

STATE	Does your DOT require a tack coat material to be placed prior to overlay on an unmilled surface? If yes, what tack coat materials are used? Do you specify a bond strength or an application rate?	Does your DOT require a tack coat material to be placed prior to overlay on a milled surface? If yes, what tack coat materials are used? Do you specify a bond strength or an application rate?	Has your DOT done any research on bond strength? If so, are you willing to share this research?	Contact person if other than e-mail respondent (Name, e-mail address, phone number)?
Alabama	Yes and an application rate is currently specified.	Yes and an application rate is currently specified.	Yes, a previous research report, "Evaluation of Bond Strength between Pavement Layers," can be found on the National Center for Asphalt Technology web site (National Center for Asphalt Technology) under NCAT Report 05-08. ALDOT also has a project entitled "Refinement of the Bond Strength Procedure and Investigation of a Specification, currently underway.	Lyndi Blackburn - blackburn@dot.state.al.us
Arkansas	Rapid curing cutbacks and emulsified asphalt conforming to grades SS-1, SS-1h, CSS-1 or CSS-1h are allowed by the specifications. The actual grade used is selected by the Engineer. SS-1 is the most commonly used grade of material	Rapid curing cutbacks and emulsified asphalt conforming to grades SS-1, SS-1h, CSS-1 or CSS-1h are allowed by the specifications. The actual grade used is selected by the Engineer. SS-1 is the most commonly used grade of material	No	Chris Wald, chris.wald@arkansashighways.com - No phone number supplied
Arizona	Yes - Emulsified asphalt, typically SS-1, diluted or undiluted, or a PG-grade asphalt binder is used and only application rates are specified	Yes - Emulsified asphalt, typically SS-1, diluted or undiluted, or a PG-grade asphalt binder is used and only application rates are specified	No	Dan Simpson dsimpson@azdot.gov (602) 712-8201
Canada	Yes - The only product we have used is an emulsion product SS-1. I believe some jurisdictions in the USA use asphalt cement. - Our application rate is generally judged in the field but is usually 0.33L/m <sup>2</sup>	No response.	No	Magdy Beshara mbeshara@highways.gov.sk.ca (306)787-4922
Colorado	Yes - CSS or SS - No specification for bond strength. The application rate is 0.1 gal/sy diluted at 50/50	Yes - CSS or SS - No specification for bond strength. The application rate is 0.1 gal/sy diluted at 50/50	No	Roy Guevara - roy.e.guevara@dot.state.co.us - (303) 398-6526
FHWA - Federal Lands Div	Yes - Use one of the following emulsions; CSS-1, CSS-1h, SS-1. We do not specify bond strength. Exact application rate determined by PE in the field based on affinity of existing pavement (usually 90.05 to 0.10 gal/sy diluted 1:1)	Yes - Use one of the following emulsions; CSS-1, CSS-1h, SS-1. We do not specify bond strength. Exact application rate determined by PE in the field based on affinity of existing pavement (usually 90.05 to 0.10 gal/sy diluted 1:1)	We have not done research on bond strength. However, we have completed a prime and tack coat guidelines manual which included information on bond strengths from the literature review of the study. You can download it at: <a href="http://www.cflhd.gov/techDevelopment/completed_projects/pavement-prime-tack/">http://www.cflhd.gov/techDevelopment/completed_projects/pavement-prime-tack/</a>	Mike Voth - michael.voth@fhwa.dot.gov - (720)-963-3505

<b>Florida</b>	Florida allows use of 4 emulsified tack materials. - Application Rate	Florida allows use of 4 emulsified tack materials. - Application Rate	Yes - Link to report: <a href="http://materials.dot.state.fl.us/smo/administration/resources/library/publications/researchreports/pavement/02-459.pdf">http://materials.dot.state.fl.us/smo/administration/resources/library/publications/researchreports/pavement/02-459.pdf</a> Also see following reference: Sholar, page, Musselman, Upshaw, Moseley, "Preliminary Investigation of a Test Method to Evaluate Bond Strength of Tack Coats", Journal of the Association of Asphalt Paving Technologists, Vol. 73, 2004, pp23-52	Gale Page, gale.page@dot.state.fl.us (352) 955-2903
