



# History of Latex in Portland Cement Mortars TDS 107

Contrary to popular belief and information promoted by relatively new entries into the field of latex fortified mortars, latex has been used in portland cement mortars for over 70 years and may well be one of the oldest continuously used additives in cement technology.

The earliest commercial use of latex in portland cement was in England, in the early 1920's. Natural rubber latex, imported from Malaysia, was introduced as a means of fortifying portland cement mortars used for repairing sea walls. Normal portland cement mortar in stone walls deteriorated from alternate exposure to salt, water, drying, and sun. Additionally, steel reinforcements were damaged by salt corrosion.

Consequently, the novelty of adding natural latexes (or rubber) to the portland cement to form a more impervious material became well accepted in the repairing and resurfacing of sea walls.

Involved with the installation of chemical resistant bricks and tiles in various industries; the chemical engineering trades promoted the use of latex mortars for bedding and grouting brick and tile in dairies, breweries and steel mills. By the late 1920's, more than 50% of all the natural latex imported into England was going into concrete work.

The Second World War interrupted the flow of natural rubber to the Allied countries and put a stop to the use of this vital wartime commodity in concrete work. Eventually, synthetic latexes were created to provide the critically needed tires, fan belts and other parts moving the convoys of the dueling armies, but their potential uses in other fields were for the time being left unexplored.

## **Modern Development and Manufacture**

It wasn't until the late 1940's that interest in the use of latex in portland cement arose again, this time in the United States. A young chemical engineer, Henry M. Rothberg, was managing a family tile, terrazzo and marble installation company when the problems inherent to installing these materials with the traditional "full mortar bed" became more and more evident to him. This full mortar bed was usually a 1:4 or 1:6 mixture of portland cement and sand applied at least 2" (50 mm), and sometimes up to 4" (100 mm) thick, on walls and floors where ceramic tile was being installed. This "thick bed method" was necessary in order to insure retention of sufficient moisture in the mortar to cure the portland cement. It is the supply of water over an extended period of time that allows the portland cement to "hydrate" or develop its strength. In essence, the strength of portland cement comes from the dry cement powder combining chemically with free water to form a dense, stone-like material.

Although these traditional methods of installing ceramic tile had been used for years, they were plagued by severe limitations. Having decided to dedicate himself to research into alternate methods of installing ceramic tile, Rothberg's search brought him to the Chemical Division of the U.S. Rubber Company (Uniroyal) in Connecticut. He became a consultant to the Naugatuck Chemical Division to develop the use of natural latex in the construction industry, primarily in the area of ceramic tile installations.

It soon became evident that natural latex could only be used as a portland cement additive under special conditions. Mixtures of portland cement and natural latex had a very short pot life and working times. In addition, a container of natural latex, if partially used and stored, would deteriorate rapidly and develop a rancid odor. Fresh latex in shipment was susceptible to freezing, which would make it unusable.

Rothberg became convinced that the natural rubber additives could never achieve a broad market because of their shortcoming. Familiar with the polymer processes, which the Naugatuck Chemical Division was using to make synthetic rubber for tires and for other industry applications, he initiated research into developing a polymer that had all of the properties of natural rubber, such as elasticity, water resistance and durability, plus the properties necessary to make it viable to the construction industry. These would include resistance to freeze damage, the ability to mix with portland cement and remain plastic for adequate working time, the ability to be stored in full or partial containers for extended periods of time without deterioration or spoilage.

After more than 300 synthetic rubber polymers had been prepared, tested and evaluated, a unique compound was eventually developed. Having all of the required properties, the new latex was introduced to the market as LATICRETE.

### **Growth of Competition**

In the early 1950's, it was a difficult mission to convince users that portland cement could be mixed with a liquid rubber to make a strong, durable mortar with all of the waterproof characteristics of portland cement yet some of the flexibility and other benefits of rubber. The new latex modified mortars would cure in thin applications, yet provide higher bond strength as well as the ability to resist thermal shock, physical vibration, and all the ravages of wind, rain, and frost that various climates could produce.

After years of diligent promotion and education, installations of ceramic facades using LATICRETE® Latex Thin-Set Mortars began to appear throughout the United States in California, the Midwest, the Northeast and Canada. Until the introduction of LATICRETE Latex Thin-Set Mortars, very few, if any, ceramic facades had been applied in the United States.

The 1960's saw the development by the Tile Council of America of a dry portland cement mixture containing water-soluble polymers and called "thin-set mortar". This dry powder required only the addition of water to make a cement paste that was suitable for adhering ceramic tile to sound concrete or masonry surfaces. With the promotional efforts of the Tile Council of America, this thin set or adhesive method became well known and widely accepted. While this acceptance and education of the user made it easier to explain LATICRETE Latex Thin-Set Mortars, and their benefits over both conventional portland cement and the dry thin-set mortars, they were left at a cost disadvantage.

