

# WATERPROOFING INTERLAYERS

## GENERAL INFORMATION

1. What is the difference between PETROMAT and a WATERPROOFING INTERLAYER SYSTEM?
  - A. PETROMAT is the patented trade name for the WATERPROOFING INTERLAYER FABRIC and system developed and manufactured originally by the Phillips Petroleum Company in the late 60's.
  - B. A WATERPROOFING INTERLAYER is a generic reference to the fabric interlayer system, regardless of the manufacturer.
2. What are the three primary benefits of a WATERPROOFING INTERLAYER SYSTEM?
  - A. Slow crack propagation from the existing pavement in to the new overlay. Caltrans states that a fabric interlayer is equivalent to .1 to .15 feet (3-4 centimeters) in retarding reflection of cracks. There is typically a 50-100% delay in the time for cracks to reflect to the new surface.
  - B. Increase the fatigue life of the new pavement section. Laboratory test show that fatigue life of an asphalt section can be increased by as much as 100-300% with the installation of a WATERPROOFING INTERLAYER.
  - C. Stop the intrusion of water into the existing pavement and most importantly the base underneath the pavement. According to the Cedergren studies, pavements on bases that are saturated just 10% of the time will have less than 50% of their expected life.
3. How common are WATERPROOFING MEMBRANES?
  - A. Over 100 MILLION Square Yards are installed in the United States alone EVERY YEAR!!
4. How long have WATERPROOFING MEMBRANES been used?
  - A. The first were installed in the late 1960's and have been used continuously ever since.
5. In what climates are they used?
  - A. From areas such as Colorado mountains where the roads are exposed to constant moisture and over 70 freeze-thaws annually to desert climates.
6. What is the relationship between asphalt stripping and WATERPROOFING MEMBRANES?
  - A. Asphalt stripping occurs in asphalt mixes when the binder and the aggregate are not sufficiently compatible to resist the negative affect of water under pressure. Two necessary elements are;
    - a. Water must be present
    - b. Pressure brought on under heavy loading (trucks)Stripping prone aggregates at that point allow the asphalt to strip or disbond from the aggregate. The asphalt then breaks apart. All studies show that stripping prone aggregates will eventually fail. The inclusion of a WATERPROOFING MEMBRANE can definitely increase the potential to have water present. In summary the WATERPROOFING MEMBRANE will NOT be the source of the breakdown but with the ability to stop water from passing through the asphalt pavement it undoubtedly increases the likelihood that one of the necessary components for failure will be present.
7. When a crack eventually reflects all the way to the surface is the system still waterproof?
  - A. If the WATERPROOFING MEMBRANE is installed properly the system will continue to keep the base dry even after the crack has made it all the way to the surface.
8. What is different about thermal cracks?
  - A. Very different forces create Thermal cracks as compared to fatigue cracks. They are caused by very high temperature differences such as found in desert climates. In the case of thermal cracks the expansion (at very high temperatures) and contraction (at very low temperatures) of the asphalt actually pulls the asphalt paving apart. The cracks therefore are typically in relatively straight lines perpendicular to the section of asphalt (i.e. across the road) and are very large (often 2" and wider). Thermal cracks are usually not inhibited greatly by WATERPROOFING MEMBRANES. However, cores have shown that the correctly installed membrane DOES stay intact and continue to protect the base.

9. How is a WATERPROOFING MEMBRANE different from REINFORCING FABRIC or PAVING FABRIC?

A. The terms are used interchangeably although they may be confusing. WATERPROOFING FABRIC does not increase the structural capacity of the pavement directly. According to AASHTO (American Association of Highway Transportation Officials) keeping a base dry can increase the structural capacity by as much as 60%. The primary benefit of a WATERPROOFING membrane is keeping the base dry.

10. Isn't asphalt pavement waterproof by itself?

A. Absolutely NOT! Federal Highway Administration testing shows that approximately 1/3 to 1/2 of the water that strikes a paved surface will pass through the asphalt in to the base and subbase.

11. What are 2 ways water effect a base or subbase material?

A. Crushed aggregate base material depends on the interlock between the crushed faces of the stone to carry loads placed on the aggregate. When this base gets wet the stones slide off one another and consequently lose their structural load carrying capability.

B. The water allows fines (like clay) to be pumped up into the crushed aggregate (as muddy water) and contaminate it. These fines add lubricity (slickness) and allow the crushed rock to slide over each other.