<b>Georgia</b>	Yes - Application Rates for bituminous tack gal/yd <sup>2</sup> (L/m <sup>2</sup> ) Under OGFC and PEM Mixes - Min. 0.06(0.270) Max. 0.08 (0.360) All other mixes Min. 0.04(0.180) max. 0.06(270) *On thin leveling courses and freshly placed asphaltic concrete mixes, reduce the application rate to 0.02 to 0.04 gal/yd <sup>2</sup> (0.09 to 0.18 L/m <sup>2</sup> )	Yes - We currently require Asphalt Cement - only for all state routes. The application rates given in question 2 still apply. While our specifications show CRS 2h and CRS 3 as acceptable materials when approved, we currently approve the use of these emulsions only when city and county crews are actually doing the paving operations. We let local city and county road projects in April allowing the use of anionic emulsified asphalt NTSS-1HM - Application rate under OGFC and PEM mixes 0.06(0270) to 0.10(0.450). *On thin leveling courses and freshly placed asphaltic concrete mixes, reduce the application rate to 0.02 to 0.04 gal/yd <sup>2</sup> (0.09 to 0.18 L/m <sup>2</sup> ). *Allow anionic emulsified asphalt NTSS-1HM to cure for a minimum of 30 minutes after initial application. Proceed with paving only after the anionic emulsified asphalt NTSS-1HM has cured to the satisfaction of the Engineer. Do not use anionic emulsified asphalt NTSS-1HM under OGFC or PEM	Very limited	Sheila Hines sheila.hines@dot.state.ga.us - (404) 363-7501
<b>Idaho</b>	Yes - Liquid Asphalt as called out in the individual contract conforming to AASHTO M320. Normally Idaho uses an emulsion, a CSS1 primarily/No bond strength is specified. An application rate of 0.05 gal/s.y. is normally called for	Yes - Liquid Asphalt as called out in the individual contract conforming to AASHTO M320. Normally Idaho uses an emulsion, a CSS1 primarily/No bond strength is specified. An application rate of 0.05 gal/s.y. is normally called for	No	Mark Wheeler, mark.wheeler@id.idaho.gov (208) 334-8887

<b>Illinois</b>	Yes - SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, RC-70, SS-1hP, CSS-1hP - Application rate of 0.05 to 0.1 gal/yd <sup>2</sup> regardless of product used. (This may change to be product specific. Currently it is contractor's choice whether they use a cutback or an emulsion. An emulsion, which already contains water, is required to be diluted again with equal volume water. A cutback is not further diluted, thus contains higher residual asphalt content than an emulsion when used at the same application rate).	Yes - SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, RC-70, SS-1hP, CSS-1hP - Application rate of 0.05 to 0.1 gal/yd <sup>2</sup>	Illinois is in the process of conducting research through the Illinois Center for Transportation on "Overlay and Tack Coat Performance" IHR-55. This research looks at bond strength for various concrete surface textures (smooth, tined & milled) using both SS 1hP and RC-70. Bond strength will be assessed in the laboratory using a shear device designed specifically for this research. Bond strength will also be assessed using strain and rut depth measurements induced by a full scale accelerated loading facility. Bond strength will also be tested for each texture/product combination on the test section using a torque test. This research should finish up by the end of this year.	James S. Trepanier - james.trepanier@illinois.gov - (217) 782-9607
