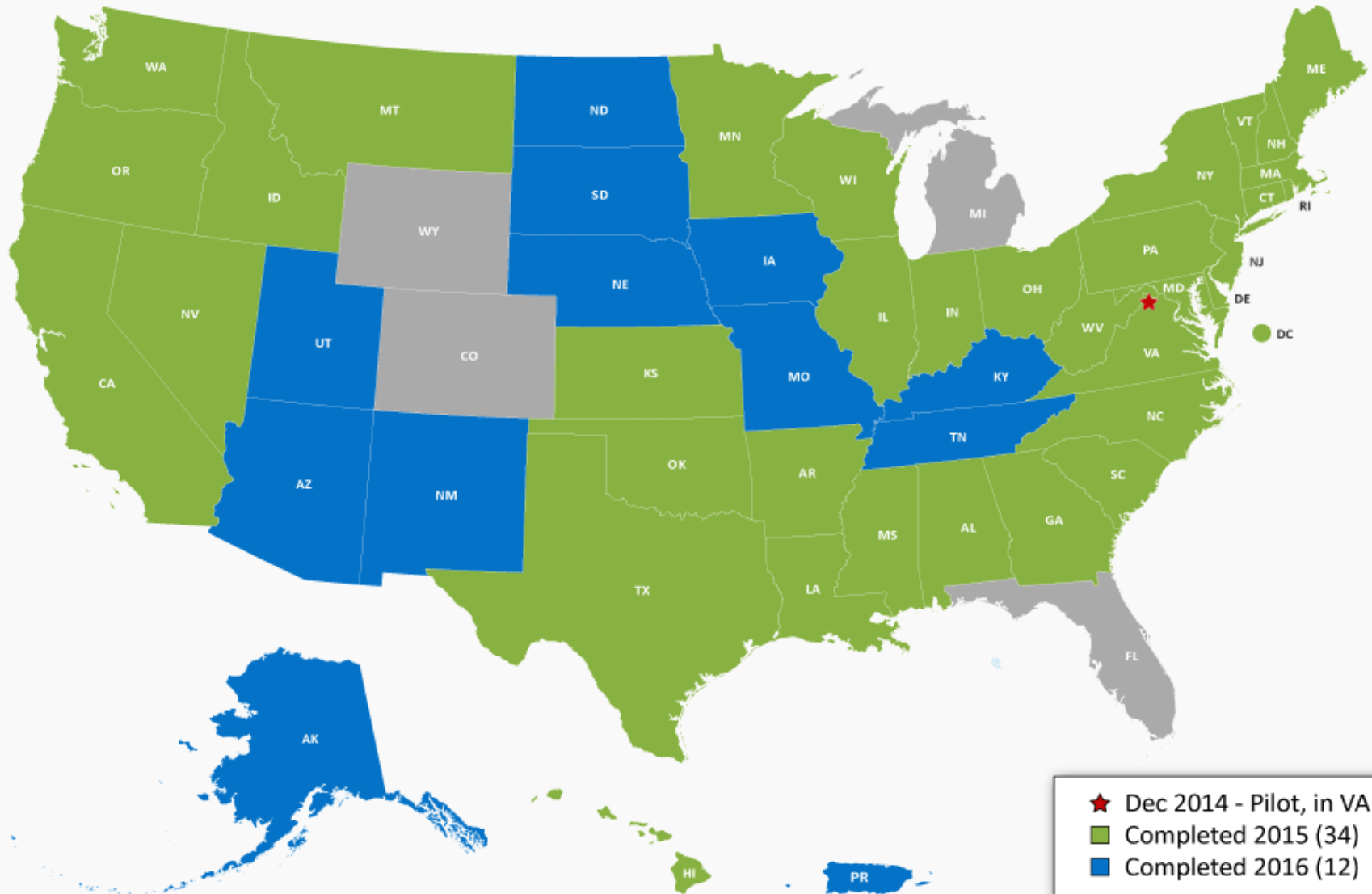
(Longitudinal Joints
Intelligent Compaction)



Tack Coat Workshops, 2015-2016



Reach: 2700 Attendees through 47 workshops, plus additional 3100 with 35 presentations



TechBrief

The Asphalt Pavement Technology Program is an integrated, national effort to improve the long-term performance and cost effectiveness of asphalt pavements. Managed by the Federal Highway Administration through partnerships with state highway agencies, industry and academia the program's primary goals are to reduce congestion, improve safety, and foster technology innovation. The program was established to develop and implement guidelines, methods, procedures and other tools for use in asphalt pavement materials selection, mixture design, testing, construction and quality control.



U.S. Department of Transportation
Federal Highway Administration

Office of Asset Management,
Pavements, and Construction

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Tack Coat Best Practices

This Technical Brief provides an overview of tack coats and their vital role bonding multiple asphalt layers into one monolithic system. Poor tack coat techniques result in compromised bonding of the asphalt layers. This leads to pavement distresses. Possible slippage cracking and delamination are associated with poor bonding. Additionally, poor bonding can lead to structural distresses, namely fatigue cracking and potholes. Often this lack of sufficient bonding is not recognized as the source of failures.

Introduction

A key, but sometimes overlooked, component of an asphalt pavement is the bond strength between asphalt pavement layers. Tack coat is a sprayed application of an asphalt binder upon an existing asphalt or Portland cement concrete pavement prior to an overlay, or between layers of new asphalt concrete. This thin membrane of asphalt binder provides the glue between the layers, creating a monolithic structure which performs as a unit as opposed to unbound, independent, layers. When properly built, a pavement will provide the desired characteristics for its users, while meeting the needs of an agency for an economical, environmentally friendly and sustainable material.

Poor bonding of a pavement surface layer is a direct result of inadequate tack coat practices resulting in slippage and shoving of the pavement, as seen in Figure 1. This type of failure is most frequently seen in locations where braking or acceleration is common, such as intersections. Other distresses can also be made related to poor tack coat bonding, most notably pavement fatigue cracking.

- 12-Month Effort
 - Began in November 2016
 - Ends October 2017
- Survey
 - January – April 2017
 - 50 States
 - 7 Providences
 - Follow-up Interviews
- 1st Draft Report
 - May 19, 2017
- Panel Comments and Meeting
 - June 1, 2017
- 2nd Draft Report
 - July/August 2017
- Final Report
 - October 2017
- Publication
 - May 2018

- Literature Review
 - Specifications
 - Research
 - Testing
- Survey
 - US DOTs
 - Canadian Ministries
- Follow-Up Interviews
- Report

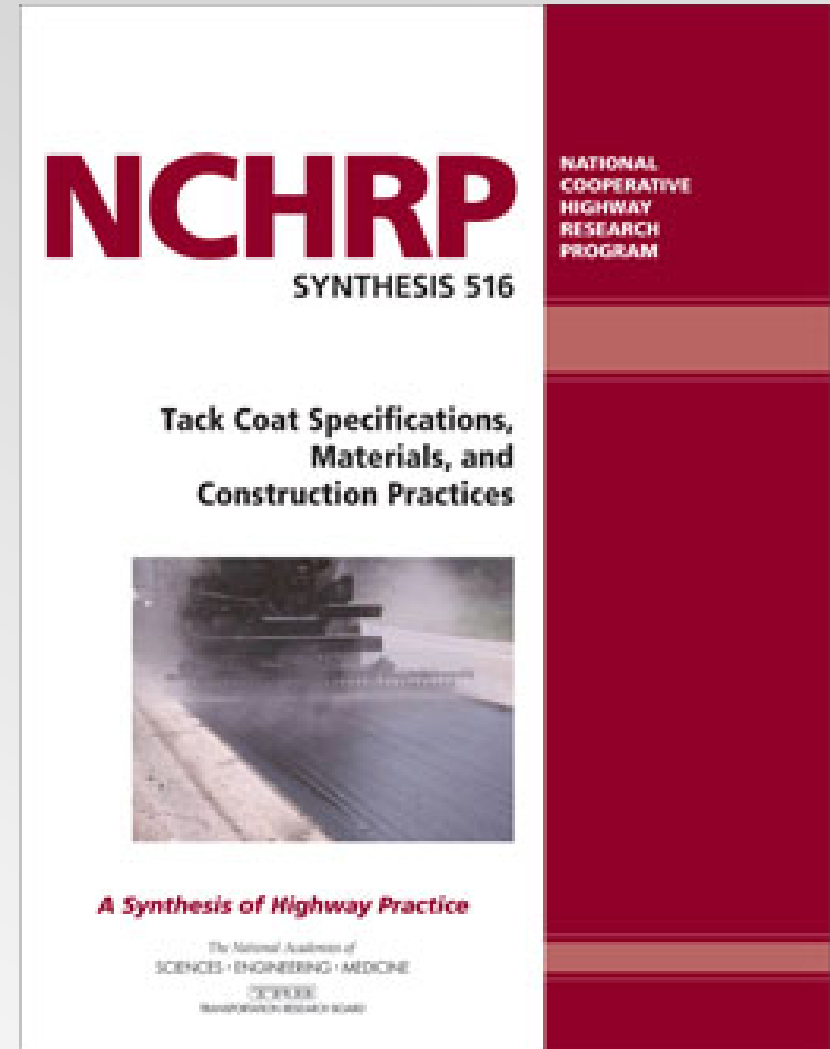


How not to use a Distributor Truck



Sections of the Synthesis 516

- Introduction
- Literature Review
- Survey Results
- Case Examples
- Conclusions
- Appendices



- Importance of Tack Coats
- Tack Coat Definitions
- Tack Coat Specifications
- Tack Coat Materials/Products
- Tack Coat Construction Practices
- Testing and Acceptance of Tack Coats

Importance of Tack Coats

- discusses reasons why a good tack coat is important
- reviews typical pavement distresses that occur as result of poor bonding between pavement layers
- examines probable reasons why poor bonding results in the reported distress

Tack Coat Definitions

- ***Undiluted Emulsion*** - an emulsion which consists primarily of a paving grade asphalt binder, water, and an emulsifying agent.
- ***Diluted Emulsion*** - an emulsion with additional water added to it. The most common dilution rate is 1:1 (one part undiluted emulsion and one part additional water).
- ***Residual Asphalt*** - the remaining asphalt after an emulsion has set, typically 57-70 percent of the undiluted emulsion.
- ***Tack Coat Break*** - the moment when water separates enough from the asphalt to show a color change from brown to black.
- ***Tack Coat Set*** - when all the water has evaporated, leaving only the residual asphalt. Some refer to this as completely broken.

Tack Coat Specifications

- discusses ways agencies have specified issues related to tack coats
- provides information about:
 - methods of material acceptance
 - how tack is paid for by agencies
 - tack coat material dilution
 - tack coat application rates

Tack Coat Materials/Products

- provides information on materials specified by agencies for the use as tack coats.
- includes basic information about emulsions, cutbacks and asphalt binders, which ones are specified as tack coat material, and why
- includes information about reduced-tracking materials and their usage
- discusses temperatures at which materials are applied, and how agencies choose what they believe to be the best product for their use

Tack Coat Construction Practices

- provides detailed findings on agencies' and contractors' best practices regarding the application of tack coat in the construction phase
- discusses:
 - material storage and transport
 - equipment inspection and calibration
 - handling issues
 - surface preparation
 - effects of environmental factors
 - longitudinal joint surfaces
 - vehicle tracking of tack coat

Testing and Acceptance of Tack Coats

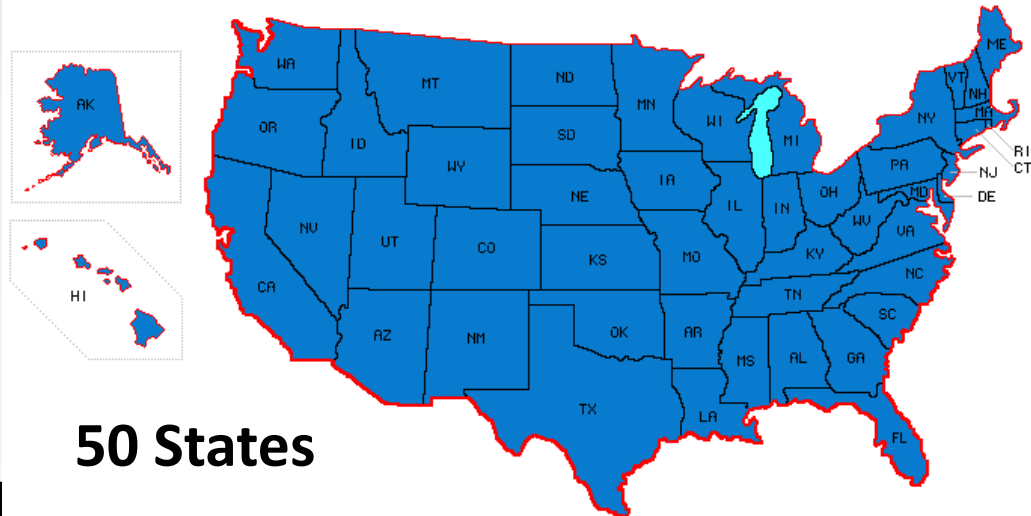
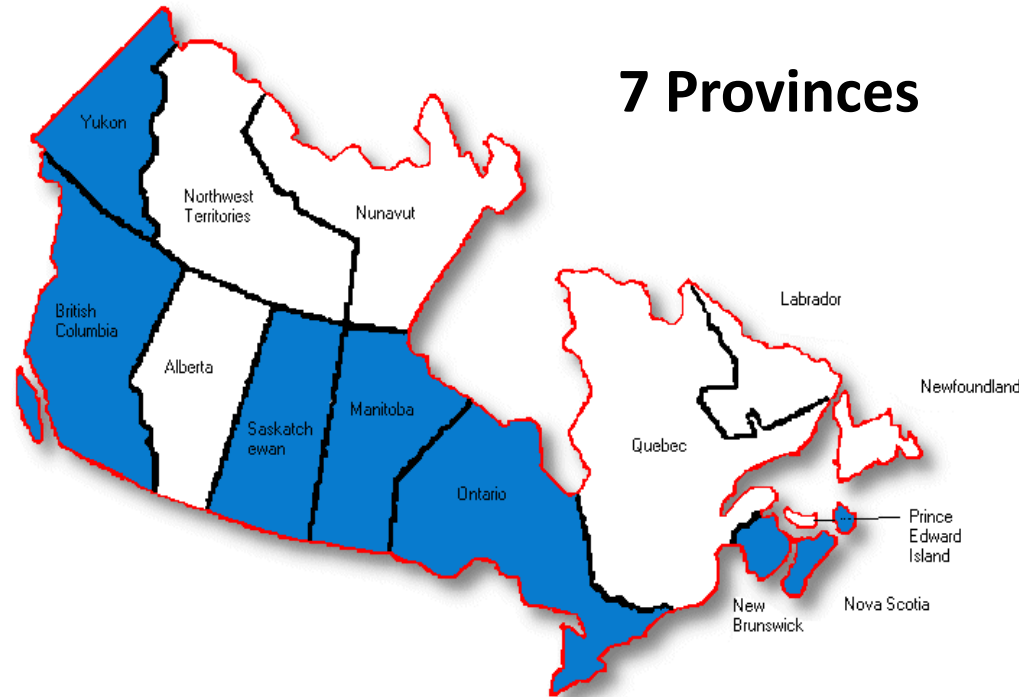
- tack coat quality assurance (QA) processes
- discusses:
 - whether tack coat material acceptance is based on field sampling or source sampling
 - what types of tests agencies specify for acceptance of tack coats
 - how agencies verify that the appropriate rate and surface coverage of tack coat is achieved.

