# Rehabilitation of concrete walls using thermal insulation

# Rehabilitation of Concrete Walls using Thermal Insulation

**Helmut MARQUARDT**
Prof. Dr.-Ing.
FH Nordostniedersachsen
Buxtehude, Germany

Helmut Marquardt, born 1956, received his civil engineering degree and doctor's degree from the Technical University of Berlin, 1983 and 1990 respectively. Since 1993, he is Professor in Buxtehude near Hamburg

## Summary

Exterior walls of concrete buildings frequently exhibit surface deterioration due to corroding reinforcement. Laboratory and field experiments show that it is possible to arrest the rebar corrosion in exterior walls of concrete buildings in Central or Eastern European or similar climates by additional thermal insulation. This method makes it possible to arrest the rebar corrosion without the usual concrete repair and at the same time to save heating energy.

## 1. Introduction

Exterior walls made of reinforced concrete often show surface deterioration due to rebar corrosion. Hand-applied concrete repair of these walls is expensive and the results may be imperfect. On the other hand the thermal insulation of these walls often is not sufficient according to today's standards. It can be demonstrated by diffusion calculations that it is possible to dry the exterior walls of concrete buildings in Central European or similar climates by attaching an additional thermal insulation to the outside of these walls. To verify this theory the following laboratory and field experiments were made.

## 2. Experiments

Accelerated carbonated concrete specimens with in advance weighed steel bars were stored in different relative humidities. Later the specimens were investigated for steel corrosion (fig. 1):

- All steel bars showed a basic corrosion caused by the carbonation of the concrete specimens.
- After four years of investigation the basic corrosion level did not change in specimens which were stored in climates with a relative humidity of 60 to 80 %.
- When stored in 90 % relative humidity the rebar corrosion in the specimens showed a significant growth over the time.

To verify the above mentioned theory long-term field tests were made at a dwelling in Berlin. Temperatures and moistures in the concrete sandwich exterior walls with and without additional thermal insulation were recorded for more than five years (fig. 2): The outer layers as well as the bearing layers of the sandwich walls were drying behind the additional thermal insulation. After a few years the concrete moisture was in an equilibrium to the measured relative humidity of 30 to 70 %.

## 3. Conclusions

The above mentionded experiments show that steel corrosion in reinforced concrete walls with additional thermal insulation can be arrested because after some years of drying the concrete moisture is in equilibrium to not more than 80 % relative humidity to the surrounding atmosphere (fig. 3). Another corrosion protection (as used in usual concrete repair) is not necessary.

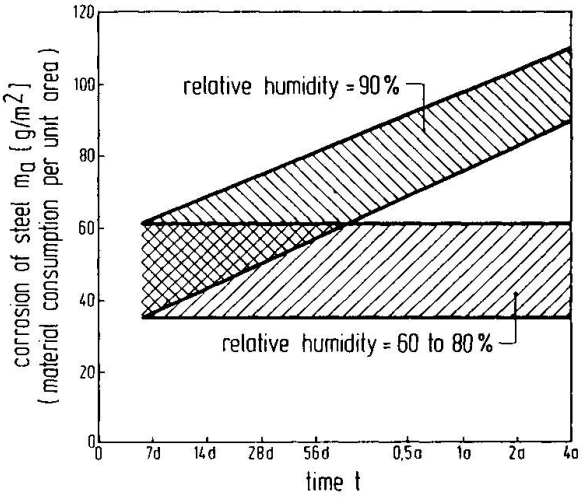


*Fig. 1 Mass losses of rebars in carbonated concrete specimens stored at different r.h.*

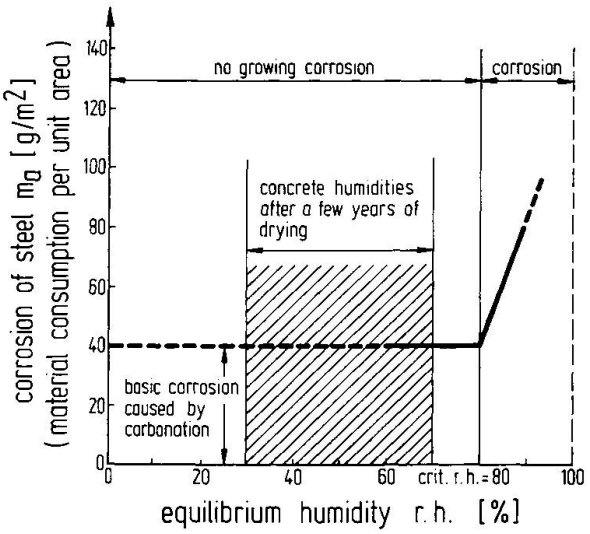


*Fig. 3 Scheme of arresting rebar corrosion in concrete exterior walls using additional thermal insulation*

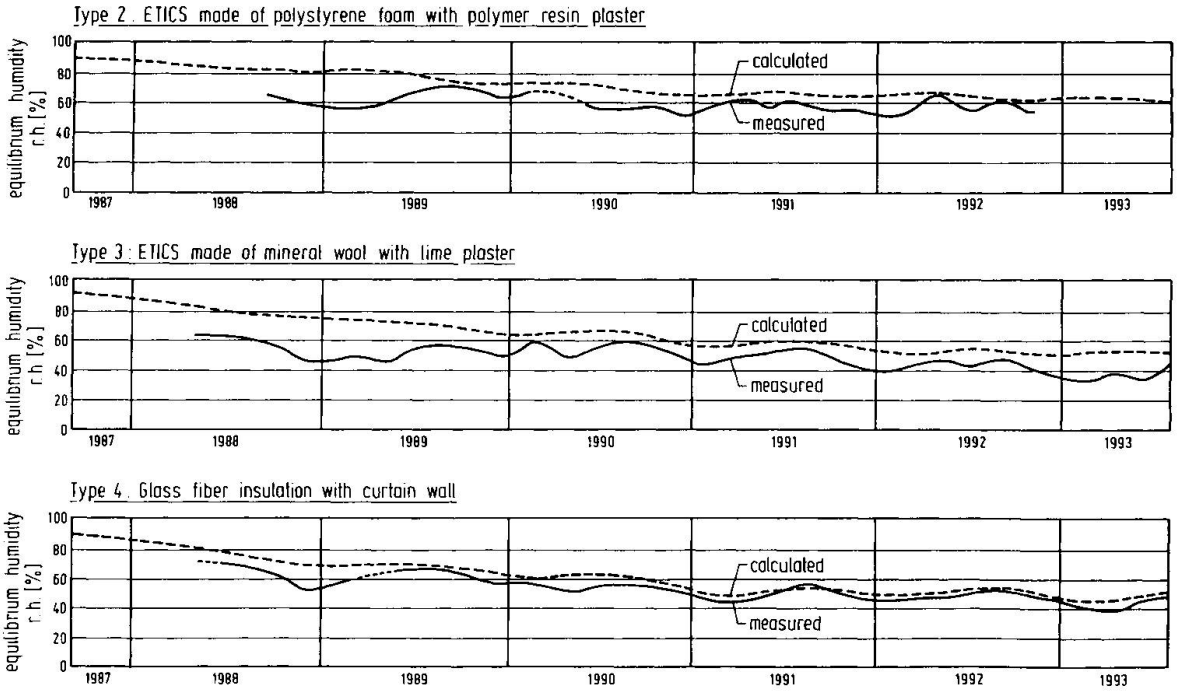


*Fig. 2 Measured and calculated equilibrium humidities in the outer layers of concrete sandwich exterior walls with additional thermal insulation*