<b>Iowa</b>	Tack coats are always required in Iowa. Most common material used is CSS-1H emulsion. We do not bond strength. Application rate is 0.02 to 0.05 gal/sq_yd	Tack coats are always required in Iowa. Most common material used is CSS-1H emulsion. We do not bond strength. Application rate is 0.02 to 0.05 gal/sq_yd	We have done no research in this area	John Hinrichsen - john.hinrichsen@dot.iowa.gov
<b>Kansas</b>	Yes - SS-1HP - Application Rate	Yes - SS-1HP - Applicatin Rate	No	Rick Barezinsky - RickBa@ksdot.org - (785) 296-1198
<b>Kentucky</b>	The most used tack is SS-1h, with application rate of 0.05 gallons per square yard(undiluted residue of 0.4 lbs per square yard)	Tack coat (usually SS-1h) is applied to surface of concrete or brick pavements and bases, to existing asphalt (including milled) surfaces and when necessary to newly constructed asphalt courses.	I am not aware of any research into bond strength of tack oil applications	Doug Lafoe - Doug.Lafoe@ky.gov -
<b>Louisiana</b>	Yes - tack coat shall be an undiluted modified asphalt emulsion grade CRS-2P, CSS-1, SS-1, SS-1P, or SS-1L. Applicatin rate is specified	Yes - tack coat shall be an undiluted modified asphalt emulsion grade CRS-2P, CSS-1, SS-1, SS-1P, or SS-1L. Applicatin rate is specified	Yes - see Dr. Louray Mohammad research NCHRP Project 9-40 on the Optimization of Tack Coat for HMA Placement	Dr. Louray Mohammad - Louaym@Lsu.edu - (225) 767-9126
<b>Maine</b>	Yes - RS-1 or HFMS-1 - Application rate of 0.025 gal/sy	Yes - RS-1 or HFMS-1 - Application rate of 0.05 gal/sy	No	Bruce Yeaton - bruce.yeaton@maine.gov - NO phone number suplied
<b>Maryland</b>	Yes, most commonly CRS-1, CRS-2, CSS-1. Maryland's specification (504.03.04) requires a residual rate of .01 to .05 gal/sq yd. We do not specify a bond strength	Yes, most commonly CRS-1, CRS-2, CSS-1. Maryland's specification (504.03.04) requires a residual rate of .01 to .05 gal/sq yd. We do not specify a bond strength	Maryland is the chair for NCHRP 9-40, Optimization of Tack Coat for HMA Placement. We are making significant advances in determining application rates and bond strength for CRS-1, CSS-1, 64-22, and trackless tack coat (NTSS-1hm). The panel has added research to determine if there is a benefit from placing tack on freshly placed HMA vs no tack coat applied. This is in addition to milled vs unmilled surfaces, wet/dry conditions, hot/cold climates. Currently we are working with 4 test lanes at the Louisiana Transportation Research Council facility and will soon start field trials in various climactic regions of the US. An interim white paper on our progress is planned for publication very soon.	Gloria Burke - Gburke@sha.state.md.us - 1-800-477-7453/301-678-6134

<b>Michigan</b>	SS-1h and CSS-1h - Application Rate	SS-1h and CSS-1h - Application Rate	No	Curtis Bleech - bleechC@michigan.gov
<b>Mississippi</b>	Yes - In most instances an emulsion is used. However, in some instances a PG binder has been specified for tack coat. Our specifications for tack coat are 0.05-0.10 gal/yd however this is not closely monitored. We are making a move toward measuring the in-field application rate	Yes - In most instances an emulsion is used. However, in some instances a PG binder has been specified for tack coat. Our specifications for tack coat are 0.05-0.10 gal/yd however this is not closely monitored. We are making a move toward measuring the in-field application rate		There has been some laboratory work performed by Mississippi State University. Please view the final report at <a href="http://www.gomdot.com/Divisions/Highways/Resources/pdf/Research/InterimFinal/SS168.pdf">http://www.gomdot.com/Divisions/Highways/Resources/pdf/Research/InterimFinal/SS168.pdf</a> Jeremy Robinson, wjrobinson@mdot.state.ms.us (601-359-1718)