12. How much contamination by fines does it take to lower the strength of the base?

A. Studies show that just 10% contamination will reduce structural capacity by over 80%

13. How much can water affect the load carrying capability of a competent structural aggregate paving base material?

A. Studies show that saturated aggregates lose up to more than 60% of their load carrying capacity.

14. What are the two components of a WATERPROOFING INTERLAYER SYSTEM?

A. A synthetic fabric. Typically a nonwoven needlepunched polypropylene fabric of 4.1 oz per square yard in weight

B. A liquid asphalt binder.

15. What are the three ways to make asphalt (solid at room temperature) a liquid and therefore a usable construction material?

A. Heat the asphalt, then shear it into very fine particles in an emulsion mill, add an emulsion (soap) and blend with water to make an **EMULSION**. An asphalt emulsion will remain as a liquid at ambient temperatures above freezing. Obviously below freezing the water turns to ice and the emulsion is normally ruined. As the water evaporates the asphalt is returns to its' original solid form.

B. Using a petroleum solvent with a low vaporization point (such as kerosene) the asphalt is dissolved "CUTBACK" into solution. As the solvent evaporates the asphalt returns to its original solid form.

C. Heat the asphalt until it becomes a workable (can be pumped or sprayed) liquid. Depending on the asphalt this is usually 280F and above.

16. What is **residual asphalt**?

A. Residual asphalt is the pure asphalt that is left after evaporation. When the water or cutback evaporates the only thing left is the residual (pure) asphalt.

17. What fabric is typically used for a WATERPROOFING INTERLAYER SYSTEM?

A. The Phillips Petroleum Company developed the system with a nonwoven needlepunched polypropylene fabric of about 4 to 5 oz/sy.

B. Other synthetic resins have been used to produce fabrics for interlayer systems and have been successful. However the fabric most readily available today from at least 1/2 dozen manufacturers is nonwoven fabric of polypropylene.

18. What is a Nonwoven fabric?
- A. Once the resin pellets are extruded in to fibers some means of connecting the fibers must be used to get them in to a fabric. One method is to weave them and produce consequently a WOVEN fabric. Although a very commonly used fabric for other uses, WOVEN fabrics are used very seldom as WATERPROOFING INTERLAYER FABRICS. A nonwoven fabric is commonly described as having the appearance of felt.
19. If the fibers are not woven in to a fabric, how are they held together?
- B. Once the resin is extruded in to fibers they are cut to length and are called *stapled* fibers. These random fibers are then passed over a bed through which thousands of *barbed* needles are inserted and removed from the bed of fibers. The barbs pull and tear the fibers until they are sufficiently interconnected to remain a fabric. The sheet is then rolled between two smooth steel rollers, which then provide uniformity.
20. What is heat calendaring?
- A. The finishing rolls can be heated sufficiently that the exterior fibers of the fabric are very slightly melted which gives the fabric more strength and reduces potential for the fabric to pull apart.
21. Is INTERLAYER FABRIC heat calendered?
- A. Yes, but only on ONE side. The heat calendaring of the fabric slightly reduces the *porosity* of the fabric and therefore it is more difficult for liquids to pass through the fabric.
22. How is INTERLAYER FABRIC different from Filter Fabric or Landscape Fabric?
- A. Filter Fabric is typically very similar in weight (approximately 4oz./sy) but is not heat calendered on either side. It therefore works poorly as an Interlayer as it does not stop the binder from passing through the fabric.
- B. Interlayer Fabric is typically about twice the weight of landscape fabric.
23. How do INTERLAYER FABRICS compare to PAVING GRIDS?
- A. Paving grids are marketed as products which reinforce the pavement and reduce reflective cracking
- B. Interlayer fabrics waterproof, increase fatigue life and reduce reflective cracking
24. How do you get waterproofing from paving grid?
- A. **Composite** grids are sold which have the WATERPROOFING MEMBRANE attached to the grid.
25. How do the grids and paving fabrics compare in cost?
- A. The grids typically are about 4 times the cost of WATERPROOFING MEMBRANES.
26. What is rubberized asphalt?
- A. This asphalt where ground rubber tires are included in the asphalt.
27. What are the benefits of rubberized asphalt?
- A. It is marketed as resisting reflective cracking, rutting & shoving, provides skid resistant surface, reduces road noise & hydroplaning, has excellent color contrast for striping & marking.
28. What is the relative cost of rubberized asphalt to conventional dense graded asphalt?
- B. Depending on the cost of Crum rubber the rubberized is approximately twice that of conventional dense grade asphalt
29. Is rubberized asphalt waterproof?
- A. ABSOLUTELY NOT! According to the report published by LA County in 1993, gap graded rubberized asphalt at 95% relative density has over 5 times the permeability of dense graded asphalt at 95% density. As the density of the gap graded rubberized drops into the 90% range the permeability goes to 50 to 80 times dense graded asphalt.
30. Should a WATERPROOFING MEMBRANE be used with rubberized asphalt?
- A. As you can see it would be more important under rubberized asphalt than conventional dense graded.
31. How hot is the rubberized asphalt when laid?
- A. Per Caltrans, the upper temperature limit stays the same (350F)
- B. The lower limit is typically about 25-40F higher (275-290F)
32. Is this too hot for the WATERPROOFING FABRIC?
- A. NO

