Port of Los Angeles - Condition Assessment of Pre-stressed Concrete Piles

MATERIALS SERVICE LIFE
LIMITED LIABILITY COMPANY

Port of Los Angeles, CA

Owner
Port of Los Angeles

Client
Blaylock Engineering Group

Location
Los Angeles, California

Project Components
- Pre-stressed concrete piles
- Durability analysis
- Service life predictions
- Determination of degradation mechanisms

Services Provided
- Civil Engineering
- Laboratory Testing
- Service Life Modeling
- Materials Forensics

Completion Date
2003

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The inspection of a berth located in the WorldPort facility in Los Angeles, CA revealed the presence of cracks in some of the piles. This berth, constructed in 1969, consists of 1318 octagonal pre-stressed concrete piles.

MSL's input in this project was to determine the causes of the degradation of the cracked pre-stressed concrete piles and provide a predictive analysis of the residual service-life of these piles exposed to seawater using a unique numerical model (called STADIUM).

MSL was able to identify the mechanisms responsible for the observed degradation using stereo-optical microscopy (SOM), light optical microscopy (LOM) and scanning electron microscopy (SEM). MSL also characterized the physical properties of concrete using various test methods and generated information on the porosity and ionic diffusion coefficient of the material.

The experimental results and the numerical simulations clearly indicated that the degradation of the piles was the result of a series of phenomena, both internal and external in nature. Not only did MSL's expertise revealed that degradation was well developed in the visually cracked piles, but also that uncracked piles (from visual observations) showed moderate levels of microcracking. In addition, test results clearly showed that chloride ions had penetrated the concrete piles.

Numerical simulations emphasized the influence of microcracks on the kinetics of chloride penetration and provided information on the microstructural alterations of concrete resulting from exposure to seawater. Considering the presence of microcracks in all piles, the corrosion of reinforcing steel was likely to accelerate in the future and, in that respect, corrosion was likely to become the primary cause of degradation of the piles in the future.