<b>Missouri</b>	Yes, SS-1h, CSS-1h, generally the rate is 0.05 gallon per square yard (0.23 L/m <sup>2</sup> ) with a minimum of 0.02 gallon per square yard (0.1 Lm <sup>2</sup> ) with a minimum of 0.02 gallon per square yard (0.01 L/m <sup>2</sup> ) and a maximum of 0.10 gallon per square yard (0.45 L/m <sup>2</sup> ).	Yes, SS-1h, CSS-1h, generally the rate is 0.05 gallon per square yard (0.23 L/m <sup>2</sup> ) with a minimum of 0.02 gallon per square yard (0.1 Lm <sup>2</sup> ) with a minimum of 0.02 gallon per square yard (0.01 L/m <sup>2</sup> ) and a maximum of 0.10 gallon per square yard (0.45 L/m <sup>2</sup> ). The rate will generally be closer to the maximum depending on coverage	No	Joe Schroer - joe.schroer@modot.mo.gov - (573) 526-4353
<b>Nebraska</b>	Yes - CSS-1H - Application rate of 0.10 to 0.20 gal/sy	Yes - CSS-1H - Application rate of 0.10 to 0.20 gal/sy (note - on freshly laid asphalt the application rate is 0.05 to 0.10 gal/sy)	No	Laird E. Weishahn, PE - (402) 479-4675 lweishah@dor.state.ne.us
<b>New Jersey</b>	Yes - Emulsified Asphalts - RS-1, SS-1, SS-1H, CSS-1, CSS-1H, Neat Asphalt - PG 64-22 - Application rate but bond strength is a good idea	Yes - Emulsified Asphalts - RS-1, SS-1, SS-1H, CSS-1, CSS-1H, Neat Asphalt - PG 64-22 - Application rate but bond strength is a good idea	No formal research has been performed	Robert Sauber - Robert.Sauber@dot.state.nj.us - (609) 530-4230
<b>New Hampshire</b>	Yes - Asphalt Emulsion - Application Rate 0.02 - 0.05 gal/sy	Yes - Asphalt Emulsion - Application Rate 0.02 - 0.05 gal/sy	No	Alan Rawson, arawson@dot.state.nh.us (603)271-3151
<b>New York</b>	Yes, excluding surface of permeable base. Grades used - RS 1h; HFMS - 2h; SS- 1h; CSS - 1h; CRS - 1h - We specify application rates based on surface type (i.e. New HMA; milled & existing HMS; Portlant cement concrete; vertical surfaces)	Yes, excluding surface of permeable base. Grades used - RS 1h; HFMS - 2h; SS- 1h; CSS - 1h; CRS - 1h - We specify application rates based on surface type (i.e. New HMA; milled & existing HMS; Portlant cement concrete; vertical surfaces)	No	Sigrid Rantanen, srantanen@dot.state.ny.us (518)457-2074.
<b>Nevada</b>	Yes - Application rate 0.07 gal/sy	Yes - Application rate not supplied	No	dtedford@dot.state.nv.us
<b>North Carolina</b>	Yes - (we do have allowances for no tack between new layers of asphalt placed on the same day) - Materials - PG64-22 (binder), RS-1H, CRS-1H, CRS-1, HFMS-1, CRS-2 (we very seldom see the High-Float materials used for tack). We specify an Application Rate.	Yes - Materials - PG64-22 (binder), RS-1H, CRS-1H, CRS-1, HFMS-1, CRS-2 (we very seldom see the High-Float materials used for tack). We specify an Application rate.	Yes - very limited. In a recent pavement failure investigation, we worked with Florida DOT on shear testing of 150 mmcores. They first tested cores for us and ten were gracious enough to share their shop drawings of their shear test head with us so that we could fabricate our own. Our research has been limited to the one project, which did have known delamination issues. We plan to soon try the shear test across several projects to try and develop criteria for Goo vs Unacceptable bond strengths.	Todd Whittington, PE - twhittington@dot.state.nc.us - (919) 329-4060
<b>North Dakota</b>	Yes, CSS 1h, SS 1h and MS 1	Yes, CSS 1h, SS 1h and MS 1	No	Joe Davis - jdavis@nd.gov - (701) 328-6912

<b>Ohio</b>	Yes -99% of time is SS-1H. We require a latex modified tack when placing directly on concrete or brick. Application rate and 100% cover	Yes -99% of time is SS-1H. We require a latex modified tack when placing directly on concrete or brick. Application rate and 100% cover	Yes - We did research on various tack materials a few years back looking at shear strength when tacked to a composite bridge deck. Results were interesting in that the stiffest or hardest tacks gave highest shear strength. Modified tack had great adhesion but less shear (cohesion) strength than a hard unmodified tack. I do not have the actual numbers. Of course these tests were done dry and tacks are affected by moisture.	Dave Powers - daniel.powers@dot.state.oh.us - (614) 261-7455
