Guidance on Minimum Roadway Placement Temperatures

**Introduction**

The 2004 Standard Specifications contain wording that addresses minimum roadway surface temperatures for placing hot mix asphalt. Stone matrix asphalt (SMA) and permeable friction course (PFC) mixes represent the extreme case since they require that the roadway surface temperature be 70°F or higher, unless otherwise approved prior to paving.

On more common mixes such as dense graded hot mix asphalt and performance design hot mix asphalt, the specifications state the following: “Place mixture when the roadway surface temperature is 60°F or higher unless otherwise approved.” A number of individuals have asked the question: “When is it appropriate to approve paving pavement temperatures lower than 60°F?” While there are times when waiving or lowering the pavement surface temperature requirements will not have a significant adverse impact on the performance of the mix, there are cases where low pavement surface temperatures can have a serious, detrimental effect on mix performance.

This document provides some background and guidance regarding minimum pavement temperatures.

**Background**

Previous hot mix specifications used in Texas stated that hot mix “shall not be placed when the air temperature is below 50°F and falling, but it may be placed when the air temperature is above 40°F and rising.” There were several issues with this wording. One issue, night paving would technically never be allowed since the ambient temperature is rarely ever “rising” at night. Second and more importantly, this wording allowed paving in conditions that are not suitable to good performing hot mix.

There are numerous accounts of premature pavement failures due to debonding, raveling, pot holes, etc., that can be traced to cold weather paving. There is also documented research that shows that a very high percentage of premature hot mix failures are related to cold temperature paving. Cold temperature paving in combination with inadequate tack coat was attributed to four premature failures within one year in Texas.

Under quality control/quality assurance (QC/QA) specifications, contractors will often make the point that they should be allowed to pave regardless of temperature as long as they can meet the specifications, which essentially means that they can achieve adequate in place density. However, most of the premature failures related to cold temperature paving show up within the first year or so after the project has been completed and opened to traffic when TxDOT rather than the contractor is responsible for the long-term performance of the pavement. The traveling public, the Department and the contractor all experience a negative impact if a premature pavement failure occurs even if the contractor may have achieved adequate in place density at the time of construction. Therefore, many TxDOT engineers requested that better temperature controls be put in place to address the problem of cold temperature paving.

**Guidance**

The 2004 Specification Rewrite Committee looked at this issue and considered several options. Some of the options considered included requiring insulated trucks and tarps or specific remixing devices such as shuttle buggies. The industry strongly opposed
specification language requiring specific equipment and this language was never adopted into the 2004 specifications. A compromise was reached that addressed TxDOT’s three main concerns:

1. reducing thermal segregation
2. reducing the risk of debonding from cold temperature paving and
3. ensuring a better bond between paving layers by improving tack coat practices.

Language was placed into the 2004 specifications that addressed all three of these issues.

Some have questioned whether or not the 60°F requirement is too stringent. Contractors have expressed concerns that these temperature requirements will not allow them to finish contracts on time because they feel that they will be greatly restricted on the number of days they can pave. The long term pavement performance (LTPP) database has documented pavement surface temperatures versus ambient temperatures, humidity, etc. Analysis of the LTPP database can be used to quantify how many paving days might be lost as a result of the new pavement surface temperature requirements.

It is important to emphasize two issues regarding the wording in the 2004 specifications which state “Place mixture when the roadway surface temperature is 60°F or higher unless otherwise approved.” The first is that the roadway surface temperature is almost always higher than the ambient temperature. On a hot sunny day, the roadway surface can be more than 50°F higher than the ambient temperature. In addition to ambient temperature and sunlight, factors such as wind speed and humidity control how high the pavement surface temperature will reach. At night and on cloudy days there may not be a significant difference in the roadway temperature and the ambient temperature but generally speaking if the sun is shining and the ambient temperature is above 40°F, then the roadway surface temperature will be above 60°F. From this standpoint it can be argued that the new roadway surface temperature requirement of 60°F is not significantly more restrictive than the former ambient temperature requirement of 40°F and rising.

As a result of the unusually warm dry climate in Texas over the past year, there have been very few days that hot mix paving has not been allowed. Although it may seem that pavement surface temperatures are a nonissue at this time, normal climate patterns will return and pavement surface temperatures may become a real issue in the future.

This brings us to the second issue regarding the wording in the 2004 specifications. We intentionally added the phrase “unless otherwise approved” to the pavement surface temperature requirements. This wording gives the engineer the latitude to waive or reduce the 60°F requirement when appropriate. Make no mistake “hot mix paving is ideally a warm/hot weather process,” but, there are times when we acknowledge that the 60°F may be too restrictive.

As a general rule, the 60°F surface temperature requirement should almost always be enforced for relatively thin surface mixes that have PG 76-xx binder. In many other cases, it might be appropriate to allow a surface temperature requirement of no less than 50°F and only in rare cases would it be appropriate to allow the surface temperature requirement to be below 50°F.

**The following is a list of considerations for lowering the 60°F pavement surface temperature requirement.**

- The project requires night paving (more necessary than appropriate).
- There are very short haul distances.
- The lift thickness is greater than 2 inches.
- The mixes use PG 64-xx binder and to a lesser degree PG 70-xx binder.
- The mix is for an intermediate layer, base layer or bond breaker.
- The mix that will not be exposed to significant amounts of traffic such as shoulders, driveways, crossovers, ramps.
- The contractor will be utilizing insulated trucks and/or aggressive remixing equipment such as a shuttle buggy or equivalent device.

**Conclusions**

The department has pushed for acceleration of work and project completion; however, this is not a reason to waive a specification requirement if doing so could have an adverse effect on the long term performance of the hot mix. If the engineer chooses to allow paving when the pavement surface is below 60/70°F, we encourage diligence in the enforcement of thermal segregation and tack coat requirements.
Obviously, there is no “one size fits all” solution to selecting appropriate pavement placement temperatures and there is no suitable replacement for good engineering judgment. One must ultimately balance the fact that the department has ultimate responsibility for the pavement performance versus the fact that we must sometimes pave in less than desirable conditions in order to finish construction projects in a timely and cost-effective manner.

**Contact Information**

For more information, contact Dale A. Rand, P.E. at 512/506-5836 or drand@dot.state.tx.us.