

Contributing human and organizational factors for the failure of balconies in Maastricht

Karel C. Terwel

PhD MSc

Delft University of Technology / IMd
Consulting Engineers

Delft, The Netherlands

k.c.terwel@tudelft.nl

Karel Coenraedt Terwel (1975) returned to the University after 7 years of building practice. As assistant professor he teaches structural design and does research into human and organizational factors influencing safety. Currently, he is also part-time working in building industry as a structural engineer.



Contact: k.c.terwel@tudelft.nl

Abstract

In 2003 five balconies of an apartment building in Maastricht, the Netherlands, collapsed, resulting in two fatalities. The building was just completed.

Forensic investigations showed that detailing of the reinforcement in the precast concrete slabs of the balconies was questionable. Several design changes hampered clear force flow through the structural elements. Inappropriate design fixes were made after discovery of some cracks that could not avoid failure of a lower concrete ridge, resulting in a progressive collapse of the 5 balconies.

Profound investigation of this case showed various human and organizational factors, that might have contributed to the failure. A complex process, with several design changes and many involved parties increased the probability of failure. Furthermore, insufficient communication, inadequate checking and inadequate follow up to warnings were present.

This paper will give insight in technical causes of the failure and of contributing human and organizational factors. These underlying factors will be systematically studied, by using a theoretical framework.

Keywords: forensic structural engineering, structural failure, human and organizational factors

1 Introduction

In 2003 a residential building called Patio Sevilla was delivered. In the evening of April 24 2003, five balconies of this apartment building collapsed, resulting in two fatalities. Several major investigations were started by insurance companies, police and criminal court.

To focus on learning points related to structural safety, it is worthwhile to investigate failure cases with a framework of set parameters.

Terwel set up a framework with possibly influencing factors for structural safety [1,2]. The framework is based on critical success factors derived from management literature and factors from safety science. In chapter 3 the framework will be explained.

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