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FROM: A. J. Siccardi

SUBJECT: Technical Memorandum #4
Concrete Admixtures

Attached to this memorandum is a data notebook, CORROSION PROTECTION SYSTEMS. WR Grace & Co. Also included in the data notebook is a separate flyer booklet which contains data on EMSAC, by Elkem Materials, Inc. Following your review, the material should be placed in the library.

The information is circulated to ensure your awareness of these products as an alternative corrosion inhibitor product. DCI corrosion inhibitor is a calcium nitrate based liquid which chemically blocks the corrosive action of chloride salts. DCI is, of course, a proprietary product of WR Grace. Generically, the product can be specified as ASTM C494 - Type 4, "STANDARD SPECIFICATION FOR CHEMICAL ADMIXTURES FOR CONCRETE." This type of chemical inhibitor is seen as an alternative to epoxy-coated rebar. I am not at this writing proposing a policy change in that direction; however, I would not be opposed to inclusion of the calcium nitrite admixture in a project on an experimental feature. Included in the data notebook, you will find special provisions utilized by the states of Illinois, Michigan, New Hampshire, Rhode Island, New York and Ohio regarding this type of corrosion inhibitor product.

In the use of this type product, one must pay special attention to the concrete finish and curing. In general, a light fog mist to keep the environment above the concrete surface at a high humidity is recommended during the lacing and finishing operations. Following the finishing operation, a water cure is the best method for curing. Water cure can be accomplished by

Technical Memorandum #4
July 7, 1989
Page 2

placing burlap over the deck and maintaining it wet throughout the specified curing period. This type of fogging and cure system will help overcome possible concrete plastic or drying shrinkage problems which can obviously be detrimental to the long term life of concrete.

A second product which also shows considerable potential benefit is the use of a microsilica-based admixture. Microsilica is a by-product during the production of silicon metal and other ferroalloys. Microsilica consists of highly-reactive, ultra-fine amorphous silica particles. The reactivity works on the calcium hydroxide crystals which results in an enhancement in the strength, durability and impermeability of the concrete.

It is the enhanced impermeability that is of immediate interest which will result in greater resistance to the penetration of chloride salts which cause corrosion of the reinforcing steel. The cost of this admixture is fairly expensive; ie. in the range of \$30-\$50/cu. yd. of concrete. When compared to epoxy-coated rebar at roughly 300#/yd.³ in bridge decks, the cost of epoxy coating of all bars is at the lower end of the range. Thus, as a product to only enhance impermeability, it may be appropriate to utilize the higher strength characteristics of the concrete which could result in the elimination of a girder line, for example.

The data notebook includes specifications used by Alabama, Michigan and Virginia, as well as a proposed generic specification by WR Grace. I have requested specifications from both California and Washington. To date, this material (microsilica) has been used primarily in the deck rehabilitation (overlay) program; however, I believe it has great potential for decks in general. The curing process is similar to what is required when the chemical water cement ratio is low (0.40) which means a super plasticizer may be appropriate to facilitate placement.

Each of the items must be viewed as potential alternate corrosion protection strategies and not a supplementary to current practice.

AJS/kj

Attachment