## WATERPROOFING INTERLAYERS INSTALLATION INFORMATION

1. What must the minimum pavement temperature be to install a WATERPROOFING SYSTEM?
  - A. 40F and rising
2. What must the minimum air temperature be to install a WATERPROOFING MEMBRANE?
  - A. 50F and rising
3. What 3 things must be done to the existing asphalt to prepare it for the installation of a WATERPROOFING MEMBRANE?
  - A. Replace any broken, loose or pumping asphalt with new asphalt hot mix
  - B. Remove all water dirt and debris from the surface
  - C. Fill all cracks 1/8" or larger
4. What type of crack fill is recommended?
  - A. In the case of a WATERPROOFING MEMBRANE the purpose of filling the crack is simply to fill the void so that tack necessary to saturate the fabric is not lost.
5. Can too much crack fill be used?
  - A. Absolutely! Excess crack fill material that is left on the surface of the pavement can expand under high temperatures can cause delamination and /or "floating" of the new asphalt lift (this is especially true of hot pour rubber).
6. Which way is the FABRIC INTERLAYER TO BE INSTALLED?
  - A. The heat-treated side is placed on the top while the "fuzzy" side is placed directly on top of the liquid binder.
7. Why is the "fuzzy" side placed down?
  - A. The "fuzzy" side is absorptive and will allow the liquid asphalt to penetrate and saturate the fabric.
8. Why is the heat treated side placed on the top?
  - A. The heat-treated side very slightly restricts the movement of liquid asphalt through the fabric and therefore reduces "bleeding" (premature saturation of the fabric) or large quantities of liquid binder on the upper surface of the fabric after being placed.
9. Is bleeding bad for the FABRIC INTERLAYER SYSTEM?
  - A. It is not a problem for the performance of the system, however, in the case of asphalt overlayment over the fabric, the presence asphalt tack bleeding through the fabric complicates the paving operation because the construction vehicles and equipment can stick to the fabric and pull it from the roadway.
10. Is asphalt bleeding caused from TOO much asphalt tack?
  - A. Almost NEVER is this the cause of asphalt bleeding through the fabric.
11. What is the most common way that installers alter construction methods to reduce bleeding?
  - A. Reduce the amount of asphalt binder being placed. This is in fact making a decision to change the *design* of the system in order to change a construction condition while constructing the system.
12. Does reducing the rate of application of asphalt tack affect the completed system positively or negatively?
  - A. VERY VERY NEGATIVELY. Without sufficient binder to saturate the fabric, the fabric will NOT BE waterproof. Without sufficient binder the fabric may not be properly bonded to either the new or old pavement and the new lift can delaminate or slip.
13. Is that the only reason the binder rate is reduced?
  - A. The quantity of binder may be reduced simply to reduce cost of the installer. In either case, the result is a non-performing WATERPROOFING SYSTEM.
14. What are 5 ways to prevent "bleeding" or premature saturation?
  - A. ***Use the proper weight of fabric.*** When the waterproofing system was first developed by the Phillips Petroleum Company in the late 60's the work was all done with fabrics of weights from between 4 and 5 ounces per square yard.

