Form 000021wd
4-96

IOWA DEPARTMENT OF TRANSPORTATION

To Office Bridges and Structures Date March 24, 2005

Attention All Employees Ref No. 521.1

From Gary Novey

Office Bridges and Structures

Subject: Method's Memo No. 114 (Description of Concrete Mix Types on Bridge Decks)

With the use of high performance concrete (HPC) on bridge decks on I-235, questions have been raised about statewide policy on use of HPC and other options that are available, such as District 3's use of improved durability concrete (IDC). Also how the mixes compare and when can they be used. The following information is a description of the two types of concrete mix that have been used. A statewide policy is still under development and will be issued as more experience is gained from use of the mixes.

IMPROVED DURABILITY CONCRETE

District 3 implemented IDC in an attempt to enhance the life of their bridge decks by utilizing course aggregate meeting Class 3i durability and expediting the continuous wet burlap curing process. District 3, in consultation with the Office of Construction; put together a Developmental Specification covering the use of "Improved Durability Concrete for Bridge Decks" (DS-01030). District 3 would have preferred to use the High Performance Concrete as is being used on the I-235 corridor bridges, but was unable to due to the ready mix plant limitations of being equipped to provide slag and the third aggregate required for the HPC mix. The IDC DS was the next best approach. The developmental specification requires:

1. Class 3i durability aggregate
2. Stricter limitations on theoretical rate of evaporation during deck placement
3. No grooving of the plastic concrete and no placement of white pigmented curing compound (elimination of both of these aids in expediting wet burlap placement and wet curing process within 10 minutes of final finishing,
4. Continuous wet cure for 168 hours
5. The use of longitudinal grooving in the hardened bridge deck concrete.

Not all new bridge structures in District 3 are required to utilize improved durability concrete. The District decides what type of deck will be used on each structure.

Longitudinal grooving in hardened concrete is always required with IDC decks as stated in the developmental specification. However, if there are several bridge projects along the same route, the District can decide to include the longitudinal grooving bid item in the paving plan rather than the bridge plan. In the event that this occurs, the bridge plan must include a note informing the bridge contractor of the bid item change.

HIGH PERFORMANCE CONCRETE

High performance concrete has been incorporated in the I-235 bridge projects by the Bridge office as specified in developmental specification (DS-01033). HPC; 1) improves workability, 2) reduces the permeability of the bridge decks, which reduces the contamination of salts and deicers in the deck, 3) enables increased concrete 28 day strength to 5000 psi, and 4) through the use of slag and reduction of the Portland Cement content in the mix greatly minimizes the potential for plastic shrinkage cracks in the deck.

The use of HPC, on a statewide basis is not feasible at this time. The reasons are that the HPC mix requires the addition of slag and a third aggregate. Many small ready mix concrete plants around the state do not have the plant facilities to handle slag and the required third aggregate. The additional slag component requires a separate holding bin at the concrete plants. HPC also requires a special medium size aggregate in the mix, which would also require a separate bin. It is anticipated, with the expanding availability of slag-blended cements and future gradation changes to include the third aggregate that HPC may be able to be specified on a statewide basis in the coming years. Apparently there are enough concrete plants that do not have the facilities to accommodate the slag and special aggregate and therefore would not be able to supply the HPC mix or participate in the bidding of the projects. In fact in some more remote locations of the state there are no ready mix plants within a reasonable distance of projects that could supply it.

The industry is starting to use blended cements, which incorporate the slag in the mix, therefore eliminating the need for additional facilities for the slag. However, the issue of utilizing the special aggregate in the HPC still needs to be resolved.

Longitudinal grooving in hardened concrete is also required when specifying the use of HPC as per developmental specification (DS-01033). The wet burlap cure must be in placed within 10 minutes of final finishing of the concrete. Due to this expedited wet cure requirement it is not possible to groove the concrete while it is plastic or to place white pigmented curing compound. Once again the longitudinal grooving in hardened concrete can be part of the bridge plan or the road plan depending on the situation.

For more information on High Performance Concrete feel free to contact Todd Hanson, Ahmad Abu-Hawash, John Hart – District 1 Materials, or Wayne Sunday.

A methods memo is being developed to direct designers on plan preparation using details on high performance concrete and improved durability concrete.

GAN/eds/bj