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The European experts in fire safety

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Efectis Nederland-Report

2006-Efectis-R0560

Determination of the behaviour of a concrete slab protected with Promatect-H boards, anchored with fischer anchors,type FNA II 6 x 30 M6 A4 or type FNA II 6 x 30 A4 (Aisi 316 RVS A4), under RWS (Rijkswaterstaat) fire conditions (thermal properties of boards)

Date	November 2006
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Number of pages	10
Number of appendices	4 (A to D)
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Project name	resistance to fire
Project number	2006067

This report is issued by the TNO company Efectis Nederland BV (previously **TNO** Centre for Fire Research). TNO decided, in response to international developments and requests by customers, to collaborate with two European Egolf partners, both highly experienced in fire safety: the Norwegian **Sintef/NBL** and the French **CTICM**. Thus, through scaling up, a more comprehensive service of high quality and a wider range of facilities can be offered. In order to achieve this, the fire safety related activities of the partners involved have been privatised in this collaboration. With respect to TNO this has lead to the privatisation on the 1st of July of the activities of the TNO Centre for Fire Research via the establishment of the company Efectis Nederland BV.

Contents

1 Introduction

This report is supplementary to Efectis report 2006-CVB-R0559 and gives the measured interface temperatures between the Promatect-H boards and the concrete slab measured during the fire test on the 15th of August.

2 Subject

Board material, type Promatect-H , thickness 27.5 mm, attached to the concrete with fischer anchors type FNA II (Aisi 316 rvs A4) M6 or type FNA II (Aisi 316 rvs A4).

3 Investigation

Determination of the temperature development at the interface of concrete and board material during heating for a period of 3 hours in accordance with the Rijkswaterstaat (RWS) time-temperature curve.
The tested specimen consisted of a concrete slab with Promatect-H boards anchored to the slab with fischer anchors type FNA II (Aisi 316 rvs A4) M6 or type FNA II (Aisi 316 rvs A4).

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5 Place and time of the research

The test was conducted at the laboratory of Efectis Centre for Fire Research in Rijswijk, the Netherlands.
The concrete slab was casted at the beginning of 2005.
The boards were installed in week 33 of 2006.

The fire test was conducted on 15th August 2006.

6 Date and number of the report

November 2006; Efectis report 2006-CVB-Rxxxxx.

7 Materials

7.1 Reinforced concrete slab

7.1.1 Dimensions
1450 x 1450 x 150 mm.

7.1.2 Concrete grade
B35

7.1.3 Reinforcement
Two steel reinforcement meshes, diameter 8 mm, mesh width 200 mm. Concrete covering over the reinforcement on the bottom and the top of the slab: 25 mm.

7.1.4 Instrumentation
Eight thermocouples were installed on the interface of concrete and cladding at the locations indicated in Figure 2.

7.2 Promatect-H boards

The Promatect-H boards with a thickness of 27.5 mm were attached to the bottom of the concrete slab (side with thermocouples).

7.3 Fixation

See Efectis report 2006-CVB-R0559.

8 Conditions

8.1 Before heating

The test specimen was placed in the laboratory of Efectis Centre for Fire Research with ambient conditions temperature 20 ± 10°C and relative humidity 50 ± 10 %

8.2 During heating

The test specimen was placed on the furnace for preliminary testing of Efectis Centre for Fire Research and the side with the boards was heated for three hours in accordance with the Rijkswaterstaat fire curve.

9 Measurements

9.1 Density and moisture content

On the date of the test, the density [1] and moisture content [2] of the Promatect-H boards was determined by weighing the boards before and after drying.

Promatect-H boards
Density : 869 kg/m^3
Moisture content : 3.0 %

9.2 Fire test

9.2.1 Conditions

The test specimen was placed on the top of the furnace for preliminary testing of the Efectis Centre for Fire Research with the board side down.
The interior dimensions of the furnace were approximately. 120 x 120 cm.
The time-temperature curve is shown in figure 1, see page 8.

9.2.2 Measurements

The following aspects were measured and recorded during heating:
- The gas temperatures within the furnace with 3 thermocouples (see figure B1);
- The temperatures at the interface of concrete and cladding with 8 thermocouples (see figure B2)

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[1]) determined before drying
[2]) determined after drying for 24 hours at 105°C

10 Observations during heating and after cooling

10.1 During heating

See Efectis report 2006-CVB-R0559.