- B. **Increase the viscosity of the binder.** A binder having a low ORIGINAL VISCOSITY will easily pass through the fabric, especially the higher the ambient temperature. Think of coke versus molasses and the relative speed with which it will pass through a paper towel.
  - C. **Reduce embedment temperature.** The hotter the temperature of the tack at the time the fabric is embedded, the greater the tendency of the binder to pass all the way through the fabric (premature saturation or bleeding) and impede the construction process. [See photo's in AIA manual] The hotter the temperature of the tack, the lower the viscosity, and the easier for it to pass all the way through the fabric. At temperatures above the high 200's°F the fabric shrinks. The tack only need to be sufficiently sticky to hold the fabric
  - D. **Reduce embedment pressure.** The fabric DOES NOT need to be forced down into the tack coat. The heat and pressure from the hot mix asphalt will bring the binder up in to the fabric and create the waterproofing membrane.
  - E. **Broadcast asphalt hot mix over the placed fabric. If items A through D are done and premature saturation still occurs, a very thin spread of hot mix asphalt will prevent vehicle tires from sticking to and pulling up the fabric.**
15. Why is liquid asphalt the preferred binder and NOT an emulsion or “cutback”?
- A. A typical emulsion is about 40% water. The water must evaporate prior to placing the fabric in order that it will be trapped and turned to steam by the asphalt overlay or elevated pavement temperatures. Delamination would be an expected consequence of trapped water.
  - B. Since an emulsion is 40% water the application rate of the binder would have to be increased by 40% to have the same amount of *residual (pure asphalt)* remaining. Asphalt emulsion have very low viscosities and therefore when the shot rate is increased by 40% the emulsion would run off all but the flattest surfaces.
  - C. The use of “cutbacks” has been eliminated in many geographical areas for air quality reasons. The solvent used to dissolve the raw asphalt vaporizes into the air to leaving the asphalt but contaminating the air. These gases trapped under a fabric can cause delamination
  - D. Only in the case of simple heating is the processed asphalt in the form desired without a second element present (water or solvent) that must be removed before the asphalt can perform the binder function appropriately.
16. What is meant by the **asphalt retention** of a fabric?
- A. A paving fabric is weighed then submerged in hot liquid asphalt. It is suspended in a heated environment and all excess binder is allowed to drip off. The saturated fabric is then weighed. The difference is the amount of liquid asphalt a specific fabric can “hold” or “retain”.
17. How does one determine the **asphalt retention** of a fabric?
- A. All manufacturers publish an asphalt retention value for their paving fabric. Typically the manufacturer's toll free number is on the label of each roll of fabric to access that information.
18. Is the **asphalt retention** of a specific paving fabric then the proper rate to apply the binder to achieve saturation?
- A. NO! In addition to saturating the fabric, there must be sufficient binder to tack to the old asphalt as well as the new overlay. That is typically another .05 gal/sy. to be added to the **asphalt retention** amount.
19. What does the AIA recommend for the application rate?
- A. 33.6 oz/sy +/- 4 oz/sy. (1.14 kilogram/square meter +/- 0.14 kilogram/square meter) This is equivalent to .25 gallons per square yard +/- .03 gallons per square yard
20. Why does the specification read +/- 4oz +/- .03 gal/square yard?
- A. This is the amount is adjusted to compensate for the condition of the asphalt on which the WATERPROOFING INTERLAYER is being placed. If the surface is very new and nonporous then the rate may be lowered slightly to .22 to .23
  - B. On rough, very dry pavements the application rate should be increased to .28 or higher.
21. What is the lowest application rate that can be used and still achieve waterproofing?
- A. 22 hundredths of a gallon per square yard

