When a composite material (concrete-repair material composite) is subjected to a temperature change, thermal stresses are created due to a mismatch in thermal expansion coefficients (CTE). The difference in the thermal coefficient of expansion between concrete and epoxy formulations can be altered by controlling the amount of aggregate to binder ratio, where filler/epony ratio was varied in an attempt to vary (CTE) of repair materials. This considerable difference in coefficient of thermal expansion between epoxies and Portland cement does require careful consideration.

The test program required the splitting of the plaques in two halves along 30° angle. Before splitting the plaques, the plaques were grooved by a cutting wheel to a depth of about 5 mm to ensure a perfect half split. Concrete plaques were assembled with a trapezoidal steel plate and an elastomeric pad. A steel rod was located on the top of the plaque to help guiding and promoting the crack along the desired angle. Compression loading was then applied slowly at constant rate until plaque was fractured.

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• Compression loading was then applied slowly at constant rate until plaque was fractured.

Concrete plaques were sawn into two equal halves to be used for the Slant Shear Test. Assembly for splitting concrete plaques at controlled angle:

1. The temperature was raised to 120°F in a period of 5 hours at a constant rate 11°F/hour.
2. The temperature was then constant for 7 hours at 120°F.
3. The temperature is then dropped to 65°F in hours at same rate 11°F/hour.
4. The temperature is then kept constant at 65°F for 3 hours.

The following characteristics of the thermal cycles were used:

- The chamber temperature was lowered from room temperature to 65°F in a period of 5 minutes.
- The temperature was held constant for 4 hours at 65°F.
- The temperature was raised to 120°F in a period of 5 hours at a constant rate 11°F/hour.
- The temperature was then constant for 7 hours at 120°F.
- The temperature is then dropped to 65°F in hours at same rate 11°F/hour.
- The temperature is then kept constant at 65°F for 3 hours.

Slant Shear Test

The slant shear test highlighted by B. S. 6319 No. 4 was used to evaluate the bond strength between selected repair materials and parent concrete.

Preparation of Test Specimens from Composite Plaques for the Slant Shear Bond:

1. After the recommended curing period, each plaque was sawn into three segments in accordance with BS 6319: No. 4,1994 as shown in figure.
2. The prism prisms repaired with resinous and cementitious materials subjected to 80 thermal cycles
3. The prism prisms subjected to 180 thermal cycles

Effect of repair material Young’s modulus on reduction of slant shear strength of repaired prisms repaired with resinous and cementitious materials subjected to 180 thermal cycles

Avg. Slant Shear Stress (Psi)

0 1000 2000 3000 4000 5000 6000

Description of Modes of Failure

I. Diagonal failure at the joint at a significantly lower load than the control, with no concrete failure
II. Diagonal failure at the joint at a load only a little lowers than the control with little concrete failure
III. Diagonal failure in the concrete parallel to the joint but about 5 mm away from it at a similar load to the control
IV. Double pyramid failure of the same type as that of plain concrete specimens; the failure load may be equal to or superior to that of the control

Effect of Thermal cycling on slant shear strength of prism repaired with (a) cementitious repair material (005) and (b) resin-based repair material at (005)

Effect of repair material coefficient of thermal expansion on reduction of slant shear strength of repaired prisms subjected to 180 thermal cycles

Effect of repair material Young’s modulus on reduction of slant shear strength of repaired prisms repaired with resinous and cementitious materials

Sample Results