10.2 After heating and cooling

See Efectis report 2006-CVB-R0559.

11 Results

The principle results are mentioned in the table below.

Time from the start of heating in minutes	Average temperature at the interface in °C	Maximum temperature at the interface in °C
0	21	22
120	309	338
180	370	405

In the TNO-RWS procedure "fire protection for tunnels" TNO-report 98-R1161 the maximum allowed interface temperature for immersed tunnels under RWS fire conditions is 380°C.
This temperature was reached after 157 minutes.

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FIGURES

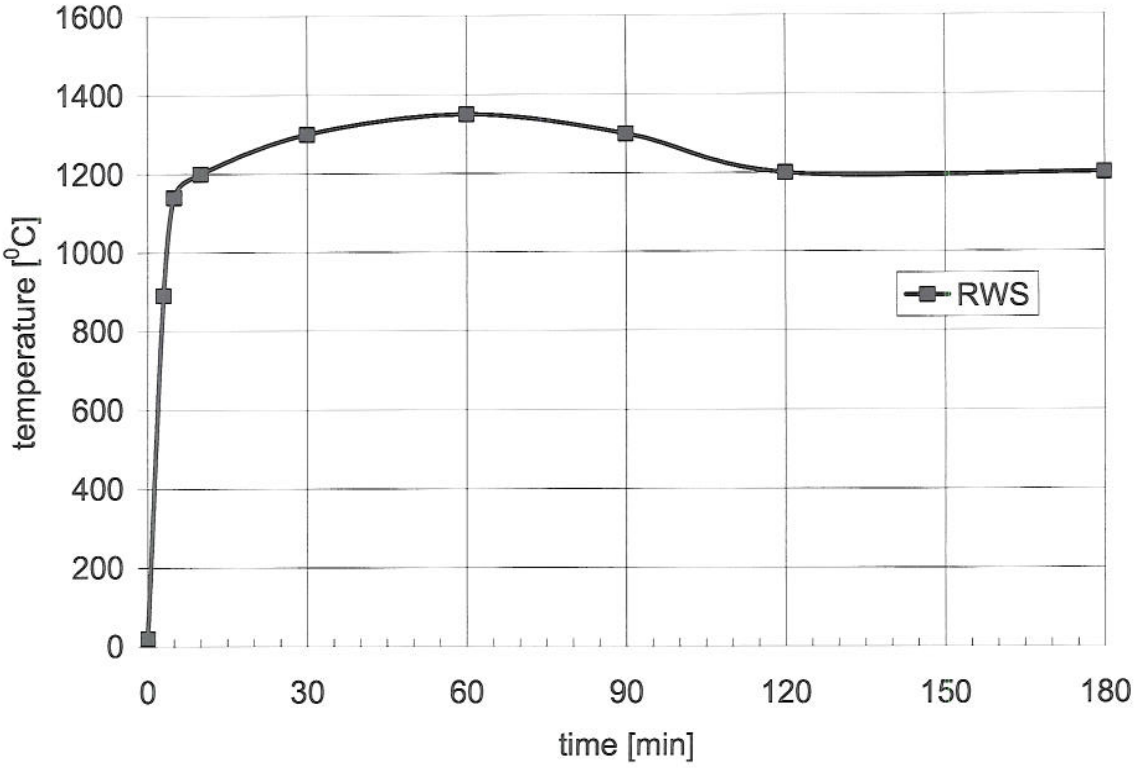

Figure 1 : Rijkswaterstaat time-temperature curve.