22. Where would that rate be used?  
A. On very smooth pavements.
23. What is the highest application rate that can be used?  
A. Typically 3 tenths of a gallon per square yard is the upper limit of application.
24. Where would that rate be used?  
A. Over milled pavement or rough, dry pavement.
25. Will too much binder cause the overlay to rut or bleed?  
A. The amount of liquid asphalt required to **over asphalt** 1- 1/2" of overlay asphalt mix is more asphalt than can reasonably be applied as a tack coat. As the overlay increases in thickness the possibility becomes impossible.
26. Why are the AIA specifications in mass per unit area as opposed to gallons per square yard like most specifications?  
A. Asphalt changes in volume as it is heated When the amount applied is measured by weight instead of volume the result is unaffected by temperature.
27. How much does temperature change the weight of asphalt?  
B. 1 US gallon of asphalt @ 60F weighs 8.4 pounds. 1 US Gallon of asphalt @400F weighs 7.4. That is a 13.5% difference.
28. What is the temperature of the liquid asphalt when picked up at the refinery?  
A. The liquid asphalt may be as much as 400F when it is picked up at the refinery. It cools when entering the tank as well on its travel to the jobsite. Some trucks are equipped with heaters to raise or maintain the temperature
29. How cool can liquid asphalt be applied?  
A. Typically spreader trucks will have difficulty pumping and spreading binders below 280-290F.
30. How hot can liquid asphalt be applied?  
A. Typically the liquid asphalt is not applied at temperatures over 350F
31. What is **embedment temperature**?  
A. That is the temperature of the liquid asphalt on the pavement when the fabric touches it.
32. How does temperature affect the viscosity or thickness of the binder?  
A. The hotter the binder the thinner or lower the viscosity.
33. Does temperature of the binder at the time of embedment make any difference?  
A. VERY DEFINITELY! The lower the viscosity the easier it is to pass through the fabric.
34. What temperature does AIA recommend the asphalt binder to be when the fabric is embedded?  
A. No more than 180F
35. How do you determine the temperature of the binder at embedment?  
A. By using a non-contact thermometer. Point the thermometer at the liquid asphalt on the pavement just before the fabric is lowered in to the binder.
36. Can the temperature of the binder be too cold?  
A. NO! Successful Interlayers can be accomplished by **nailing** the fabric to binder that has cooled to the point the binder is no longer a liquid.
37. Can the binder be too hot?  
A. YES! The hotter the binder the more likely premature saturation or bleeding will occur. Above 300F the binder can actually shrink polypropylene fabrics.
38. What can be done to lower the **embedment temperature**?  
A. Allow the binder to lie on the pavement for a period of time (typically seconds) before placing the fabric on the binder.
39. What is **embedment pressure**?  
A. Pushing the fabric down in to the liquid asphalt tack coat.
40. How much **embedment pressure** is required?  
A. NONE on asphalt overlay projects! Simply allowing the fabric to touch the liquid asphalt will provide sufficient holding power to keep the fabric in place for the paving operation

41. How is **embedment pressure** controlled?
- A. The brooms that follow the tension bar on the laydown unit can be adjusted up or down to raise or lower **embedment pressure**.
42. What do the brooms on the laydown unit accomplish?
- A. They help smooth out wrinkles and can be used to push the fabric in to the binder if desired.
43. When is it important to push the fabric in to the liquid binder?
- A. On projects where a chip seal is going to be placed over the fabric because that system will not have the benefit of hot asphalt being rolled over the fabric.
44. What happens if too much **embedment pressure** is applied?
- A. The binder is forced all the way through the fabric and causes premature saturation or bleeding.
45. What weight of paving fabric is best?
- A. The AIA in concert with the AASHTO committee of 1996 recommend a minimum fabric weight of 4.1 oz/square yard.
46. Wouldn't a heavier fabric work better?
- A. NO! No testing has indicated that a heavier fabric will perform any better than the standard 4.1oz/square yard needlepunched nonwoven fabric.
47. What problems can occur with a heavier fabric?
- A. The heavier the fabric, the more difficulty in getting the asphalt to penetrate and saturate the fabric.  
B. The unsaturated portion of the fabric may be torn apart from the saturated part and allow delamination of the overlay.
48. What happens if a lighter weight fabric is used?
- A. The light fabric cannot hold the necessary amount of liquid asphalt to obtain waterproofing and is much more prone to bleeding.
49. What is the standard length of a roll of paving fabric?
- A. 360' NOTE: Multiple length rolls are now being made to special order
50. What two things should I look for on the fabric roll from the manufacturer?
- A. The protective plastic wrapper is undamaged  
B. The manufacturing label
51. What two things does the protective wrapper insure?
- A. The fabric has not been exposed to sunlight  
B. The fabric nor the core have taken on water
52. What 3 things can I get from the label?
- A. The size (width & length)  
B. The product designation (from this comes the published weight/area)  
C. A contact number for the manufacturer to acquire any information desired about the product
53. What are the 4 standard widths of paving fabric?
- A. 6.25'  
B. 10.0'  
C. 12.5'  
D. 14.5'
54. How much binder is required for each size of the 4 roll sizes when applied at .25 gallon/square yard?
- A. For 6.25 x 360' = 62 ½ gallons  
B. For 10.0 x 360' = 100 gallons  
C. For 12.5 x 360' = 125 gallons  
D. For 14.5 x 360' = 145 gallons
55. How is the fabric typically applied?
- A. A variety of equipment is manufactured to mount on conventional bucket loading tractors, small garden tractors and spreader trucks.
56. Can the fabric be applied manually?
- A. YES, however mechanical equipment makes it much easier to keep the fabric smooth and wrinkle free.

