

Murphy Pavement Technology, Inc.

TEACHING - TRAINING - TROUBLESHOOTING - TESTIFYING

September 9, 2020

TO: Asphalt Scientists

FROM: Timothy R. Murphy, P.E.

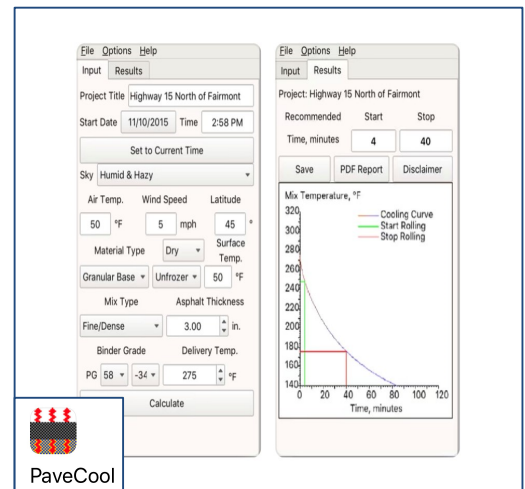
RE: Cold Weather Asphalt Paving

It is my understanding that hot mix asphalt (HMA) placement will continue late into the season this year and this may require the installation of HMA in less than ideal weather. You have asked Murphy Pavement Technology, Inc. (MPT) for recommendations to follow to ensure acceptable placement of the HMA should paving occur outside the Standard Specification limits. The efforts put forth in this report are to supply Agency, Owners, Consultants, and Contractors with a “Must Do” reference list to cold weather paving in order to ensure pavement performance, even when placing mixture in less than perfect weather conditions. It is my understanding that this information will be shared with crews throughout your organization. This document should be used as a guide to supplement, not replace your specification requirements.

Cold Weather Paving Requirements

The temperature of a mixture is perhaps the most important property towards obtaining acceptable in-place density since its temperature controls the viscosity, how fluid and workable it is, of the asphalt binder (cement). Understanding this phenomenon has led many in the industry to realize methods to maintain the proper viscosity, through proper heating techniques, exist. Although many variables will happen in the field when you actually go to pave, MPT must stress that the majority of my observations come from following these recommendations during cold yet dry paving. If rain or snow is a condition of the low temperature paving, then I am not so certain these recommendations will be enough to ensure high quality pavement can be built with any reasonable production rate.

The more variables exist then the less ‘Time Available for Compaction’ Contractors will have to pave and obtain in-place density. (Reference the Asphalt Institute manual number 22, Construction of Quality Asphalt Pavements (MS-22), p 157, para. 9.4.) It is easy to determine the time available for compaction for any set of conditions. Dickson and Corlew published cooling curves in 1910 showing the time available for compaction for any given set of ambient and mix conditions. Determining the available time became even easier with the development of the PaveCool software by the Minnesota DOT. Download PaveCool from www.dot.state.mn.us/app/pavecool/ or for your cell by searching pavecool in your app store.



Corporate Office:

7649 South State Street

Chicago, IL 60619

Office & Cell: 773-874-9800

Fax: NOPE

www.murphypavetech.com

If placement occurs in less than desirable and contrary to specification requirements, then it is imperative that you communicate this in a pre-pave meeting with all parties included, explain (discuss) the pros and cons of the construction activities, and agree in writing to allow cold weather paving to occur. Make sure everyone accurately and completely understands the benefits and negatives of cold weather paving before proceeding; think Uniform Code of Construction (UCC) as you are the experts in asphalt paving.

Cold Weather Paving “Must Do” List if density is not being achieved:

1. Pre-heat all of the equipment as best possible.
2. Ensure the vibrating screed is working from out-to-out.
3. Work the breakdown and intermediate rollers as close to the paver as possible.
4. Work the first two drums side-by-side (soldier rolling) in lieu of one-by-one (followers).
5. Cover loads during hauling and insulate the truck (trailer) walls and beds.
6. Increase the plant produced mixture temperature within specification requirements and watch for cold loads in the AM.
7. Decrease production rates and reduce paving speed.
8. Tack longitudinal joints as needed to increase bond.
9. Increase the number of rollers.
10. Use a roller with a higher frequency and consider combination rollers (vibratory and pneumatic) as well as oscillatory rollers.
11. Saw cut joints straight and true as needed prior to the next day of paving.
12. Utilize new material technology such as Warm Mix Additive – Foaming and / or Additive.

By following these ten steps you should be able to ensure the viscosity is acceptable for achieving in-place density of the HMA. Generally speaking, the key to success in cold weather paving is directly related to the temperature of the base being paved over. However, windy days will impact the mix's ability to hold the temperature as well. The economics involved with cold weather paving will be felt substantially in insulating trucks, increasing the number of rollers, decreasing production rates, and cutting joints. Regardless of the cost, these are important factors in building long-lasting HMA at this time of the year. The balance of the items listed is more or less minor changes in the production of asphalt and will most likely not increase the cost of production significantly.

As road builders we need to delineate the responsibility of reviewing HMA placement practices, especially with respect to visually observing if checking occurs. At this time of the year this phenomenon occurs when HMA is placed on exceptionally cold bases which cool the bottom portion of the asphalt lift quicker than the balance of the material. The checking phenomenon occurs when the level of compaction within the lift tries to reorient the asphalt coated aggregate matrix at the bottom of the HMA lift. If the bottom is too cold the matrix will not freely rotate / consolidate and the compaction process then begins to develop cracks from the bottom up; hair line cracks that are known as checking (cracks). Inspectors must have temperature devices (w/backups), tachometers, and calibrated density gauges to properly monitor paving activities.

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Additional Cold Weather Paving Items

The equipment controls must be clearly labeled for review by all in the field, especially with respect to the vibratory roller amplitude and frequency settings. The paver used must be capable of providing a smooth and uniform surface texture and screed and auger extensions must be used when placing wide HMA widths. Always remember that screw augers are required whenever the paving width causes the end of the auger tip and the end plate to exceed a 1-ft. gap. Paving without screed and auger extensions can cause segregation, low in-place density, and potential permeability problems. With cold weather each of these items can be a recipe for failure by next spring because coarsely segregated areas cool faster.

Summary

Everyone on the paving project must always be aware of the finished mat texture. If micro – cracks develop that is an indication of a substantial temperature differential throughout the HMA mass. This condition can exist for all type of asphalt mixtures and can be mitigated by paving in warmer weather and many times through the use of a rubber tired (pneumatic) roller. This condition typically will occur if you pave in wet or damp conditions with low temperatures as described earlier. I would not recommend that you continue paving if micro– cracks, aka checking or hairline cracks, occur.

I've covered many but not all items that you will encounter these coming weeks of late season paving. I believe I have discussed problem areas that most frequently occur and typical solutions to being successful during cold weather paving. I look forward to your input and the input of the paving crews you work with to continue to supplement and build on this document and to continue to improve your efforts in the future. As an expert in asphalt rest assured that this is a comprehensive list of items to follow in order to be successful in cold weather paving that I write about and teach practitioners worldwide.

Regards,



Timothy R. Murphy, P.E., ASCE, NAFE
President



Please help me to update this e-mail list as you have in the past at tmurphy@murphypavetech.com.

Corporate Office:
7649 South State Street
Chicago, IL 60619
Office & Cell: 773-874-9800
Fax: NOPE
www.murphypavetech.com