

Low Shrinkage Mix Design Optimization Guidelines for Eclipse® Floor

Introduction

Eclipse® Floor Shrinkage Reducing Admixture is a liquid concrete admixture specifically formulated for reducing the drying shrinkage properties of non air-entrained concrete. This technical bulletin details mix design optimization recommendations which will enhance the potential of eliminating or dramatically reducing drying shrinkage cracking in slab-on-grade construction. The inclusion of Eclipse Floor at a minimum dosage rate of 3.7 L/m³ (0.75 gal/yd³) should be included in these design modifications. If available, testing at 7.4 L/m³ (1.5 gal/yd³) may provide greater shrinkage reduction favorable to greater joint spacing. Testing a three point curve using 3.7–4.9–7.4 L/m³ (0.75–1.0–1.5 gal/yd³), Eclipse Floor will provide optimal test data to determine drying shrinkage performance vs. Eclipse Floor dosage rate.

Maximum 0.50 Water/Total Cementitious Ratio

- Admixtures, not water, should be used to achieve required workability, since water is the primary detriment for drying shrinkage.
- 18 kg (40 lbs) reduction in water content will reduce the drying shrinkage by approximately 15%.
- The lower the water/cement ratio, the lower the drying shrinkage is.

Admixture Selection

- Recommended use of ADVA® type superplasticizers to optimize mix design shrinkage characteristics and to achieve low water/cement ratios. Mid-range water reducers may not be as favorable to shrinkage performance as ADVA type superplasticizers. ADVA type superplasticizers will allow for water reduction to meet water/cement ratio requirements while providing workability, and will help to optimize drying shrinkage properties when used in conjunction with Eclipse Floor. If ADVA type products are not working, utilizing mid-range water reducers is recommended.
- Avoid utilizing chloride containing admixtures.
- Avoid superplasticizers which can promote retardation at higher addition rate.

Coarse Aggregate-Major Impact on Drying Shrinkage Properties

- Increase coarse aggregate content to minimum 1,040 kg/m³ (1,750 lbs/yd³). Use larger size aggregates when locally available. Mixes utilizing 19 mm (0.75 in.) aggregate can shrink up to 30% more than mixes utilizing 25 mm (1 in.) aggregate.
- Utilize quality aggregates that have low absorption and compressibility (modulus of elasticity) properties. Sandstone and slate aggregates may have poor shrinkage properties while limestone, dolomite, granite and feldspar often have low (good) shrinkage properties.

Cementitious Constituents

- Quantify cement brand impact on drying shrinkage by testing.
- Type II cements usually shrink less than Type I and much less than Type III cements.
- Fly ash and slag are fully compatible with mixes containing Eclipse Floor.

Minimum 28 MPa (4000 psi) 28 Day Compressive Strength

- Inclusion of Eclipse Floor may result in 28 day strength reduction on the order of 10% relative to an identical mix not containing Eclipse Floor.
- Strength should be designed by the engineer for anticipated loads.

Use of Eclipse with Type A Water Reducers

- Inclusion of Eclipse Floor may result in set retardation, typically in the 45 minute range when utilized as a stand-alone admixture. This can be amplified by the use of some Type A water reducer and some pozzolans.
- Trial mixes are recommended to determine time of set characteristics of the Eclipse mix.

Mix Design Review and Test Matrix – Optional

- Grace Sales personnel and the Regional Technical Service Manager will review test matrix and proposed mix designs to share best practices.
- Furnish current data available for the control mix. Data should include compressive strength tests, shrinkage data, aggregate gradations and a history of mix design performance.
- Review period will take 10–15 business days after the Regional Technical Service Manager receives all information.

Shrinkage Testing

Mix designs must be evaluated for drying shrinkage properties via ASTM C157, “Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete” (See Eclipse Shrinkage Testing technical bulletin).

- Assure testing lab has appropriate equipment, personnel and experience.
- Recommend 7 day wet cure (versus 28 days).

- An initial reading (one day reading) should be taken per ASTM C157 at 24 hr ± ½ hr.
- Air dry readings should be taken at minimum 3, 7, 14, 21 and 28 days. A reading at 56 days will lead to more accurate understanding of mix design drying shrinkage properties.
- Eclipse Floor mixes should be compared against the same mix without Eclipse Floor (reference mix).

Trial Placement

A pre-job test pour is recommended using a minimum three cubic yards. The trial pour should be used to determine setting characteristics, workability and general suitability for desired field performance.

Final Mix Design and Data Review

- After completion of required testing, the final mix design, along with all plastic and hardened concrete properties (including shrinkage), should be forwarded to the Grace Construction Products representative. The Grace representative will review the data with the Regional Technical Service Manager and Product Manager.
- The final design should be field trialed to confirm that the plastic properties (i.e. slump, set time, finishability etc.) are suitable for the specific application.

North American Customer Service: 877-4AD-MIX1 (877-423-6491)

Visit our web site at www.graceconstruction.com

W. R. Grace & Co.-Conn. 62 Whittemore Avenue Cambridge, MA 02140 617-876-1400

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