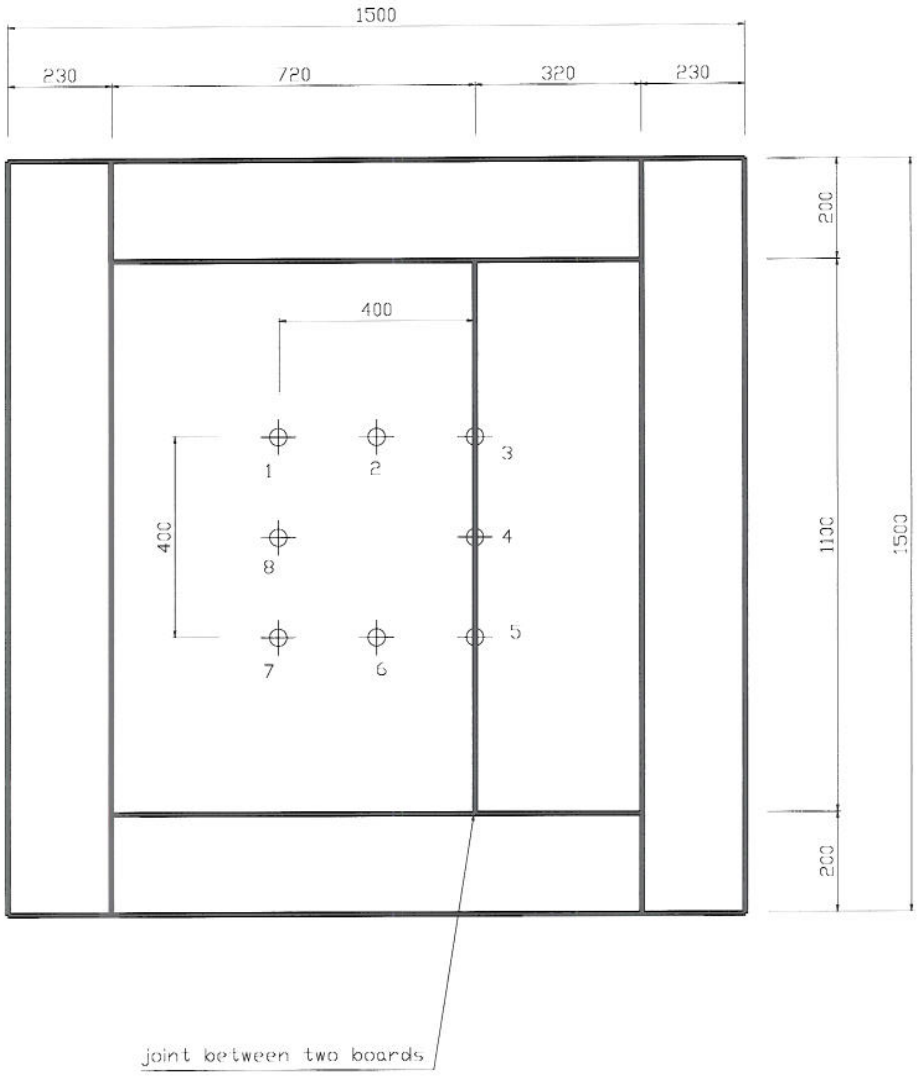

Figure 2 : positions of the thermocouples

A Observations

During heating
See Efectis report 2006-CVB-R0559.

After heating and cooling
See Efectis report 2006-CVB-R0559.

