

C - 19: Flexural Strength in Concrete

Flexural strength of a solid is defined as its ability to withstand failure from bending.

In concrete, it is generally measured by loading 150 x 150 x 460 mm concrete beams. Two of the standards for testing concrete beams for flexural strength are: ASTM C 78 (CSA A23.2-8C) and ASTM C 293. In ASTM C 78 (CSA A23.2-8C) a simple concrete beam is tested by third-point loading. In ASTM C293 a simple concrete beam is tested by center-point loading.

The flexural strength found is expressed as the "Modulus of Rupture" (MR) in MPa or psi. The flexural MR can vary from about 12% to 20% of the compressive strength of the concrete.

Designers of concrete structures, where bending is an integral function of the structure, must take into consideration flexural stresses. Designers of concrete pavements, runways, other slabs on ground and prestressed concrete must design according to a theory, which is based on flexural strength.

Today, many agencies use compressive strength of concrete as an index of flexural strength. An empirical relationship is established between compressive strength and flexural strength based on a given set of

materials and conditions as well as the size of the concrete member.

This relationship is usually accomplished through laboratory testing or the use of a cement content based on experience to yield the needed MR.

The fact that the concrete industry and the inspection agencies are much more familiar with the traditional concrete cylinder compression test for control and acceptance does not mean that flexural strength is not important.

Many of our state highway departments, who in the past have used flexural strength, are now changing to compressive strength for job control of concrete paving. Experience has shown that flexural strength testing has had such a high coefficient of variation that it has been difficult to duplicate similar results in various "round robin" test programs.

Even so, the most important underlying factor for the acceptance of any concrete in flexure is still its ability to resist failure from bending, and this is measured by testing its flexural strength. ®

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