Pavement Temperature Rates in the Intermountain Region of the United States- TRB 11-2646

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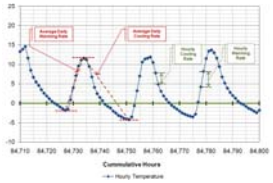
Objective

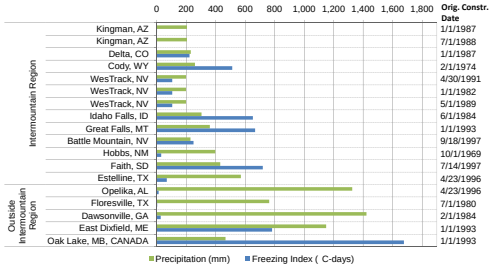
Determine average and hourly HMA warming and cooling temperature rates within the intermountain region and compare them to HMA pavements outside the region.

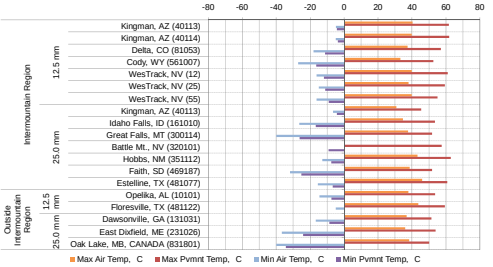


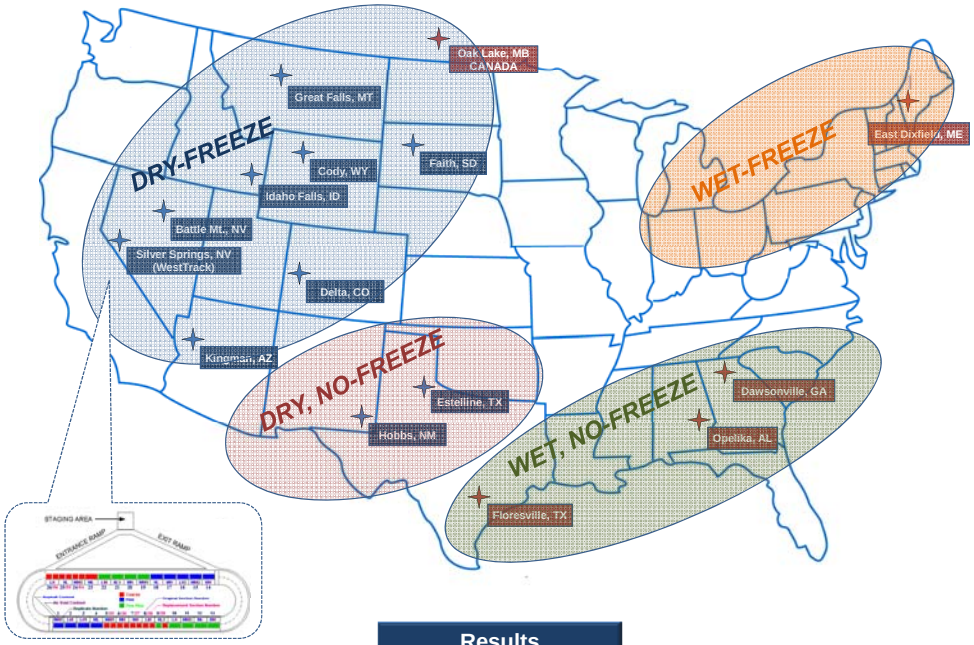
Experimental Plan

- **Hourly pavement and air temperature data from**
  - **15 LTPP SMP sections: 10 within and 5 outside intermountain region**
  - **3 WesTrack sections**

Section Properties

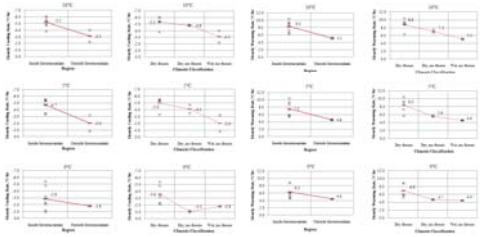




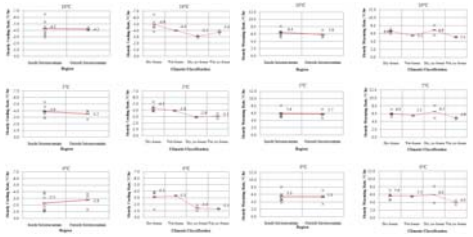


Results

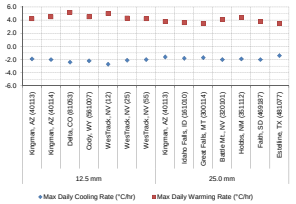
Sensor Depth = 12.5 mm below pavement surface

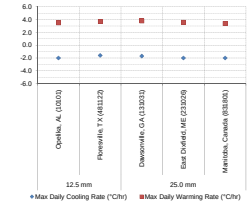


Sensor Depth = 25 .0 mm below pavement surface



Results (Cont'd)





Conclusions

- **Minimum air and pavement temperatures not only varied among all sections but also varied for sections within the intermountain region. This shows that environmental conditions may still vary within the intermountain region.**
- **Temperature rates reduced in magnitude as temperatures get colder.**
- **Daily temperature rates did not vary greatly among sections. Maximum daily cooling rates ranged from -1.4 to -2.7 C/hr; whereas maximum daily warming rates were in the 3-5 C/hr range.**
- **At a sensor depth of 12.5 mm, the average hourly cooling and hourly warming rates were greater in magnitude for sections within the intermountain region as compared to sections outside this region.**
- **At 25.0 mm depth into the HMA layer, the cooling and warming rates are not significantly different for sections within the intermountain region and sections outside this region.**
- **Most no-freeze sections have lower hourly cooling rates than "freeze" sections regardless of region.**
- **Sections classified as freeze generally have colder minimum air and pavement temperatures than other sections. This implies that they have greater range of cold temperatures which ultimately lead to higher cooling rates.**
- **The intermountain region is dominated by a freezing climate which explains the relatively higher temperature rates.**
- **Critically low temperatures coupled with high cooling rates will increase an AC pavement's susceptibility to thermal cracking**

Recommendations

- **To asses thermal cracking performance within the intermountain region, actual pavement temperature conditions will need to be simulated which may mean the use of multiple warming and cooling cycles instead of a constant linear rate such as in the TSRST (cooling rate of 10 C/hr).**
- **Variable cooling rate need to replace linear cooling rates. Cooling events are partitioned into two distinct temperature rates; therefore, a linear cooling rate during testing may not be the best approach.**
- **Research only focused on pavement temperatures and temperature rates. Authors recommend looking at other pavement properties (i.e., volumetrics, aggregate structure, binder type, etc.) to see their effect on thermal cracking performance.**

Acknowledgment

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