Survey - excellent response rate

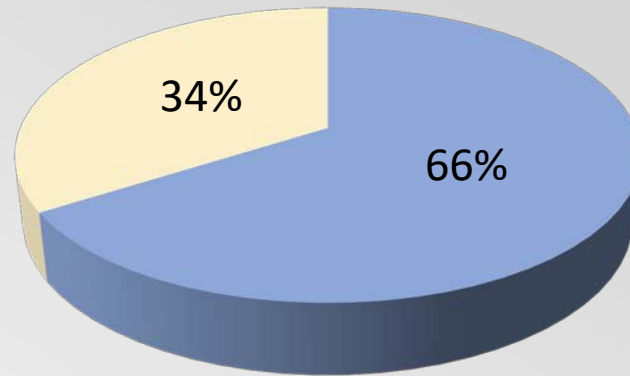


45 Questions

- Tack Coat Payment Specs
 - 2 questions
- Tack Coat Materials
 - 4 questions
- Tack Coat Application
 - 28 questions
- Tack Coat Evaluation
 - 9 questions
- Other Questions
 - 2 questions



How is tack paid for?

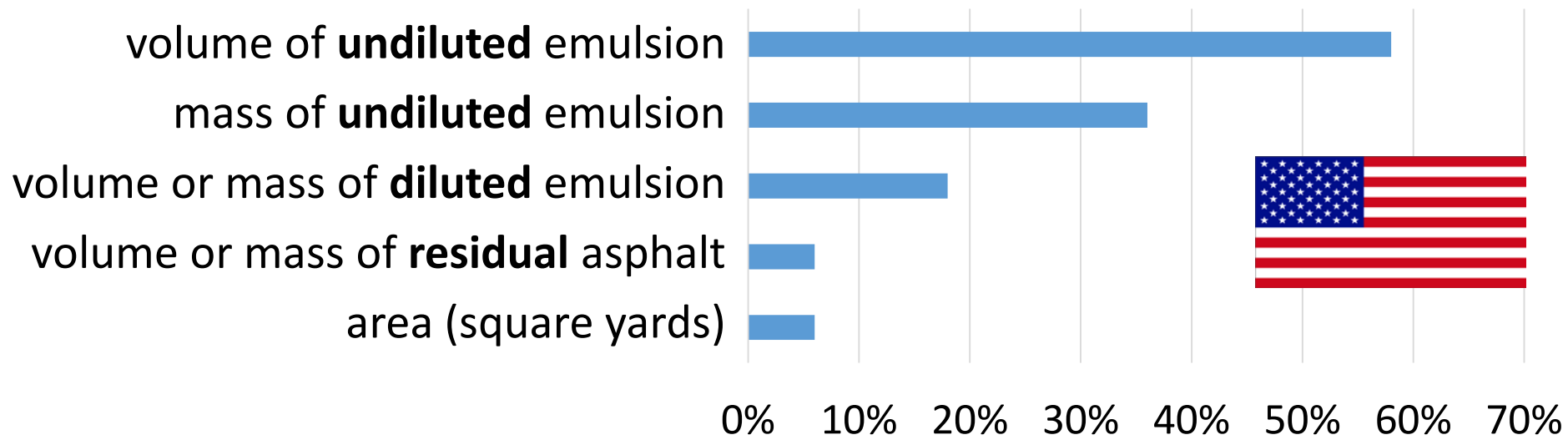


- Individual Pay Item
- Incidental to Paving

Why is this important?

Little incentive for sufficient tack application if not a direct pay item

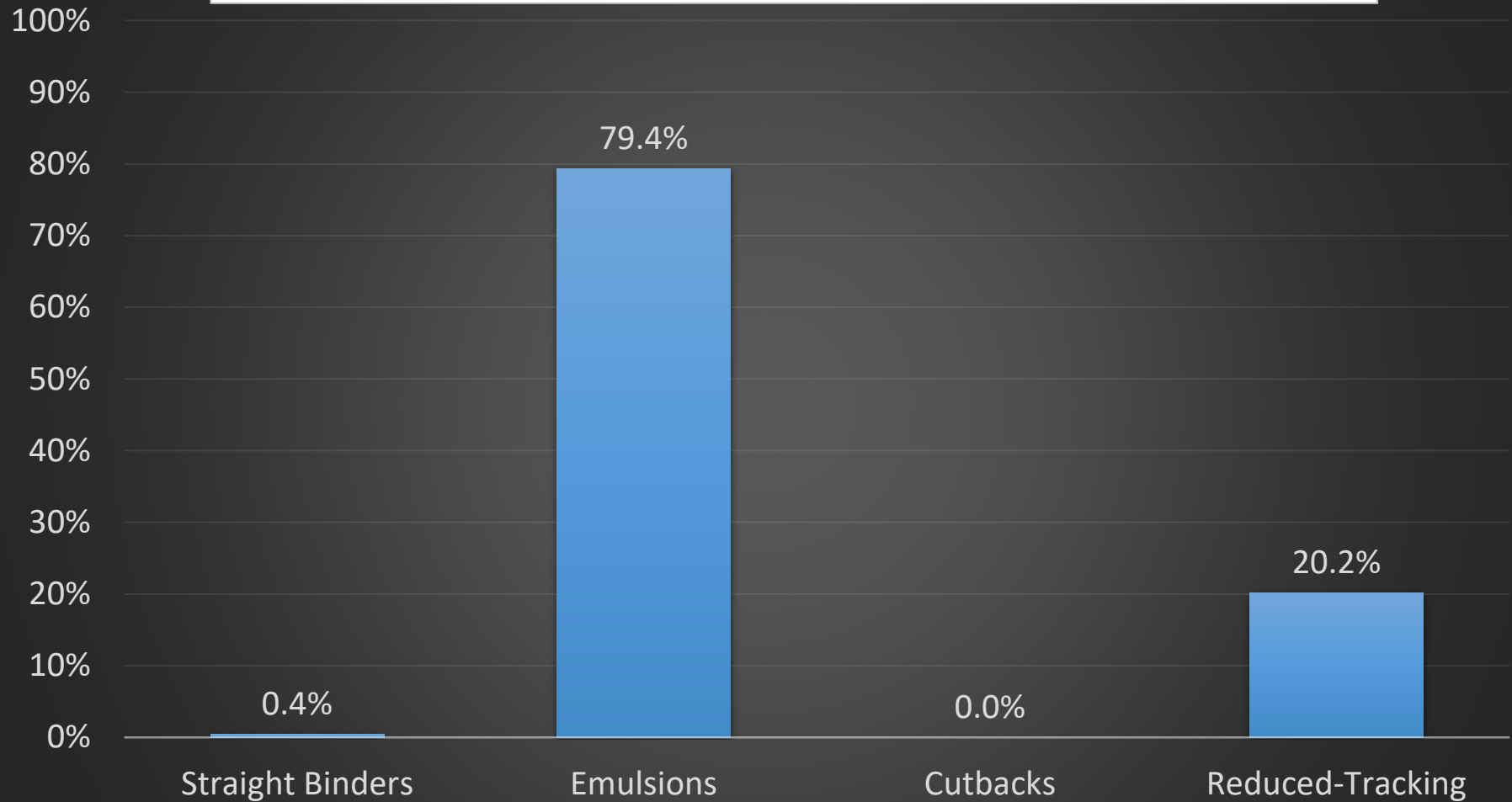
* How is tack measured for pay ?



* Some states pay by more than one method, so %'s do not add up to 100



**Synthesis Survey Results:
Percentage of Tack Coat Materials Used in the U.S.**



Top 5 Emulsions Used

1. CSS-1h	(52%)
2. Non-standard*	(48%)
3. SS-1h	(46%)
4. SS-1	(36%)
5. CSS-1	(28%)

* *Non-standard means that a state has come up with its own nomenclature for an emulsion, outside those specified in **AASHTO M 140** (Anionic Emulsions), **M 208** (Cationic Emulsions), or **M 316** (Polymer-Modified Cationic Emulsions)*
Examples: SS-1hp, CRS-2h, EBL

1. NTSS-1hm (24%)

Others specified (all by less than 3% of the states)

CBC-1H

CBC-1HT

EM-50-TT

E-Tac

NTCQS-HH

NTCQS-1HM

NTCRS-1HM

NTCRS-1HSP

NTHAP

NTT

PATT

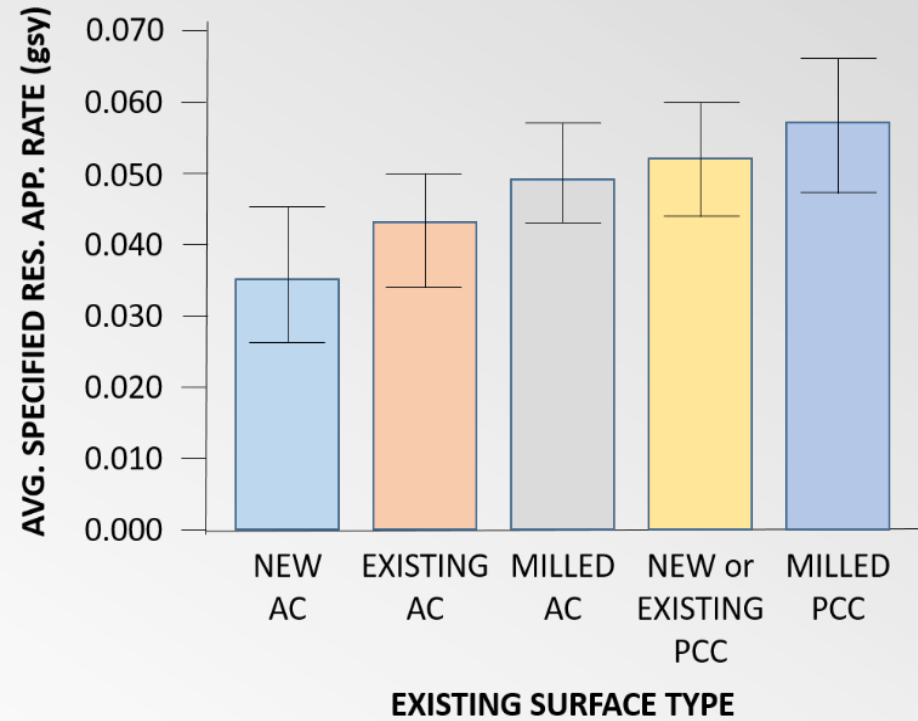
UltraFuse

UltraTack

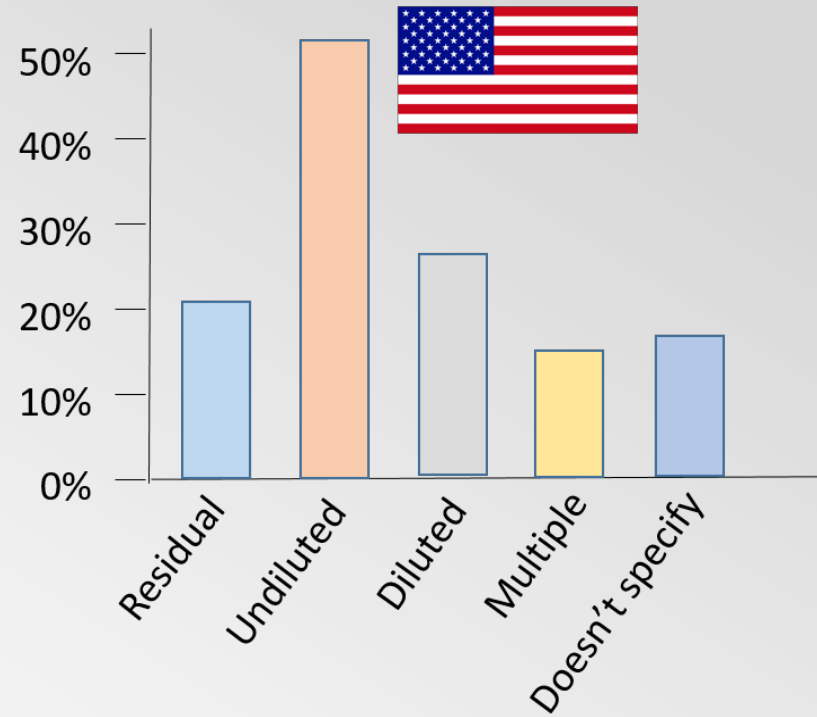
“Non-tracking tacks are designed to improve the pavement performance by avoiding the tracking problems associated with traditional tacks. This material is typically manufactured to harden quickly and adhere minimally to tires. When a hot lift of asphalt is subsequently placed over the tack, the hardened tack is reactivated by the heat, and bonds the new overlay with the existing surface.”