B Measured temperatures

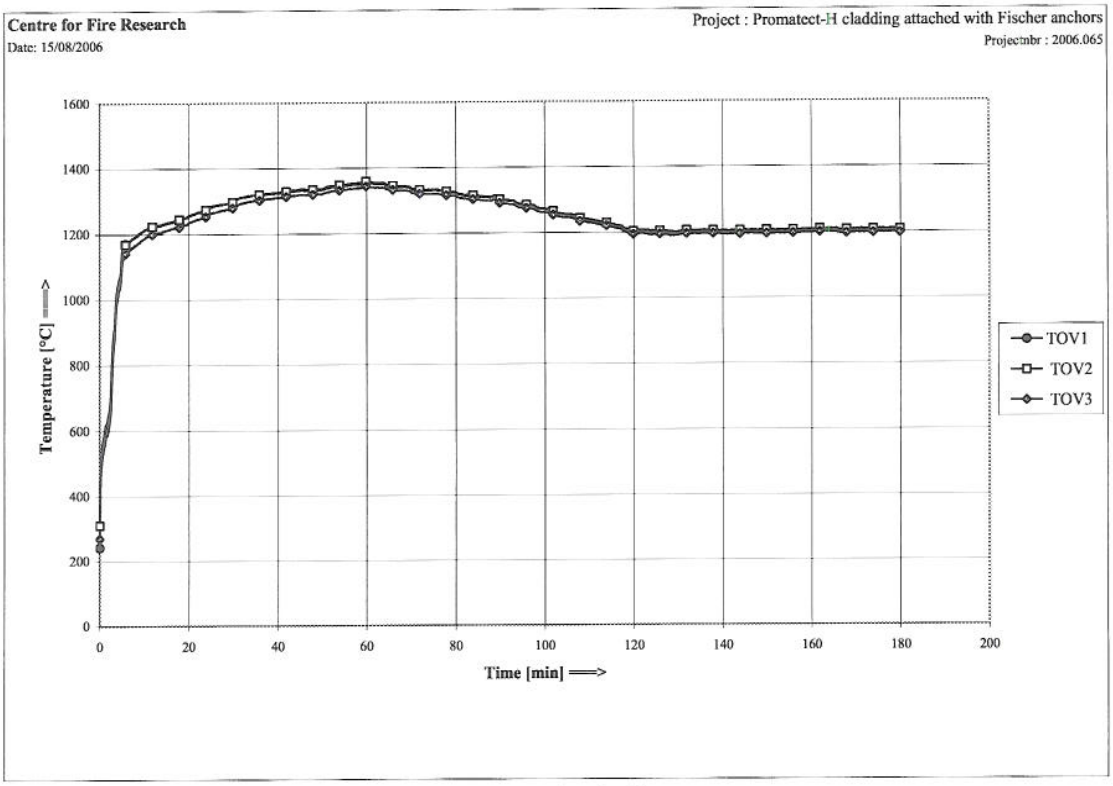

Figure B1 : measured gas temperatures in the furnace

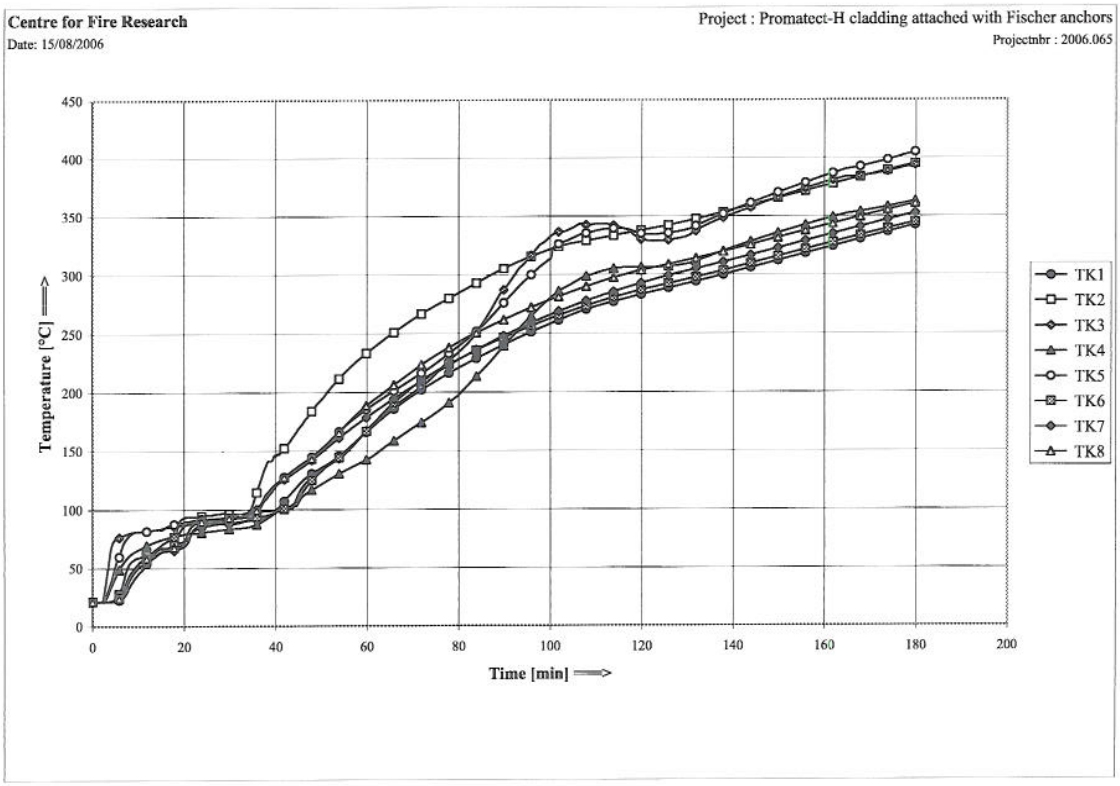

