BASF
The Chemical Company

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GUIDE SPECIFICATION FOR NAVITAS™ 33

RHEOLOGY-CONTROLLING ADMIXTURE

1. **General**: Unless specified herein, no admixtures shall be used without specific approval of the Resident Engineer.

2. **Rheology-Controlling Admixture:** Shall be used to facilitate the extrusion and consolidation of low-slump concrete (< 3 in. [75 mm]) and placement and consolidation of normal slump concrete (≥ 3 in. [75 mm]). The rheology-controlling admixture may also be used in mortar and grout applications if desired. Use Navitas 33 rheology-controlling admixture by BASF Construction Chemicals, LLC, Cleveland, Ohio, or an approved equal. The dosage shall be in accordance with the recommendations of the Admixture Manufacturer to obtain the desired workability for the project or application. **The rheology-controlling admixture shall not adversely affect the setting characteristics, air content or hardened properties of the concrete, mortar or grout mixture.** Use of the rheology-controlling admixture shall exhibit the following properties or provide the following benefits compared to untreated concrete of similar mixture proportions:

1. Improve the workability or flow of bulk concrete, and improve the response to vibration without a significant change in slump. Low-slump concrete containing the rheology-controlling admixture shall show a minimum increase in relative volume flow of 30%, as measured by the Test Method for Volume Flow.
2. Lower the yield stress, or force required to initiate flow, of the bulk concrete mixture, without necessarily changing its viscosity.
3. Not disperse cement, but impart a lubricating effect to concrete that influences particle to particle interactions, thereby facilitating flow of the bulk concrete mixture during consolidation.
4. Concrete properties shall be within tolerances specified in ACI 117.

3. **High-Range Water-Reducing Admixture**: Shall be a polycarboxylate-based product meeting the requirements of ASTM C 494/C 494M, Type F or G, or ASTM C 1017, Type I or II. Use Glenium or PolyHeed series admixtures by BASF Construction Chemicals, LLC, Cleveland, Ohio, or an approved equal.

4. **Assistance:** Coordinate with the admixture manufacturer for the services of a qualified person to establish the proper dosage of rheology-controlling admixture and make dosage adjustments to meet changing jobsite conditions.

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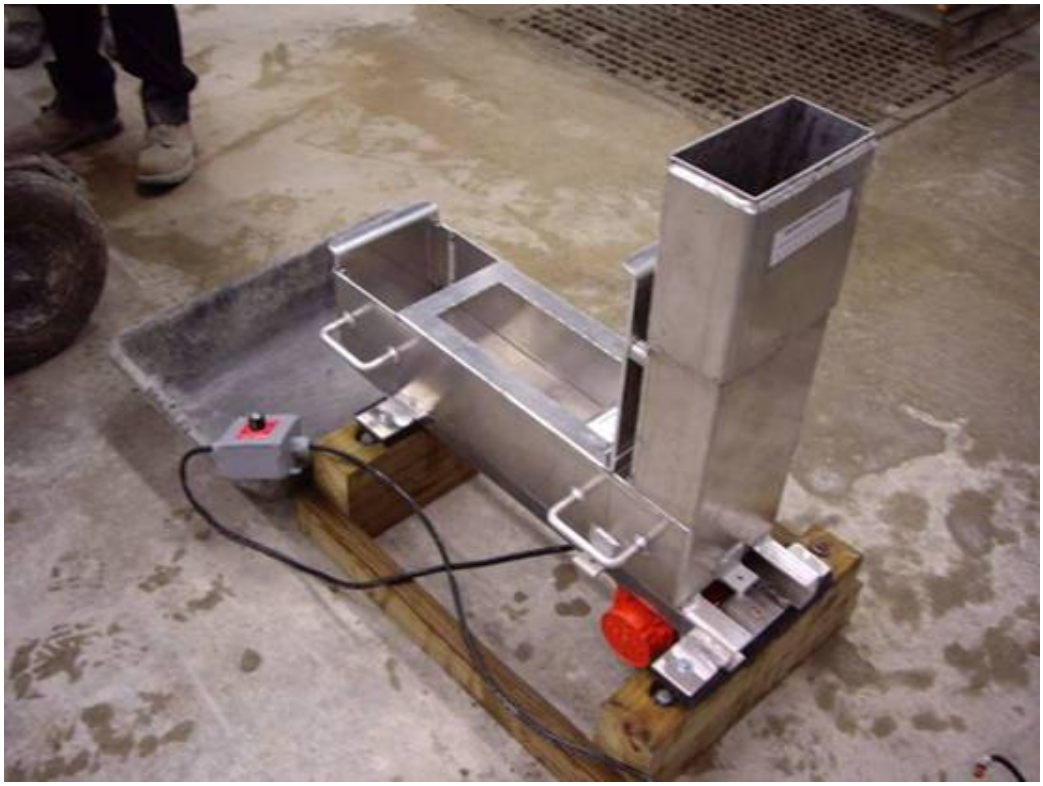
Navitas™ 33 Rheology-Controlling Admixture