(Seo, 2016)

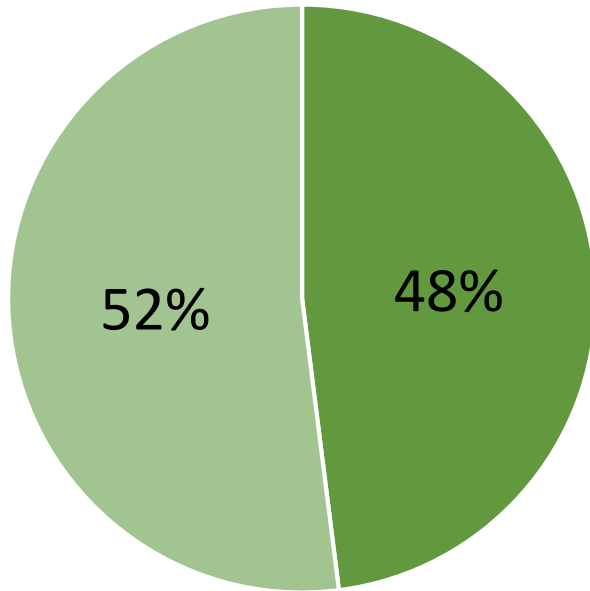
AVERAGE SPECIFIED RESIDUAL BINDER APPLICATION RATE AND RANGES FOR VARIOUS SURFACE TYPES



APP. RATE SPECIFIED BY:



Is Dilution of Emulsified Tack Allowed?

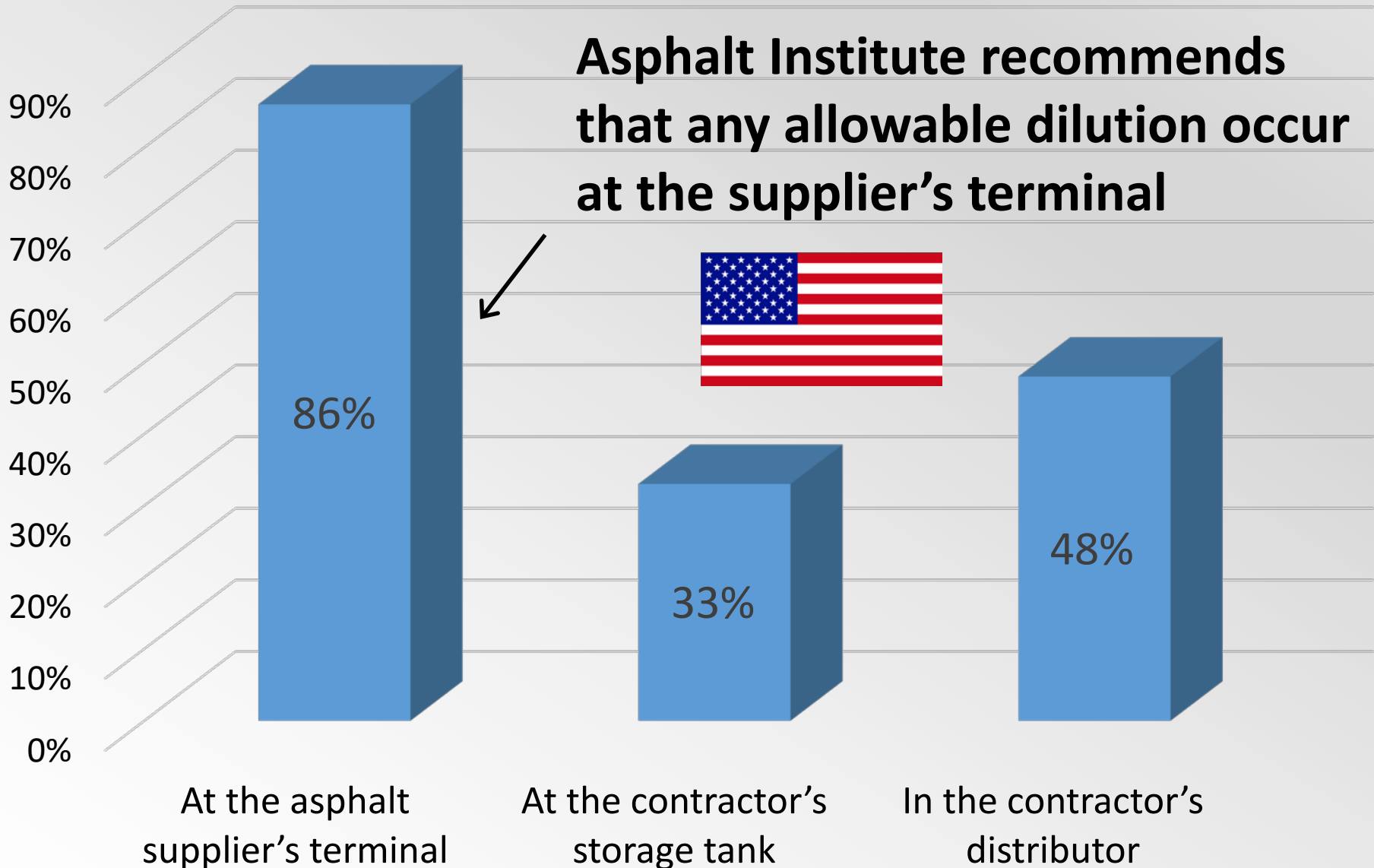


- Dilution Allowed 48% (24/50)
- Dilution Not Allowed 52% (26/50)

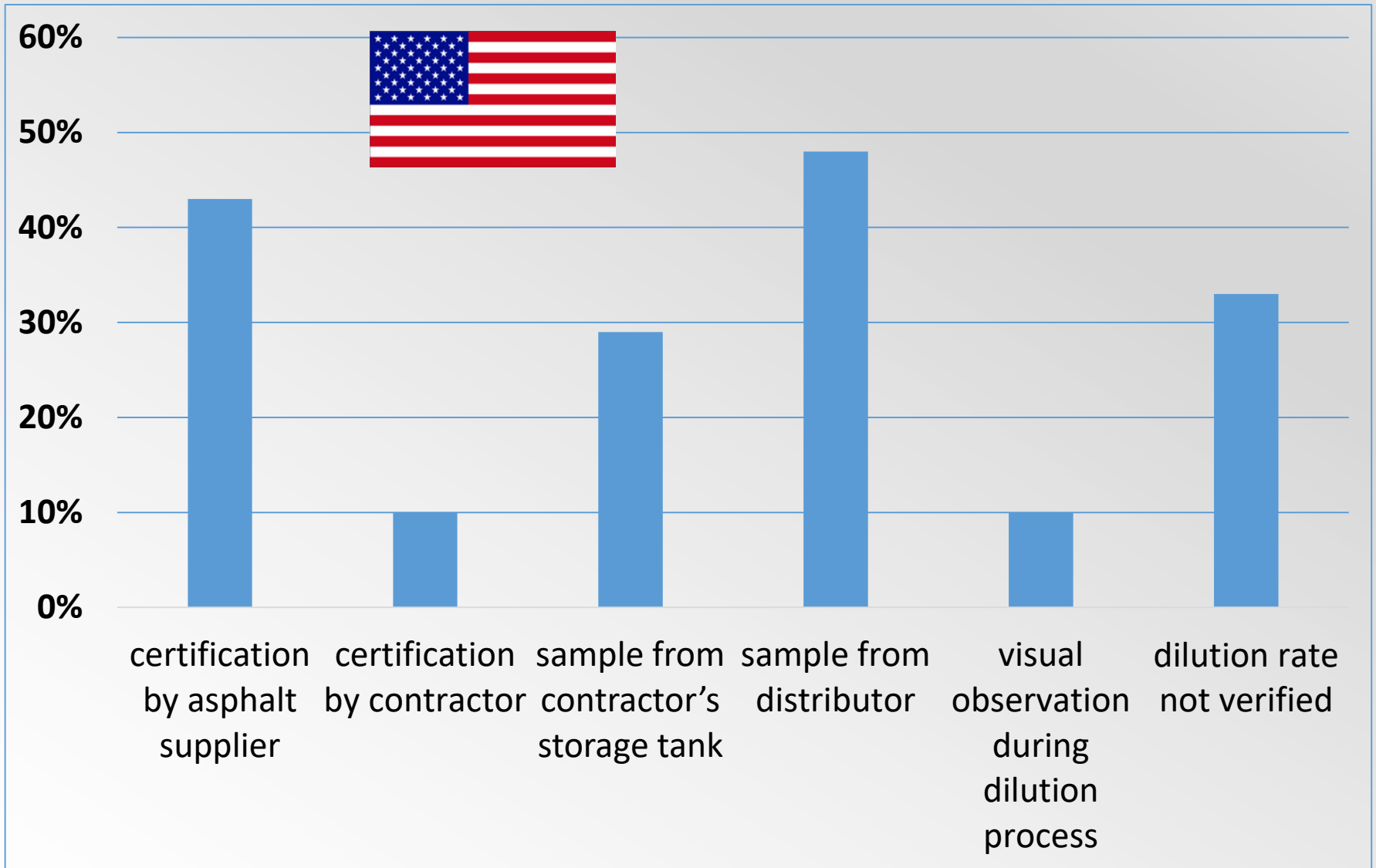
Dilution Recommendations

- Verify dilution amount
- Dilution cannot be used to “stretch” tack
- Residual value is key

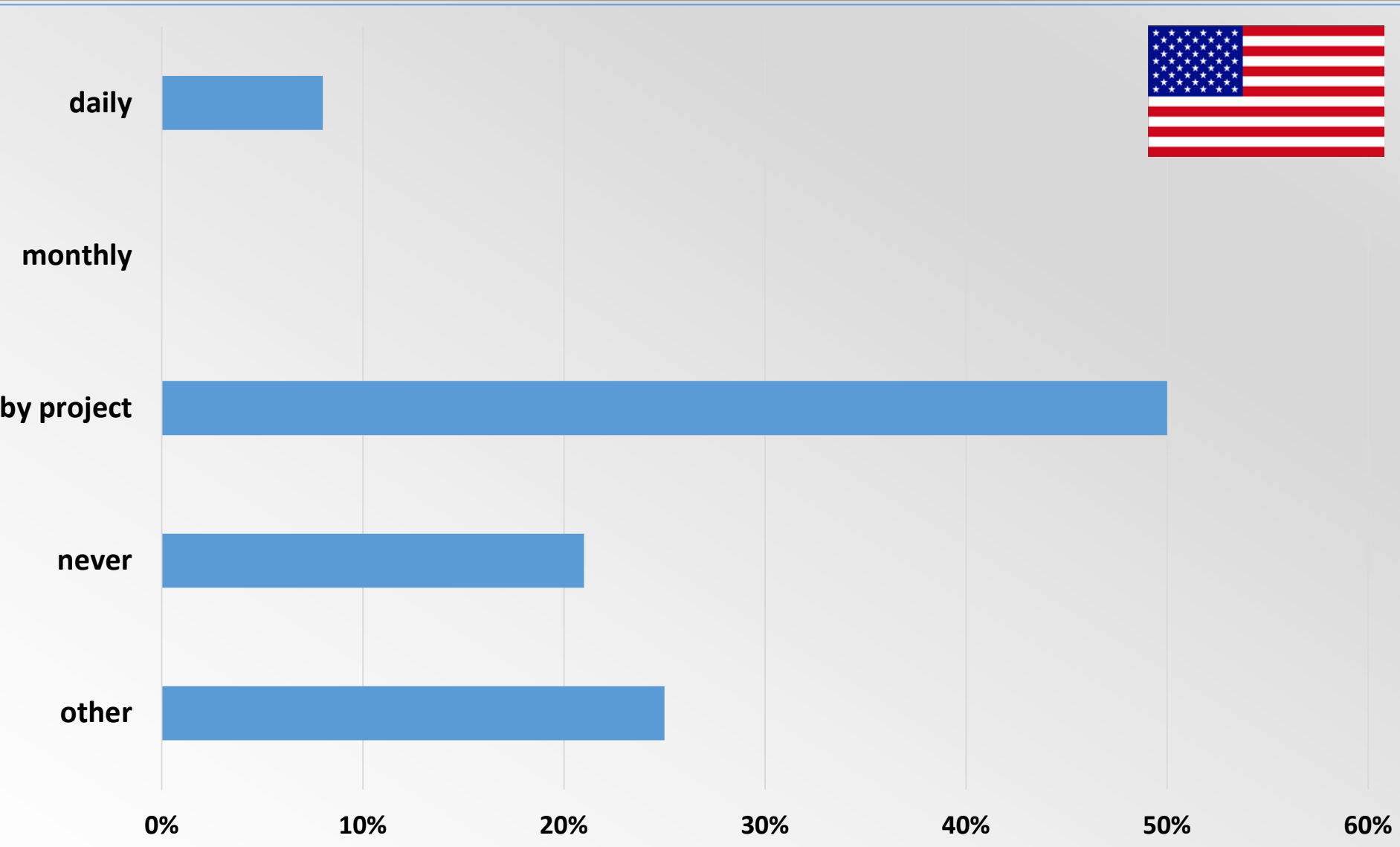
Where is Dilution Allowed?