Figure B2 : measured interface temperatures

C Photos

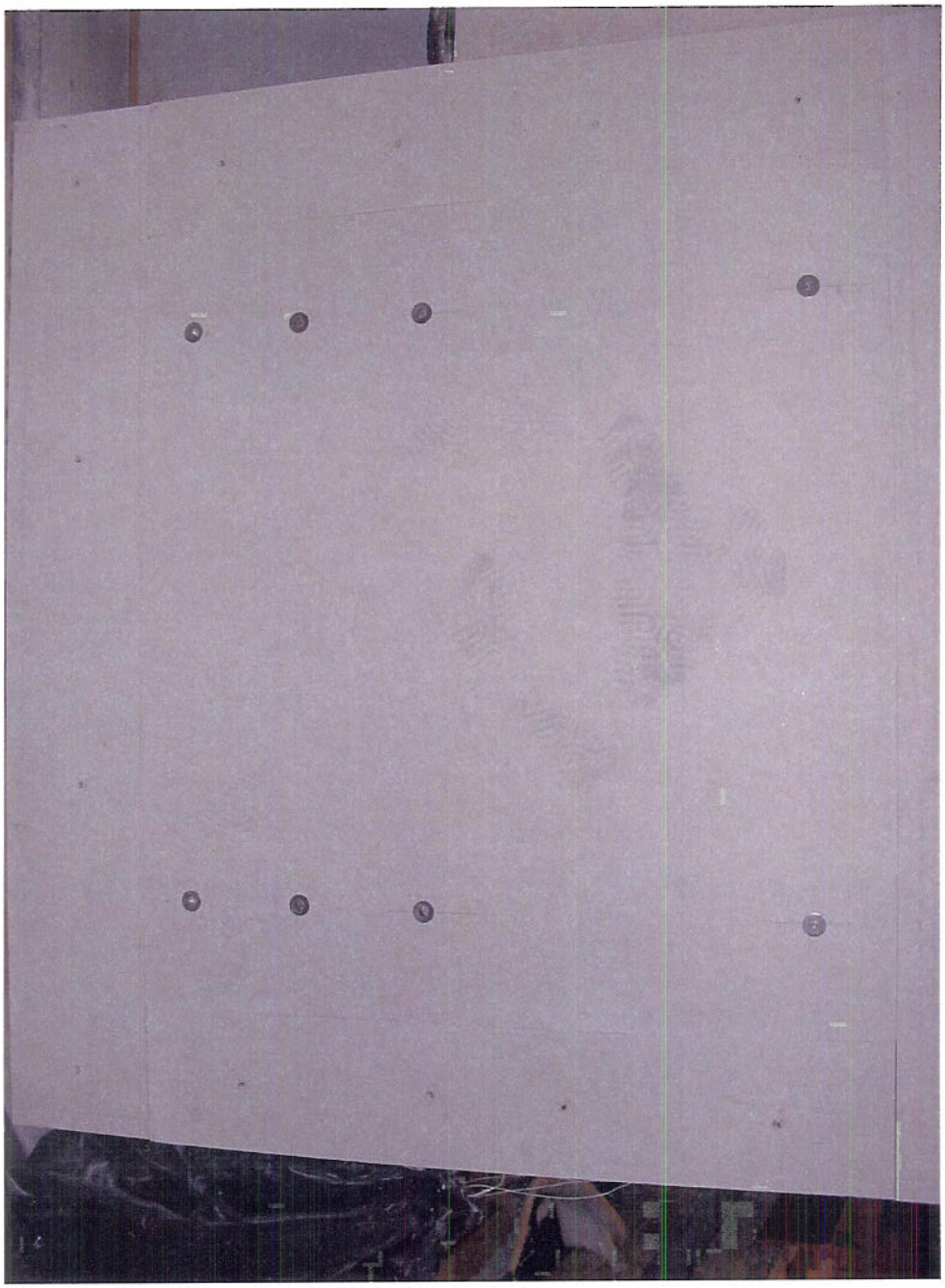

Photo 1 : view of the exposed side before the test