Test Method for Volume Flow of Low-Slump Concrete

Scope:
This test method covers the determination of the volume flow of low-slump concrete.

Significance and Use:
1) This test method provides a means for comparing the volume flow of low-slump concrete, in response to vibration.
2) The test method can be used to determine the effects of concrete mixture ingredients on the volume flow of low-slump concrete.
3) This test method is intended as a laboratory test.

Apparatus:
To evaluate the volume flow of low-slump concrete, such as that used in mainline concrete paving, a modified L-Box test apparatus is used. The L-Box testing equipment is the same as that used to measure the flowing characteristics of self-consolidating concrete. The modification consists of an externally-mounted, high-intensity vibrator (the red cylinder at the bottom of the machine) as shown in the photo below. The vibrator is capable of attaining a frequency of 5,760 rpm. The addition of the vibrator allows the low-slump concrete to be fed, vigorously vibrated, and extruded through the lower portion of the L-Box in much the same manner as a conventional concrete paving machine.



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Test Procedure:

1) Close the door at the bottom of the vertical portion of the test equipment.
2) Place the concrete in the vertical portion of the L-Box in three layers of approximately equal volume.
3) Consolidate each layer of concrete by rodding 25 times.
4) After each layer is rodded, tap the sides of the L-Box 10 - 15 times to close any voids left by the tamping rod.
5) After consolidation, strike off the top surface.
6) Open the door at the bottom of the vertical portion of the test equipment and start the vibrator. Continue vibration of the concrete for 20 seconds.

7) Measure the drop of the concrete (in inches) in the vertical portion of the test equipment following vibration.
8) Calculate volume flow of the concrete, VF, in $in.^3/s$ [mm^3/s] as follows:

*VF = (L * W * D)/T*

Where:
L = the length of the vertical top section, in. [mm]
W = the width of the vertical top section, in. [mm]
D = the drop in concrete height after consolidation/vibration, in. [mm]
T = vibrator time in seconds [s]

The relative volume flow (RVF) of a test concrete mixture with respect to a reference concrete mixture can be calculated as follows.

*RVF (%) = (VFT/VFR) * 100*

Where:
VFT = volume flow of the test concrete mixture, $in.^3/s$ [mm^3/s]
VFR = volume flow of the reference concrete mixture, $in.^3/s$ [mm^3/s]

Interpretation of Test Results:

The volume flow can be an indication of how a concrete mixture responds to vibration. The higher the volume flow, the higher the volume of concrete that moves through the test equipment due to a better response of the concrete to vibration.

Note: In practical terms, several benefits may be realized with concrete that responds better to vibration.

- Increased productivity in placing low-slump concrete.
- Reduced vibration intensity to maintain the same initial volume flow.
- Reduced impact on air content and air-void parameters due to lower vibration intensity.
- Longevity or extension in service life of vibrators and paving equipment due to lower vibration intensity.