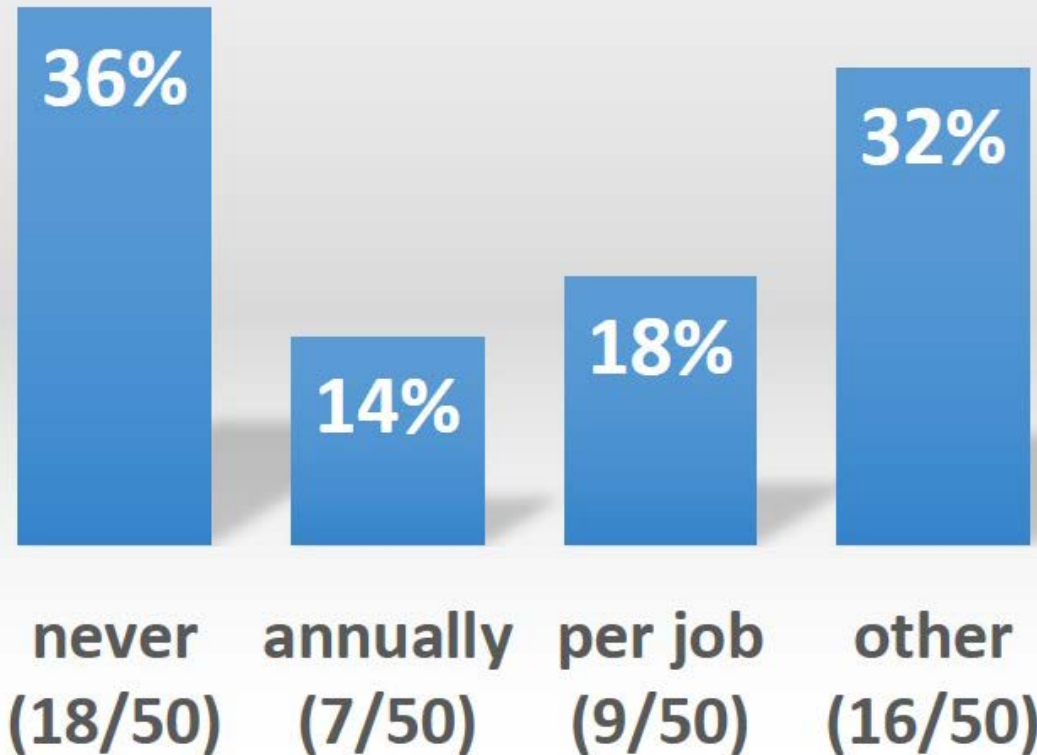
Dilution verification method(s) allowed?



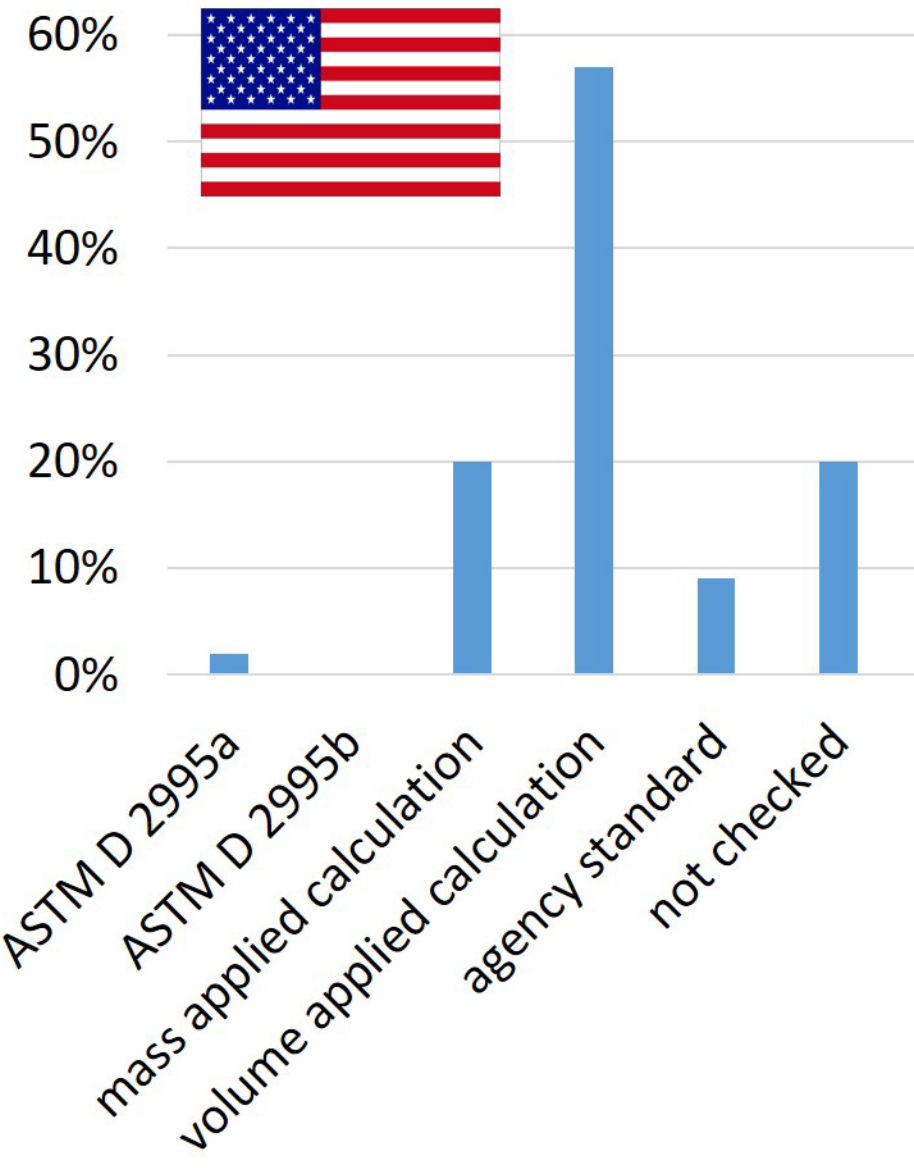
How often is dilution checked?



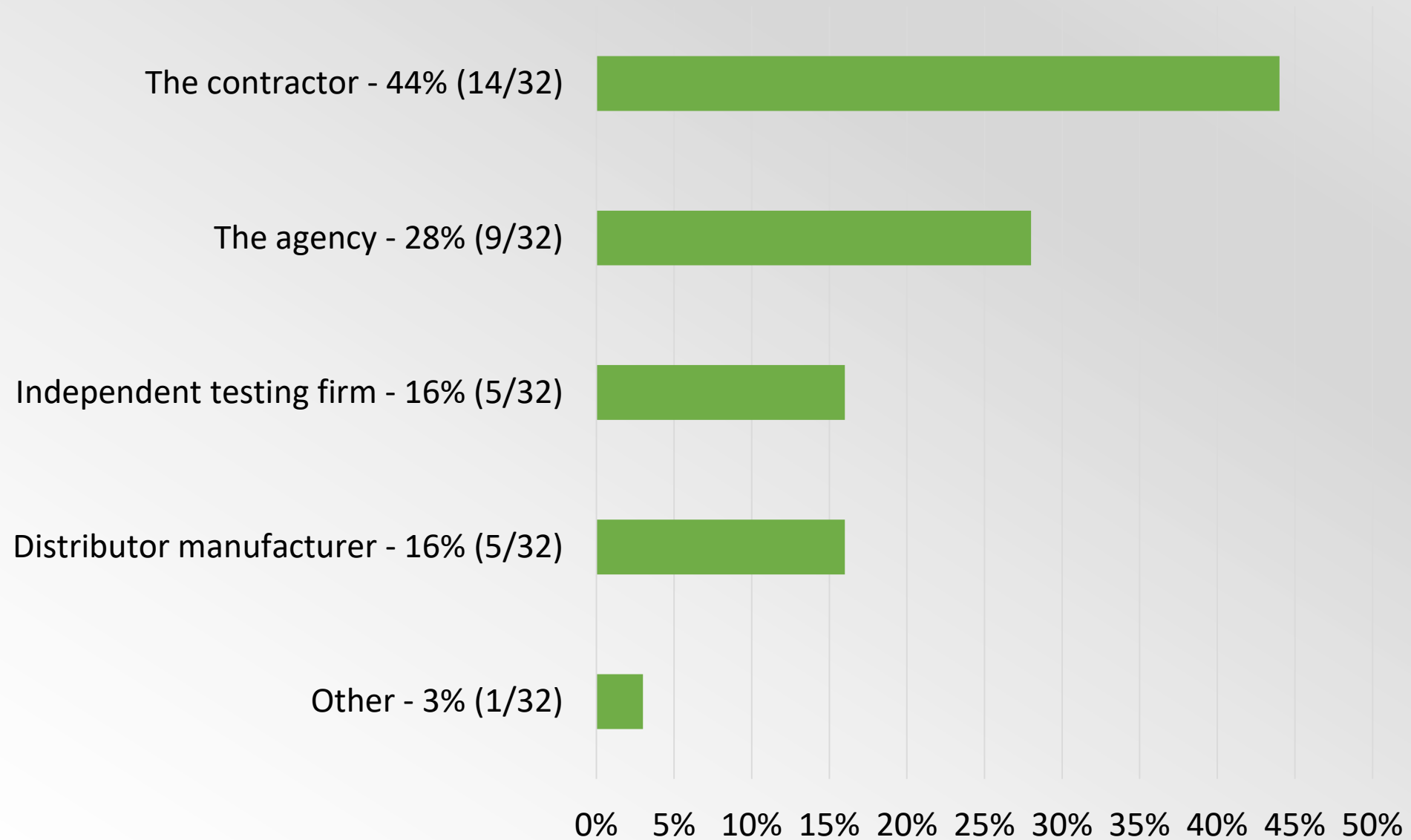
Distributor Calibration-How often?



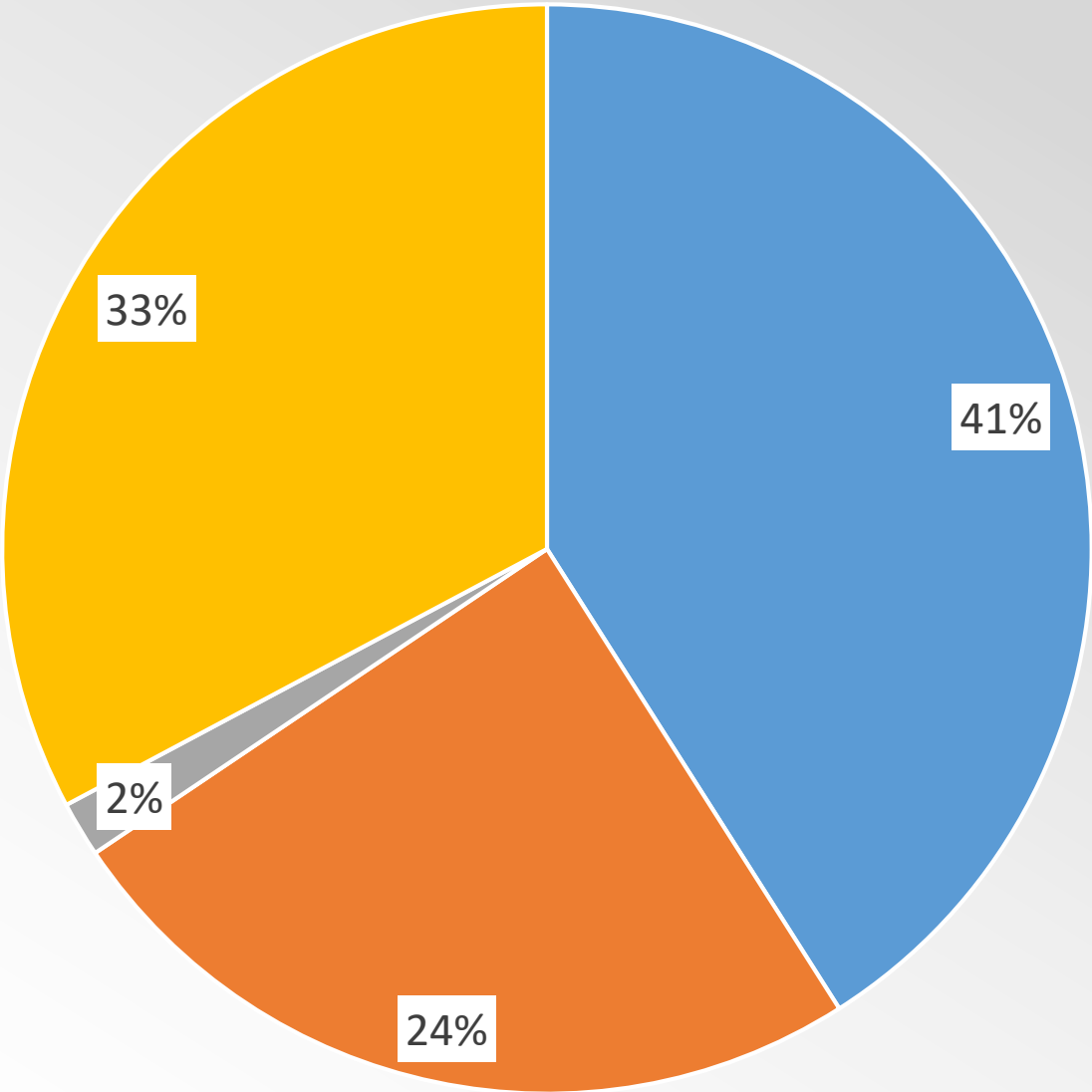
Distributor Calibration-Method?



Who performs the calibration?