Unfortunately, many of the earlier users of dry thin-set mortars were concerned with the immediate price only, and used this product indiscriminately for all types of ceramic and stone tile. Their indiscriminate use soon led to many problems and complaints because the dry thin-set mortar did not have inherent flexibility and was extremely rigid. It could not withstand deflection of the suspended concrete slab, or physical shock. The number of problems with 2" (50 mm) ceramic mosaics used on floors grew and faulty installations on suspended concrete slabs became frequent. Soon, cautions were being issued restricting the use of dry portland cement thin-sets and advising against undertaking certain difficult installations.

The industry was now finally ready to recognize the great benefits of latex modified portland cement mortars. After 15 years of persistently promoting the superiority of latex portland cement mortars, Rothberg's Research and Development team was being proved correct. LATICRETE Mortars solved many of the problems encountered with dry-set mortars and were suitable for installing ceramic tiles of every type on suspended concrete slabs, on exterior facades, in swimming pools and wherever difficult conditions existed.

As awareness and acceptance of this truly problem solving mortar additive spread, so did competition. Many of the original licensees of the Tile Council of North America who had produced only dry thin-set mortars and dismissed the need for a liquid latex additive, now began to try and imitate the LATICRETE additives. Without the amount of research, testing and quality control that had gone into the development of the original latex additives, imitation products that "looked just like LATICRETE" began to appear on the market. In addition, the latex physical properties and quality were often further compromised by these competitors due to cost considerations. When industry standards were established all the new entries clamored to be recognized. The products were far below the standards of LATICRETE. The LATICRETE standards remain the highest in the industry today; actually 200% - 300% above the national standards later established for thin-set mortars.

The latex modified cement mortar story was carried around the world and its use introduced in countries as far away as Africa, Australia and the European continent. LATICRETE remained at the forefront of this polymer technology revolution, solving the problems of the new methods of construction; lack of good workmanship and those posed by the product changes in ceramic tile and glass mosaics.

Manufactories of glass mosaics, which had been falling into disfavor with architects and owners because of the difficulty of installing them with rigid conventional mortar, began to recommend the LATICRETE® System for installing their materials. In the early 1960's unusual installations were made on the dome of the National Mosque in Kuala Lumpur, Malaysia, the Parliament buildings in Brunei, at the Kota Kinabalu Government buildings and at the B'hai Temple in Panama. Installations were also made possible in Northern Canada at the Saskatchewan Hydroelectric and in subway stations in the Toronto Metro.

The thin set mortar market is still in period of transition, with various groups more receptive than others to the need for a latex additive. Although architects and engineers readily accept the concept, there is still some resistance from contractors who do the actual installation work. One reason may be that ceramic or stone tile installation is a skill acquired through apprenticeship; a method once learned is used for a lifetime and passed on to helpers and apprentices with few novel approaches or new technology.

As ever, cost also plays a role in the decision of installation materials, and contractors are less likely to consider long-term or life cycle costs. An architect or owner recognizes that he may pay from \$10.00 to \$25.00 per square foot for ceramic installations. The difference between the cheapest product available, and the latex mortar which gives the highest possible performance, is almost negligible when compared to the total price of the installation, or if compared to the cost of repairing or replacing a poor installation. Still, many tile contractors refuse to recognize that this can mean the difference between success and failure, and latex admixtures actually provide very low cost insurance against failures.

The unique properties of latex modified portland cement are now well proven and documented by the hundred or thousands of installations that relied on LATICRETE during the past 50+ years. Although a wide variety of latices have now been introduced to the market, some offering acrylic latices, others neoprene latices, and others still synthetic rubber latices, there is only one company that has been continuously involved for over 50 years in the development and production of latex mortars and has earned the reputation as the industry leader. LATICRETE offers the same high quality materials today, made to the same exacting specifications, as those that have undergone over a quarter of a century of proven history under every type of job-site condition.

LATICRETE International has chosen to produce material of a high quality and to maintain that quality. Henry Rothberg - - inventor, promoter, and Chairman Emeritus of the company he founded on years of original research -- insists on the same quality and the performance of the product today as originally made, and the critical installation today will have the same assurance of success as those that have withstood conditions for over 50 years.

A staff of architects, engineers, chemists and technicians are constantly testing performance, improving products and investigating project applications for LATICRETE materials. LATICRETE Technical Services, who aid architects in developing specifications and providing field assistance to insure permanent and trouble-free installations, are an integral part of the LATICRETE System. There may now be many "look-alike" products, but there is only one LATICRETE which has been time and job proven worldwide, and which continues to lead the industry with innovative materials and back-up services.

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