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Sub title

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Summary

Cement mortar finish details added to a concrete surface can cause cracks at the interface due to drying shrinkage, resulting in concentrations of delamination forces near the crack tip. This paper proposes an elastic-theory formulation for these delamination stresses. The formulation is a polynomial with an exponential singular solution, decaying singular solution and particular solution for the singularity point at the crack tip. A stress function satisfying the condition of a thin cement mortar body is proposed and a parametric analysis is performed under several geometrical conditions. All numerically obtained stresses show high accuracy and are concluded to be valid.

Keywords : *Social Welfare, Clinical Psychology, Food, Nutrition, Housing, Environment*

INTRODUCTION

Concrete structures often incorporate large numbers of thin-section finishing components that are bonded or joined to the concrete with inorganic cement-type adhesives, such as cement mortar, when wet construction methods are used. These components, usually ceramic tile or other finished products, are emplaced by experienced workmen to create exterior finishing products using plastering cement mortar as adhesive.

These exterior layers are typically 5–30 mm thick. Cement mortar finishing products are normally single-layer, while ceramic tile finishing products usually consist of two layers, with the tile emplaced atop adhesive cement mortar. One of the typical signs of decay for these components is delamination at the interface of the finishing product and the concrete structure.

A semi-infinite bond interface composed of two types of elastic materials with a notch forming a singular stress field is modeled in Fig. 1, where the stresses representing the singularity can be approximated by an exponential function of equation (1). During delamination i.e., when there are no angled notches or bonds without angles within the layers, the interfacial stress in the vicinity of the crack front is generally distributed as given by equation (1).

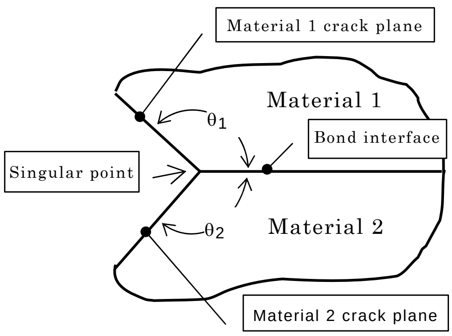

Fig. 1 Interfacial bond between two different types of materials

$$\sigma_{ij} \propto \frac{K}{r^{\lambda}} \tag{1}$$

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SHEAR DELAMINATION EXPERIMENTS

Experimental Plan

Outline of proposed simple shear testing method

For concretes under compression strain, a simple evaluation test for deformation follow-up capable of evaluating the bond stability against the interfacial shear between concrete and finishing materials is proposed in this study. A concrete specimen is compressed by a hydraulic compression testing machine, as shown in Fig.2. In this test method, a finishing material is bonded to both sides of the concrete specimen, which is then subjected to axial compressive load.

Materials Used

Ordinary portland cement was used for both concrete specimen and mortars. The mixing proportion and physical properties of the mortar (see Table 1) were the same regardless of the finishing and the substrate for ceramic tiles.

Table 1 Mix proportion of concrete

		Concrete	Mortar
Air content (%)		4.5	-
Unit content (kg/m^3)	Water	180	311
	Cement	300	690
	Fine aggregate	787	1242
	Course aggregate	981	-
	Chemical admixture	0.75	104

Results

The separation between concrete and finishing was determined for all specimens when interfacial cracks developed under a compressive load. No particular damage was observed in either the concrete specimens or finishing showing an interfacial separation failure.

CONCLUSIONS

Composite specimens with a concrete substrate and three types of finishing were prepared with bond-insulated parts at the two ends of an interface and subjected to displacement follow-up test. As a result, unstable failures were observed in many cases except for some cases that showed stable failure. The unstable failures cannot be explained in terms of the nonlinear fracture mechanics and introduction of linear fracture mechanics was needed for the safety design of structures. Hence, the first delamination point was introduced to evaluate overall characteristics of the interfacial fracture.

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