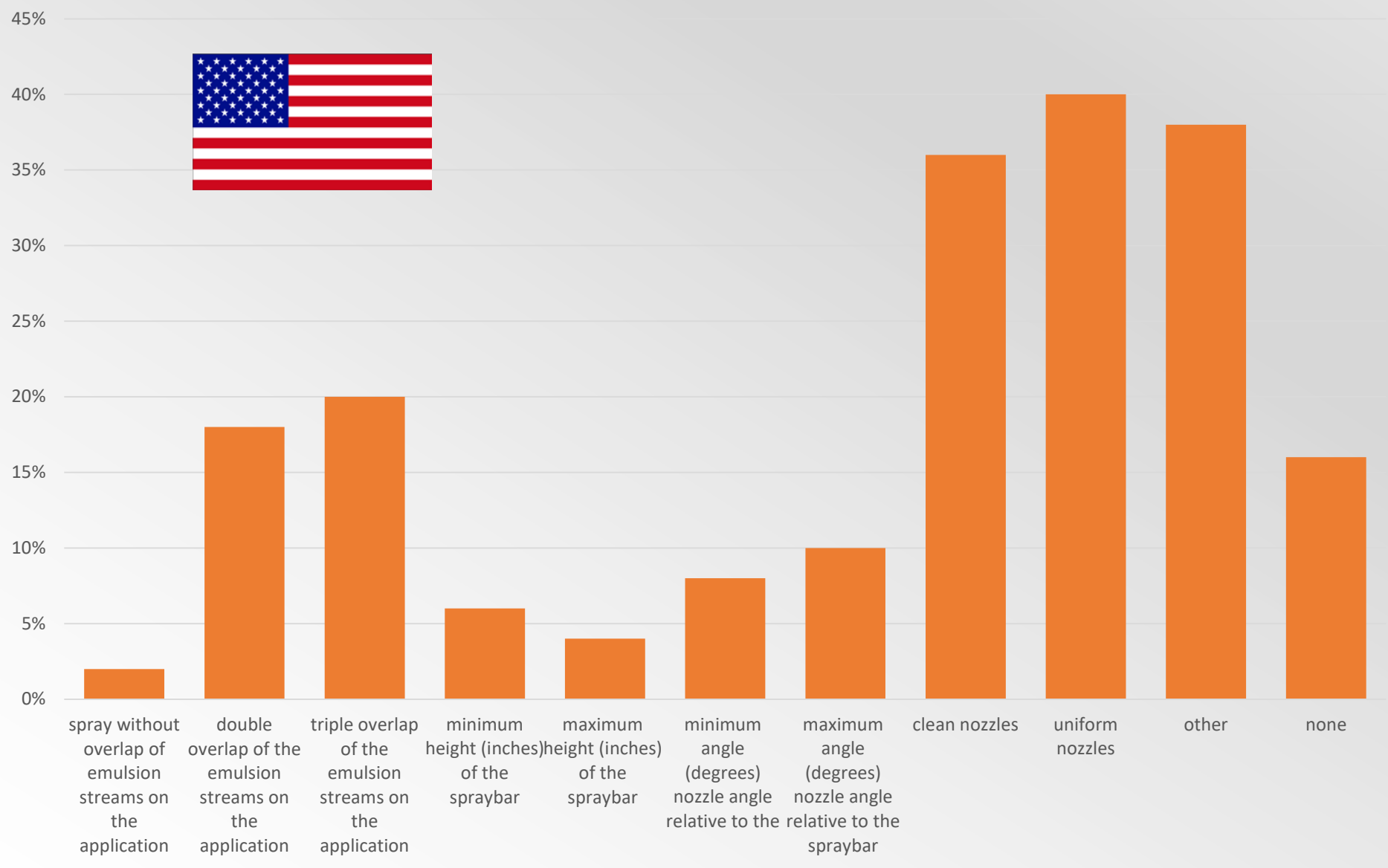


Surface Cleaning Methods

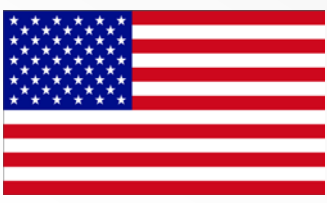
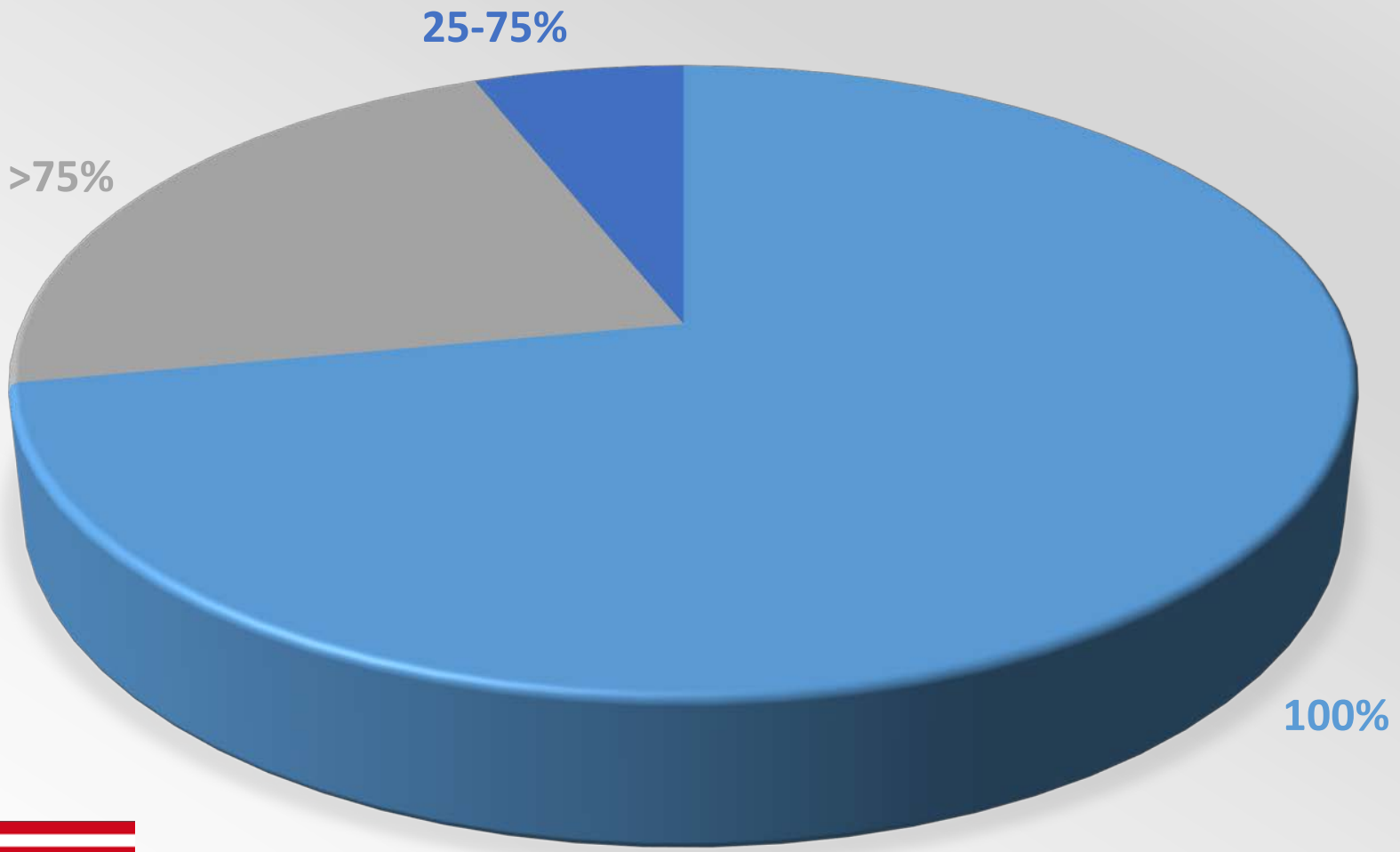


- Power Brooming: 41% (25/57)
- Both Brooming and Air Blowing or Vacuum: 24% (15/57)
- Any of Multiple Specified Methods: 2% (1/57)
- Clean, but Method not Specified: 33% (20/57)

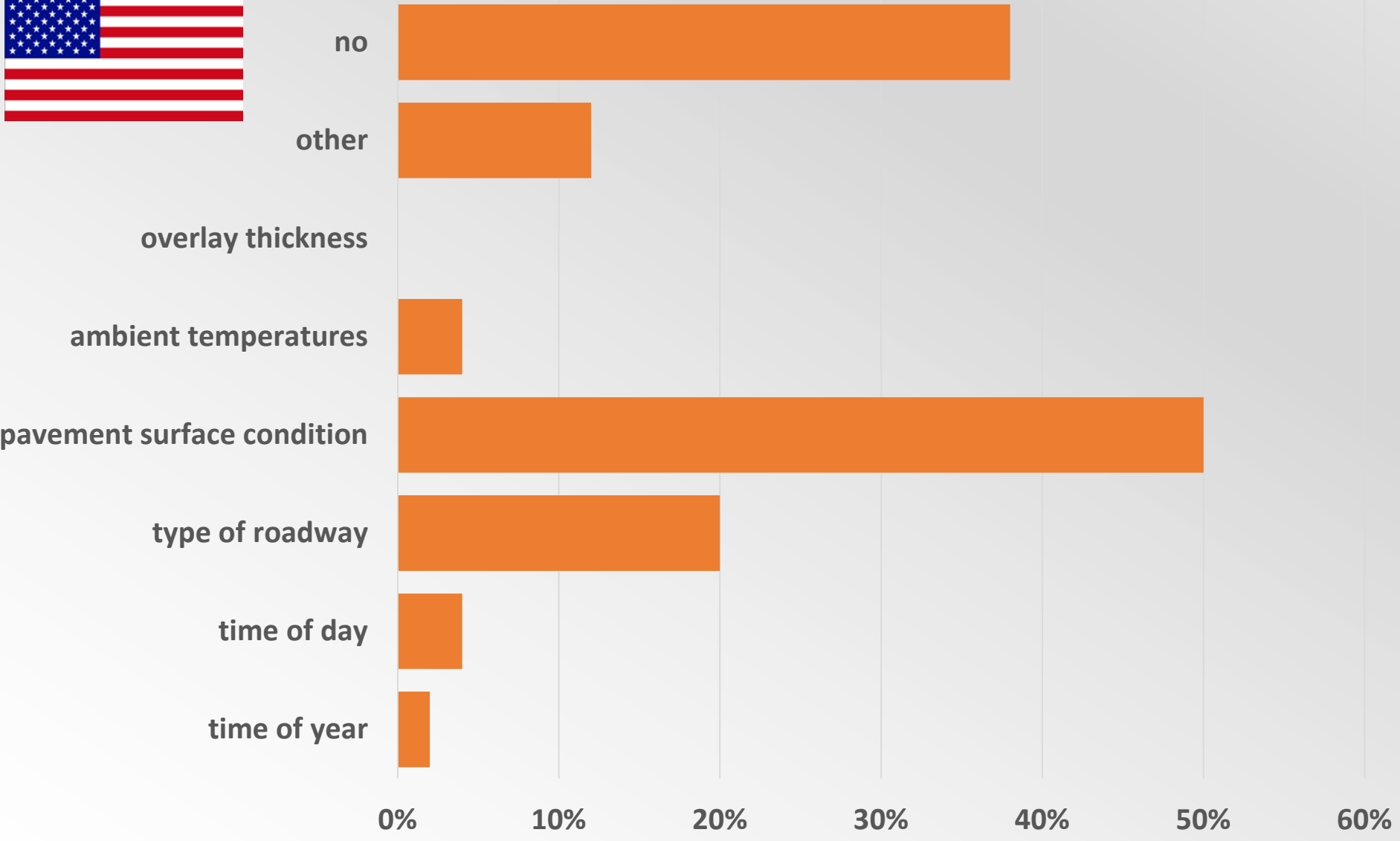
Which of the following are specified by your agency for spray application of tack coat materials?