<b>Oregon</b>	Yes	Yes - we specify an application rate of 0.5-.20 gallons per square yard	Not to my knowledge	Larry Ilg - (503) 986-3072
<b>Province of Ontario (MTO)</b>	Yes, we specify emulsified asphalt diluted with an equal volume of water. The application rate is 0.35kg/sq. metre for existing surfaces. For surfaces which were paved in the same calendar year, the rate specified is 0.20 kg/sq metre. We presently have no bond strength requirements.	Yes. We specify the same material (emulsified asphalt diluted with an equal volume of water). The application rate is 0.35kg/sq. metre for milled surfaces. We presently have no bond strength requirements.	No	Anil Virani - Anil.Virani@ontario.ca - (416) 235-3723
<b>South Carolina</b>	Yes - we require the HMA contractor to tack prior to placing HMA. We allow the use of emulsified asphalt products, grades RS-1, MS-1, MS-2, HFMS-1, HFMS-2, SS-1, CRS-1, CRS 2, CMS-2 and CSS-1. The HFMS-1 and CRS-2 are the most commonly used for this application. The rate required is 0.05 - .15 gal/sy (non residual). It is not a separate pay quantity and is included in the price of the HMA.	Yes - we require the HMA contractor to tack prior to placing HMA. We allow the use of emulsified asphalt products, grades RS-1, MS-1, MS-2, HFMS-1, HFMS-2, SS-1, CRS-1, CRS 2, CMS-2 and CSS-1. The HFMS-1 and CRS-2 are the most commonly used for this application. The rate required is 0.05 - .15 gal/sy (non residual). It is not a separate pay quantity and is included in the price of the HMA.	Some on some in house research involving an instrument called the "Tacky-Meter" sold by Instro-Tek out of NC. We had some inconsistent bond strength results using the devise and decided not to run anymore tests with the Tacky-Meter.	Cliff Selkinghaus - selkinghcb@scdot.org - (803) 737-6700
<b>South Dakota</b>	Yes - CSS-1h or SS-1h - Application rate of 0.05 gallons per square yard, higher rate on older oxidized surfaces and lower rate between multiple asphalt lifts placed on project	Yes - CSS-1h or SS-1h - Application rate of 0.05 gallons per square yard	No research on bond strength conducted by the SDDOT but are interested in any research other states have conducted. SDDOT has discussed this item as a possible Research Projec but have not done a research project at the present time.	Rick.Rowen - Rick.Rowen@state.sd.us - (605) 773-3427
<b>Texas</b>	Yes - SS-IH, CSS-1H, or a PG binder are allowed per our specifications. Generally CSS and SS tack coats are used. - No bond strength. Specifications require an application rate of 0.04 to 0.10 gal/sy	Yes - SS-IH, CSS-1H, or a PG binder are allowed per our specifications. Generally CSS and SS tack coats are used. - No bond strength. Specifications require an application rate of 0.04 to 0.10 gal/sy	Yes, 4129-1F, Development of an objective field test to determine tack coat adequacy, Center for Transportation Infrastructure Systems, The University of Texas at El Paso, June 2004	Richard Izzo RIZZO@dot.state.tx.us - (512) 506-5832
<b>Utah</b>	We require the use of a CSS-1h, diluted to two parts concentrate to one part water. Application rate is 0.15 gal/sq yd (milled or unmilled) Adjustments may be made in field by Engineers. Rule of thumb is 95+% surface coverage as a target	We require the use of a CSS-1h, diluted to two parts concentrate to one part water. Application rate is 0.15 gal/sq yd (milled or unmilled) Adjustments may be made in field by Engineers. Rule of thumb is 95+% surface coverage as a target	No	Timothy Biel - tbiel@utah.gov (801) 965-4859
<b>West Virginia</b>	Yes. SS grades are primarily used. Application rate	Yes. SS grades are primarily used. Application rate.	No	Larry Barker - Larry.R.Barker@wv.gov - (304) 558-7473