57. Is there a top and bottom?  
 A. YES. The smooth or calendared side goes up and the fuzzy side goes down.
58. Which way is the material rolled at the factory?  
 A. Since the predominance of fabric is placed with equipment, and the laydown equipment reverses the fabric during placement, the material is rolled with the calendared side out.
59. Can the fabric just be laid on the pavement and rolled out?  
 A. NO. It must be turned over after manually unrolling so the fuzzy side is down.
60. Are wrinkles OK?  
 A. Small wrinkles less than 1" are not desirable but should not affect the system. Larger wrinkles will result in lapped fabric. The layers will not be saturated and consequently are a great source for creating a crack in the new overlay.
61. What should be done with wrinkles?  
 A. The wrinkle should be cut and shingled in the direction of the paving operation.
62. Is it OK to melt wrinkles with a torch?  
 A. ABSOLUTELY NOT. This destroys the fabric and is very likely a source for a crack in the new overlay.
63. How much is the fabric lapped at transverse laps (across the road)?  
 A. 2-4 inches.
64. Do transverse laps need to be retacked?  
 A. The AIA allows if the lap is less than 4", no additional binder need be placed between the fabric layers.
65. How much is the fabric lapped on longitudinal joints?  
 A. 2-6 inches
66. Do longitudinal laps need to be tacked?  
 A. YES
67. How much of the street or lot should receive the WATERPROOFING MEMBRANE?  
 A. THE ENTIRE PAVEMENT SURFACE. The number one function of the membrane is to waterproof. Therefore only doing part of the area will not result in total waterproofing protection.
68. Do milled surfaces need WATERPROOFING MEMBRANES?  
 A. YES, even more than the original pavements as cracks are created in to the old asphalt during the milling process.
69. What 3 conditions must be met to place a WATERPROOFING MEMBRANE over milled surfaces.  
 A. Properly cleaned, sweeping up grindings and dust  
 B. Minimum 1-1/2 inch of compacted asphalt be placed  
 C. Increased binder application rate (typically .3 gallons/square yard)
70. Can placed fabric be driven on?  
 A. YES properly placed saturated fabric (not bleeding) will not be damaged by normal traffic.
71. Why do some agencies not allow traffic on the in-place fabric?  
 A. In the event of water (rain or irrigation water) getting on the fabric before placement of the overlay, the fabric and water combination will be more slick than a pavement, therefore liability to the owner could occur
72. What is the minimum thickness of asphalt that should be placed over a WATERPROOFING MEMBRANE?  
 A. ONE AND ONE-HALF INCH COMPACTED THICKNESS.
73. Why is there a minimum?  
 A. Asphalt hot mix is placed in less than 1-1/2" lifts will seldom have enough thermal mass (heat) within the asphalt to be compacted properly before cooling.
74. Is this more important when a WATERPROOFING MEMBRANE is being installed?  
 A. YES because the heat is need to draw the binder through the paving fabric to tack and bond to the new asphalt.

75. What should be the minimum temperature of the hot mix asphalt when placed?  
A. Caltrans allows nothing below 250F.
76. Why is the minimum temperature important?  
A. Unless the mix is sufficiently hot optimum density will not be achieved during rolling.
77. What is the maximum temperature of the hot mix asphalt when placed?  
A. Caltrans allows no more than 350F.
78. Why is the maximum temperature important?  
A. If the asphalt is too hot the liquid asphalt in the hot mix will prematurely age (oxidize) and result in a more brittle less flexible pavement.
79. Will the hot asphalt affect the paving fabric?  
A. If the paving fabric is properly installed it will be saturated with binder and insulated from temperature damage.
80. What are the three critical elements to obtain optimum compaction?  
A. Adequate temperature of the hot mix.  
B. Sufficient rolling pressure  
C. Adequate number of rolling passes.
81. What items are needed for comprehensive inspection of a WATERPROOFING MEMBRANE installation?  
A. Non contact thermometer  
B. Pre weighed test units  
C. Scales that measure within 2 grams  
D. Calculator  
E. Utility knife  
F. Peel & stick patches  
G. Tack Coat Reference chart
82. What are the 5 primary areas of inspection that will assure a quality WATERPROOFING INTERLAYER?  
A. Surface preparation  
B. Binder spreading equipment calibration and spray pattern  
C. Binder application rate  
D. Proper placement of fabric (wrinkles, laps, quantity)  
E. Proper installation of the overlay
83. What is the Number One cause of failure of a WATERPROOFING MEMBRANE?  
A. INSUFFICIENT APPLICATION OF ASPHALT TACK COAT.
84. Where do I get answers to questions I have about WATERPROOFING MEMBRANES?

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