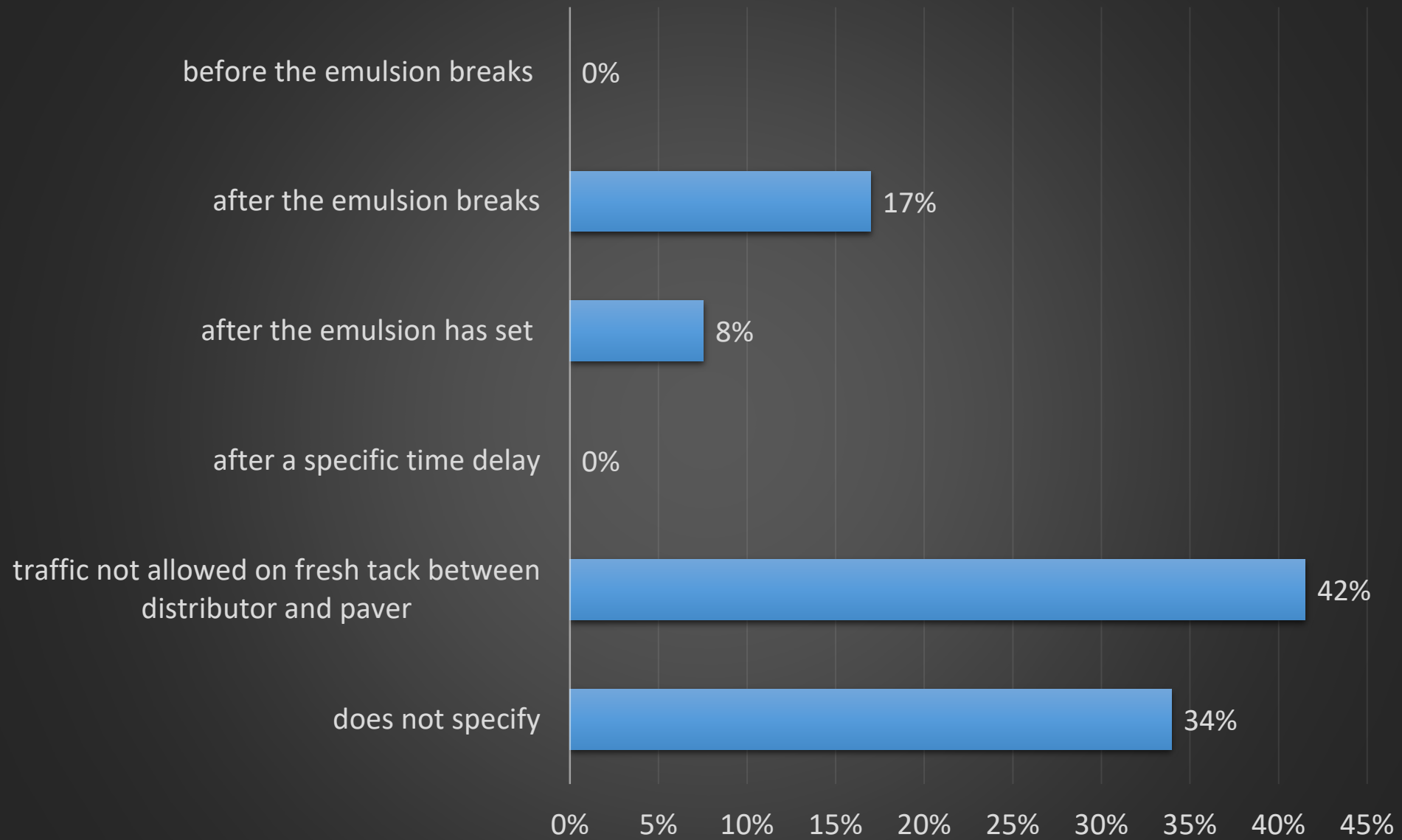
Percent of Surfaces Tacked



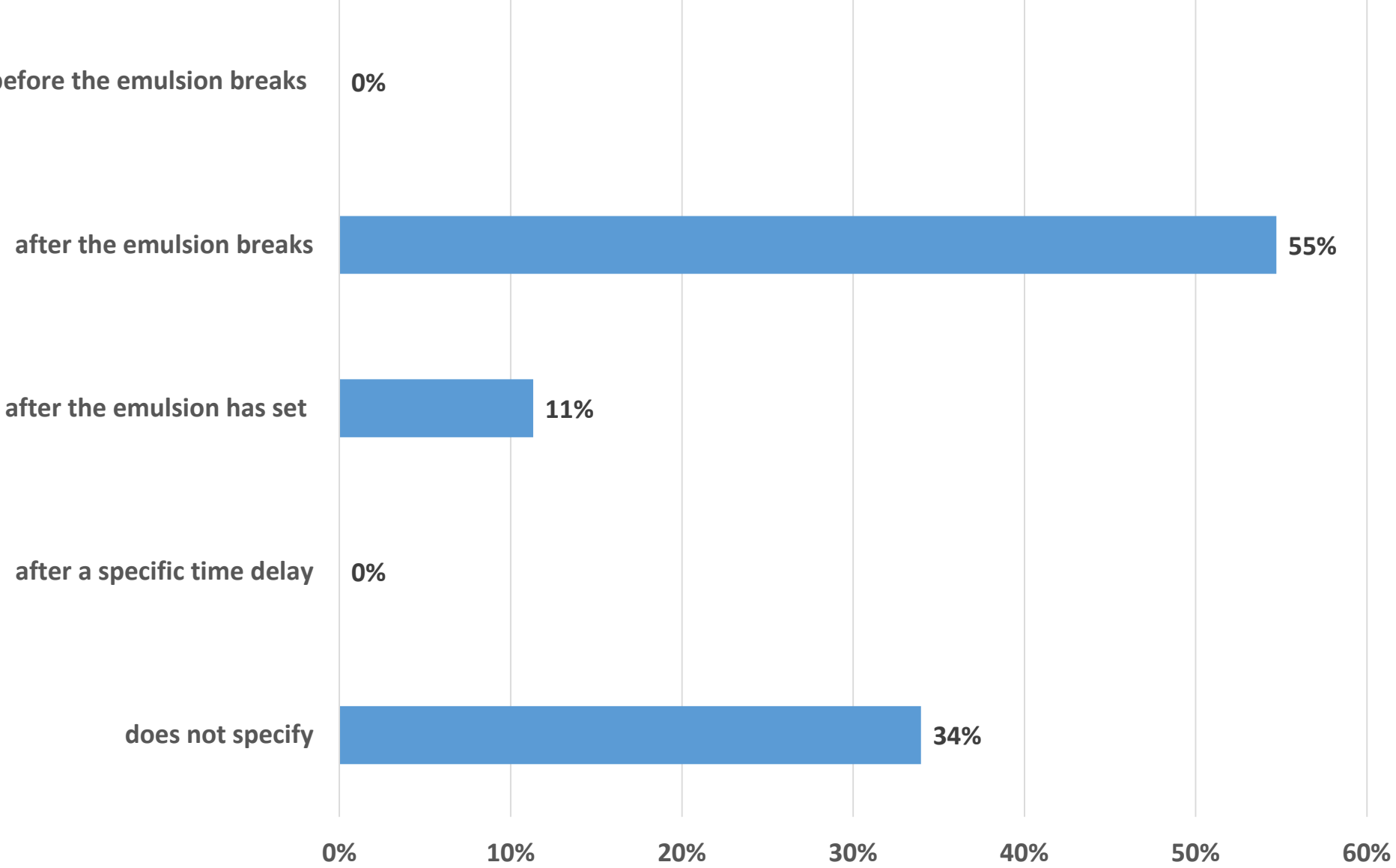
Do any of the following conditions cause the specified residual asphalt tack coat application rate to change?



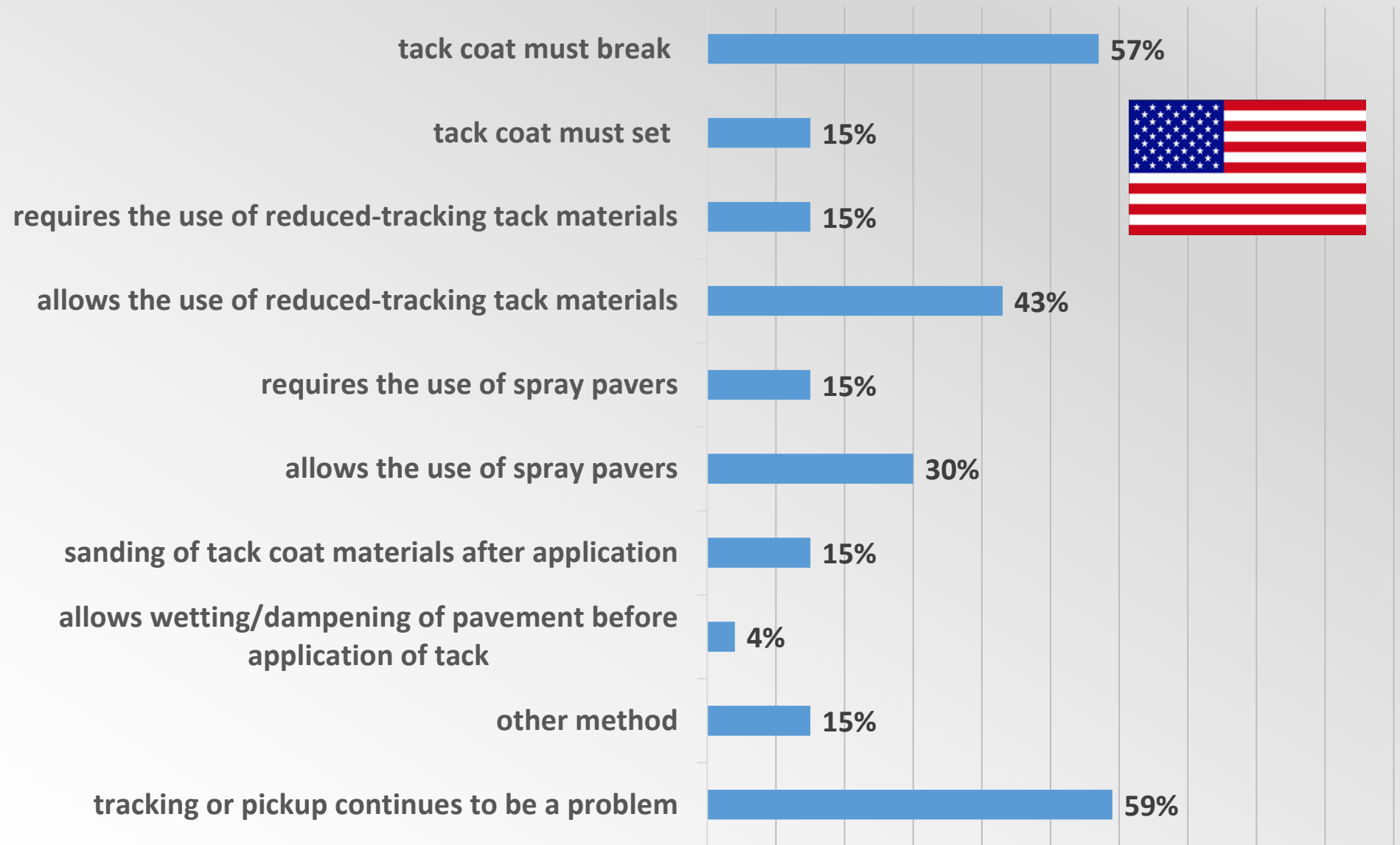
When is traffic allowed on the tack coat?



When is the paver allowed on the tack coat?



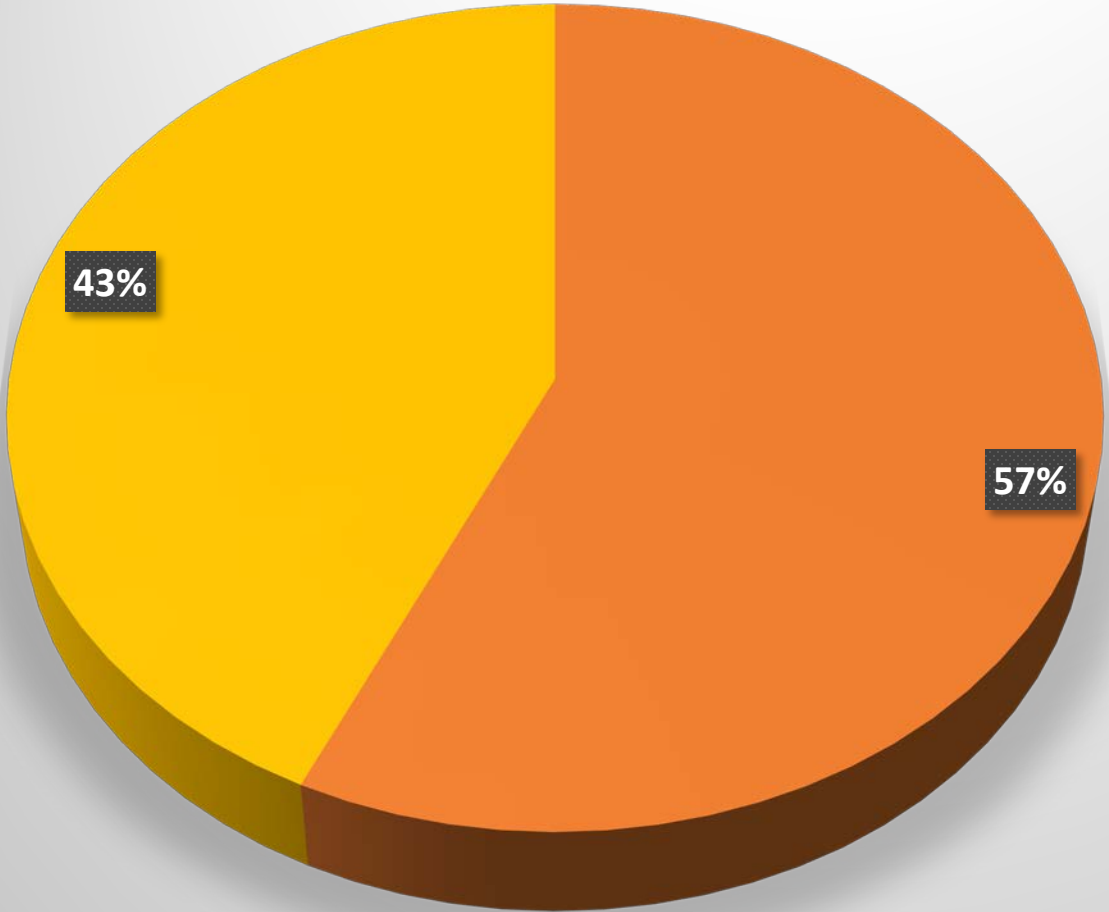
Methods Used to Minimize Tracking



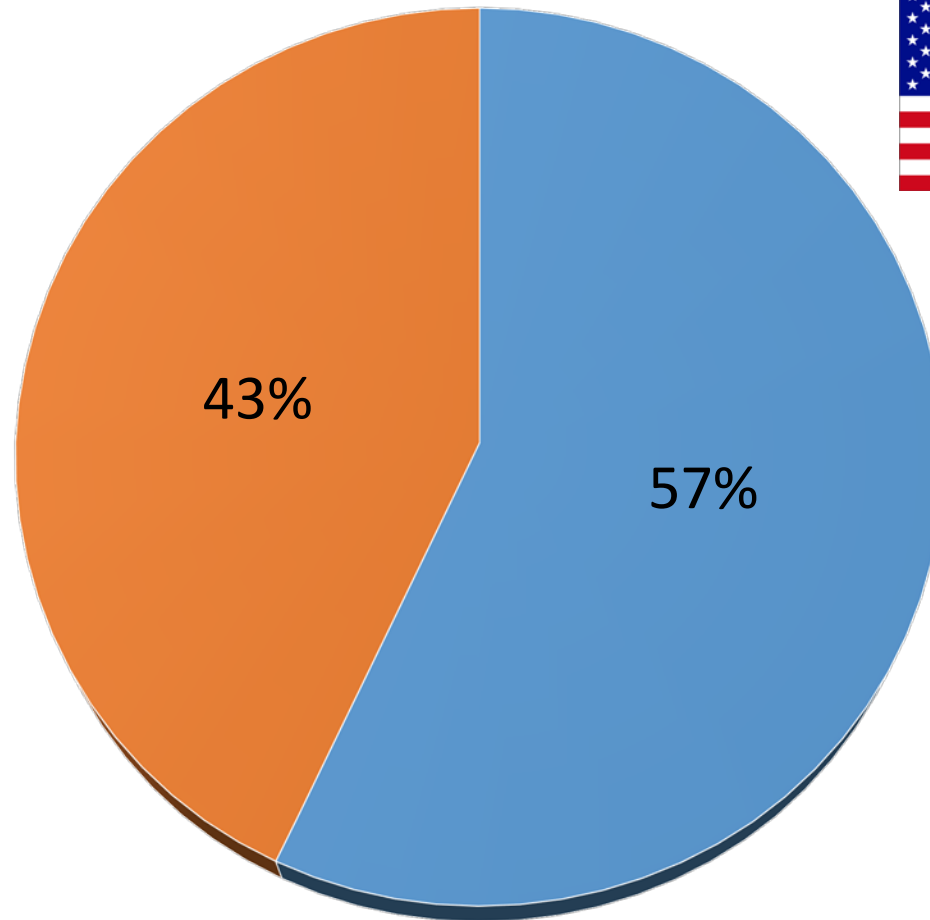
Are spray pavers allowed?



