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TechNote

Repair of Leaking Cracks in Walls of Liquid Containment Structures

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Introduction

Nonprestressed reinforced concrete liquid containment structures—in particular, noncircular tanks—often exhibit vertical and diagonal cracks that are aesthetically objectionable. More importantly, cracks could result in loss of stored liquids, leakage of hazardous materials, concrete deterioration, and corrosion of reinforcing bars. Such cracks, however, are seldom indicative of structural failure. This *TechNote* reviews the methodology of repair in liquid containment structures.

Fig. 1—Vertical cracking at the walls of a liquid containment tank.

Question

What are the typical causes of, and best practices to repair, vertical and diagonal cracks in liquid containment structures?

Answer

Vertical and diagonal cracks in liquid containment structures are usually the result of restrained movement of concrete due to shrinkage, differential thermal expansion, and contraction from moisture and temperature gradients over the wall height.

In the absence of corrosion, dormant but leaking cracks are typically repaired by pressure injection of epoxy or chemical grout, vacuum injection, or routing and sealing on the interior or exterior wall surfaces, or both. Active cracks are repaired by pressure injection with chemical grouts; by routing and sealing with a flexible sealant on the interior or exterior wall surfaces, or both; or by application of a flexible barrier membrane on the liquid retention side of the wall. ACI Concrete Terminology (ACI CT-13) defines an active crack as one whose width changes with time, and a dormant crack as the opposite—one whose width does not change with time.

Not all cracks require repair. Refer to ACI 224R, Table 4.1, for crack widths that require repair or remediation.

Discussion

Liquid containment structures, such as large rectangular tanks, often exhibit vertical and diagonal cracks that are usually the result of restrained concrete shrinkage and thermal contraction, typically spaced 4 to 10 ft (1.2 to 3 m) apart (Fig. 1). These cracks generally have an insignificant effect on the structural integrity. Cracking, however, can affect the performance, serviceability, or both, of a structure, making repairs necessary to assure liquid-tightness and long-term durability (ACI 350). Liquid containment concrete structures could have concrete roof slabs that should be kept liquid-tight to prevent contamination of the contents by exterior exposure. In these cases, differential shrinkage and thermal deformation of the concrete could result in significant wall and roof cracking if the appropriate expansion or contraction (movement joints) are not provided. Structures with movement joints in the walls and without matching joints in the base slab are prone to crack development, not only in the walls adjacent to the joint, but in the base slab below the movement joint. The cracks typically