- Spray Pavers Allowed
- Spray Pavers Not Allowed

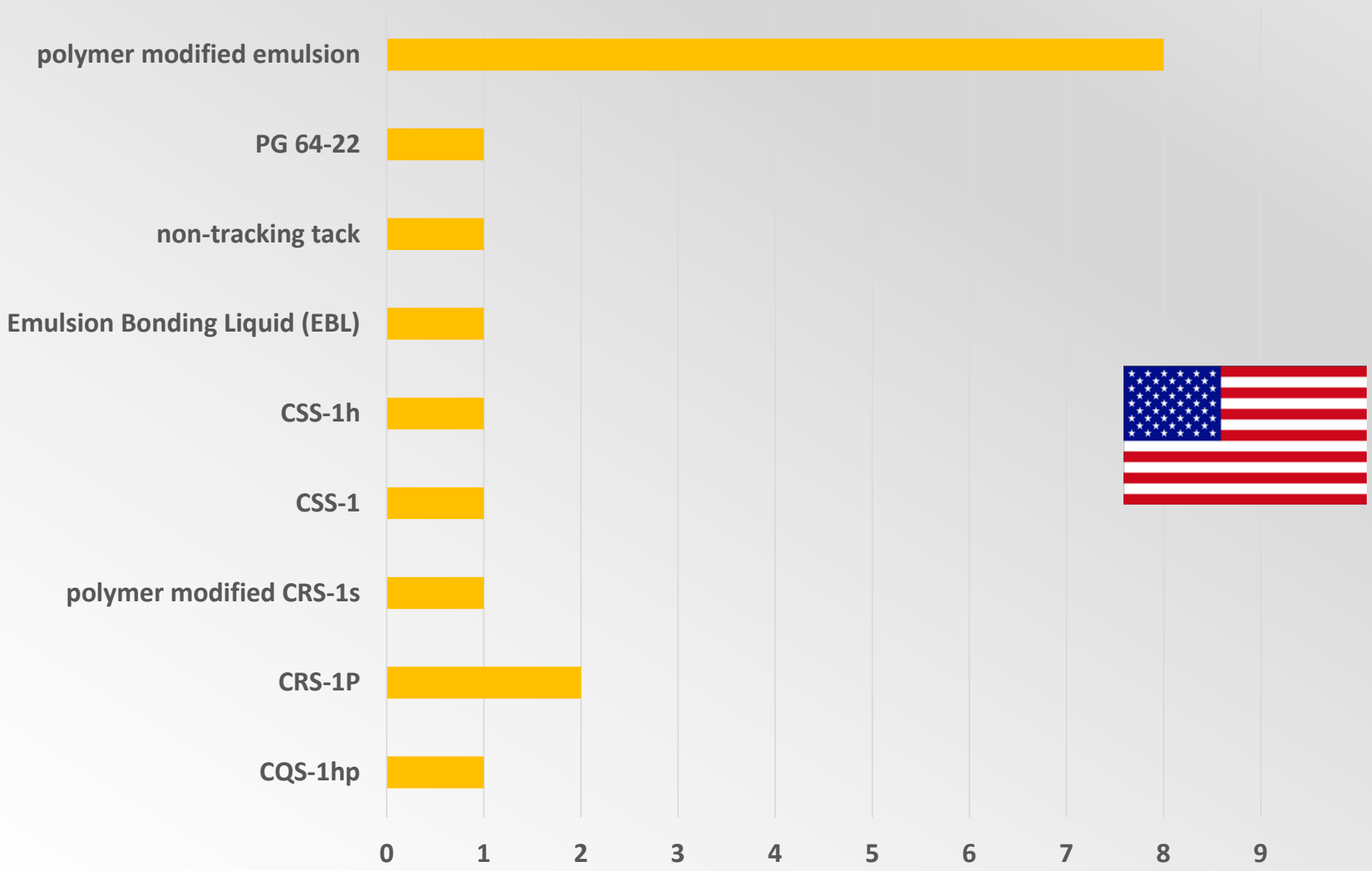


Are different tack materials used with spray pavers?

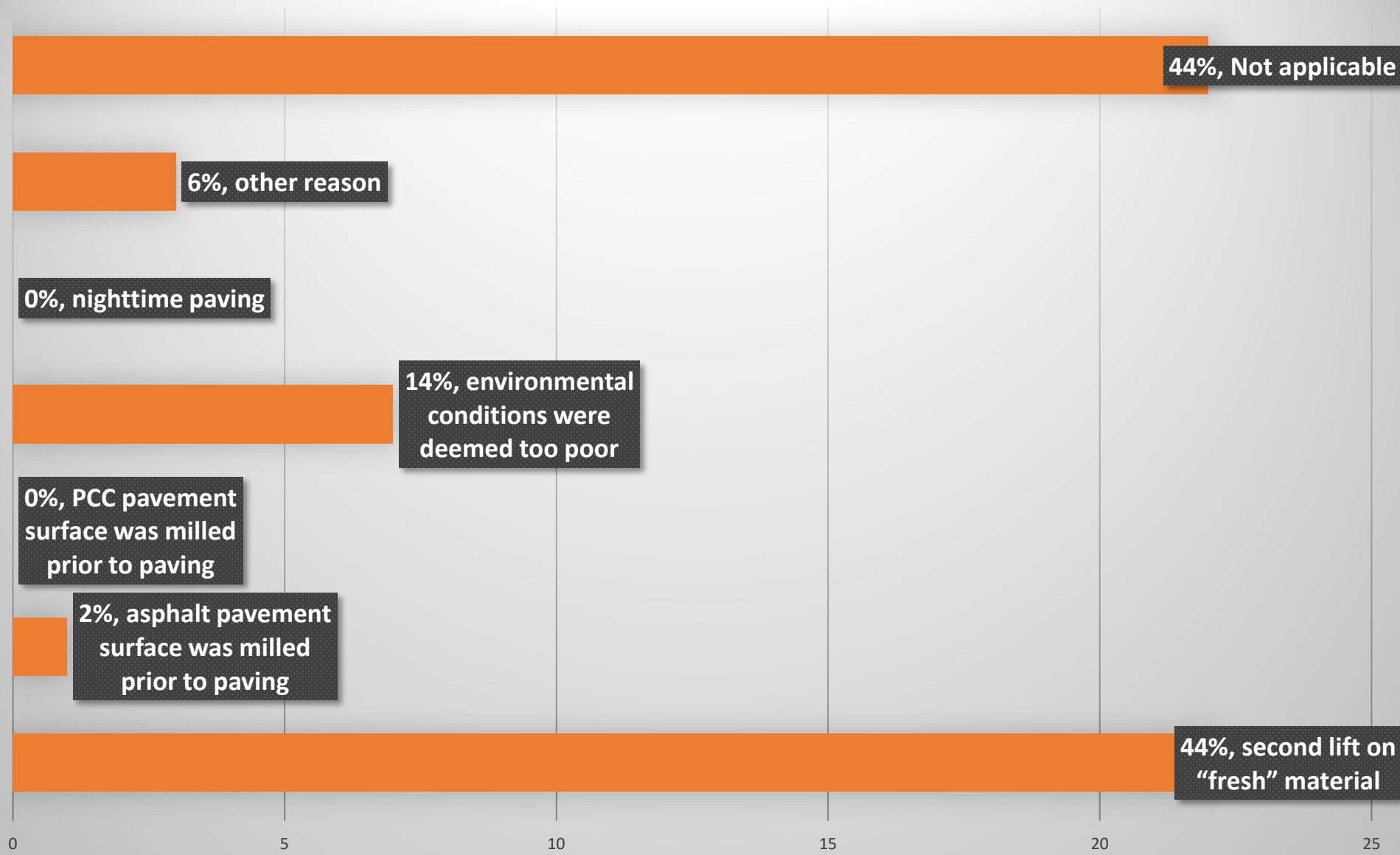


- different tack coat material used (16/28)
- same tack coat material used (12/28)

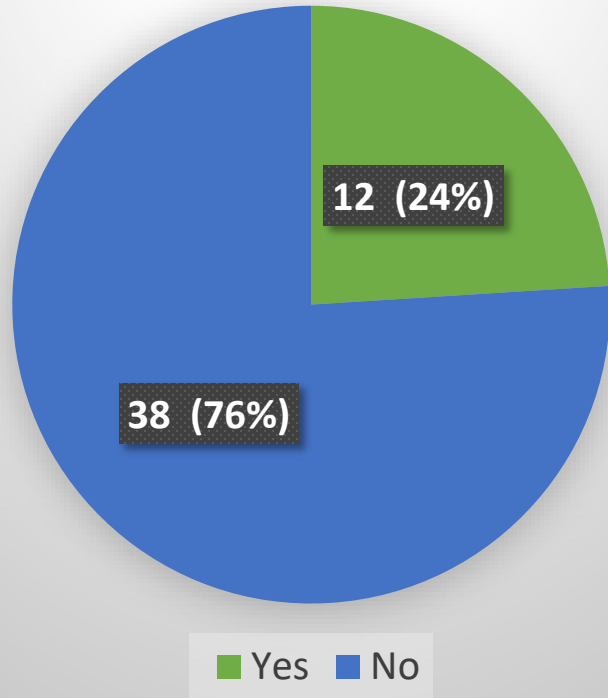
What materials do you use with spray pavers?



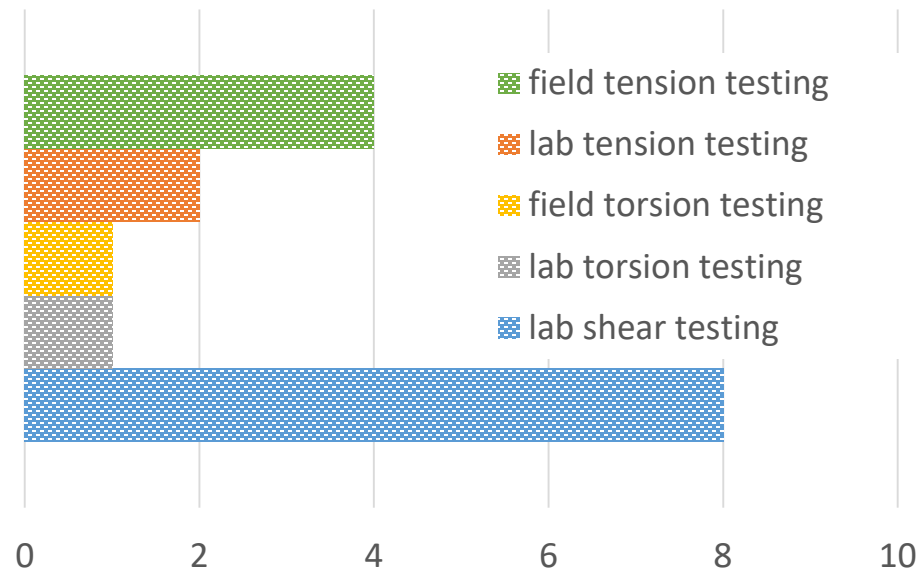
What conditions can lead to tack being waived?



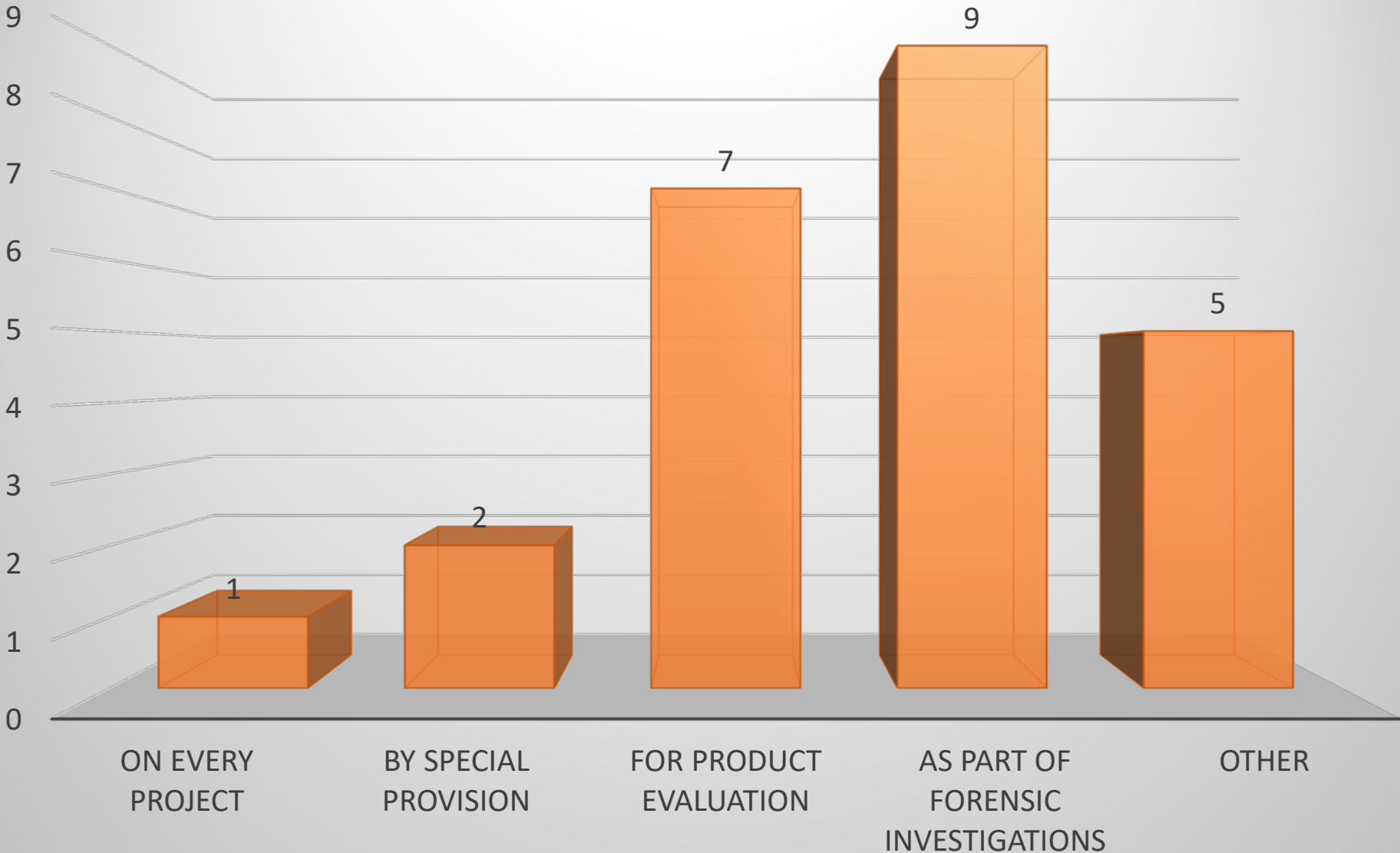
Bond Strength Testing?



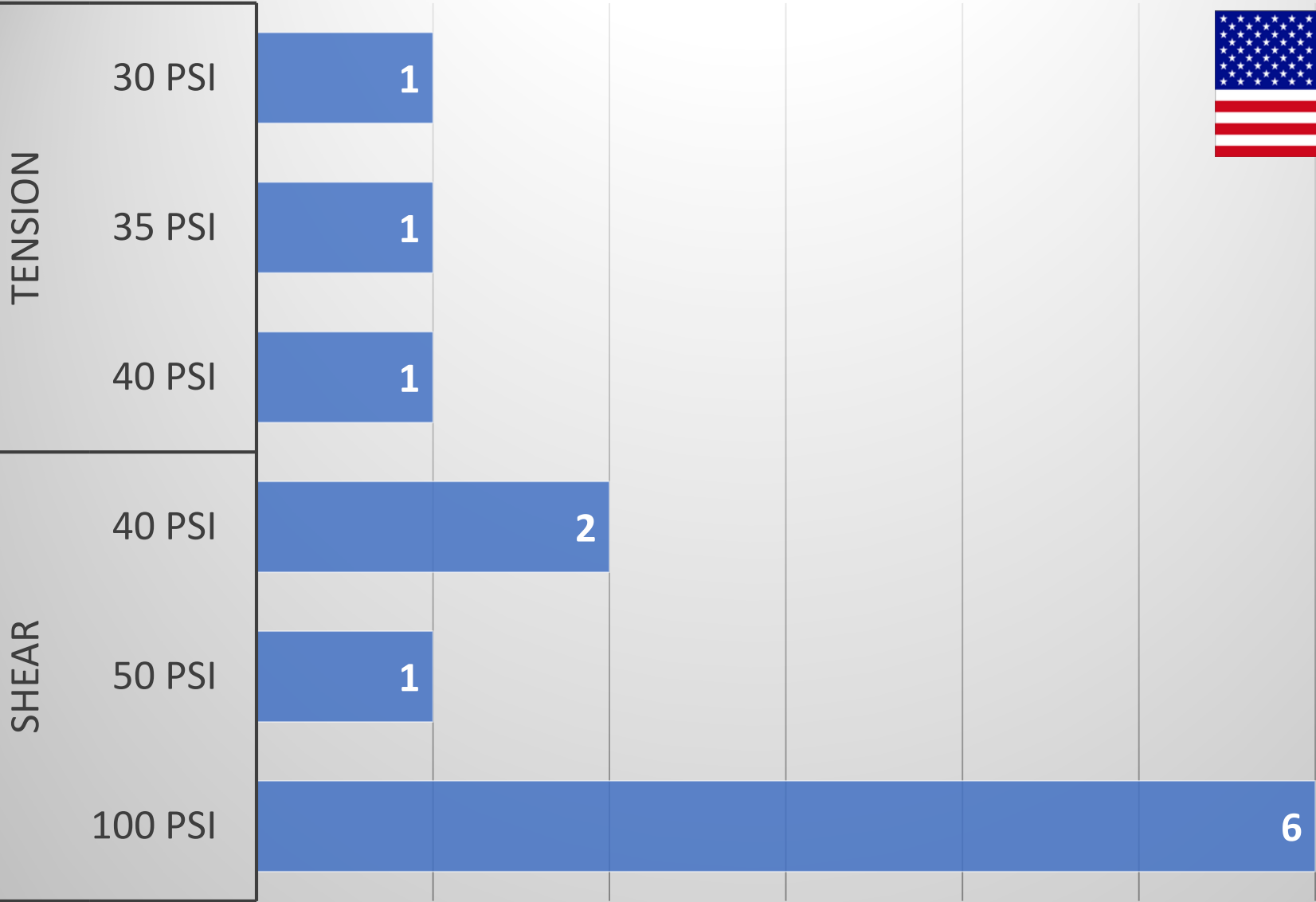
Testing style?



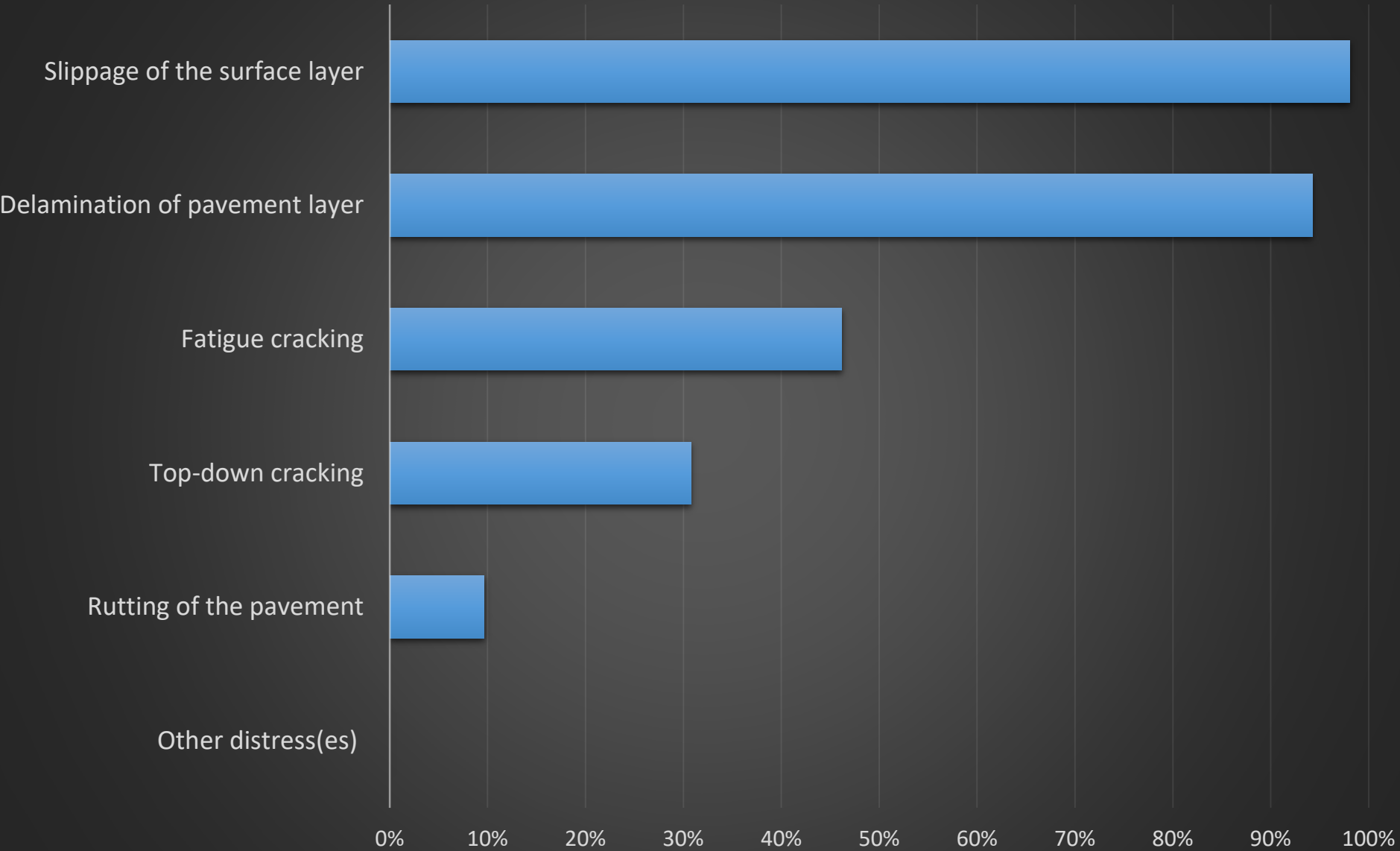
When does your agency perform interface bond testing?



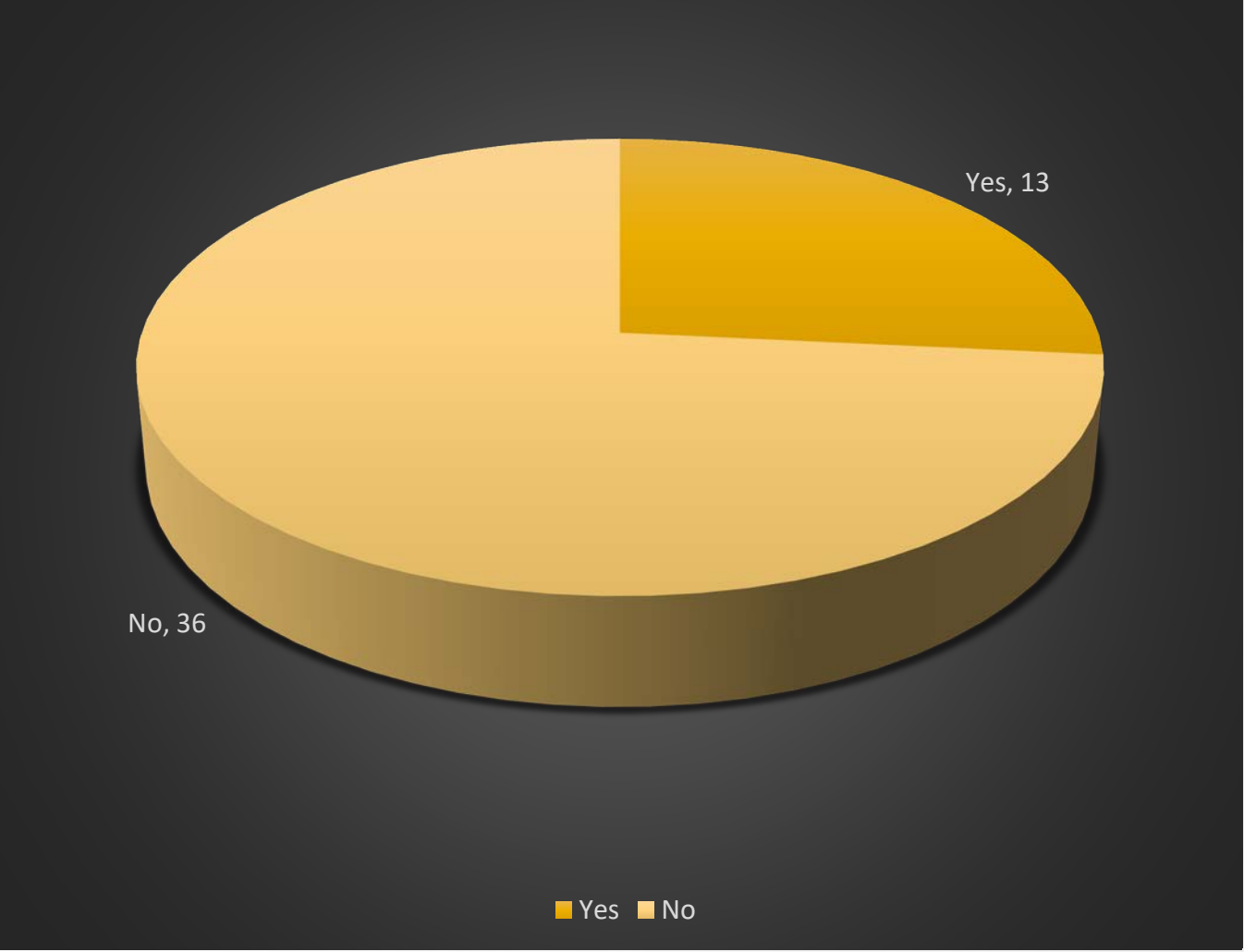
What is your minimum bond strength requirement?



Pavement failure types cited by agencies as potentially caused by poor bond strength.



Does your agency require any tests on tack coat?



**Most common?
Standard emulsion
tests.**

Case Examples

- presents the results of in-depth communication with three states (KS, TX, WV) which were identified as candidates for further study
- information is presented regarding:
 - their histories with interface bond testing
 - a summary of their testing methods
 - discussion of how the implementation of additional focus on tack coats has progressed and been received in their state.



- Survey Questions
- Summary of Survey Results
- Tack Coat Training Manual From NCHRP Report 712
- Kansas DOT Bond Strength Specs and Best Management Checklists
- Louisiana DOTD Tack Coat Inspector Checklists

Questions?

