TNO-report

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Strength test of a prototype Aluminium MOJO barrier

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1. INTRODUCTION

On request of Brinkman & De Boer b.v. a strength and sliding tests have been carried out by TNO Building and Construction research for determining the ulitmate strength of a prototype of Aluminium MOJO crowd control barriers. The barriers are manufactured by Brinkman & De Boer B.V., Nijland, The Netherlands. The prototypes concern 2 barriers with square top rail and 1 barrier with circular top rail. The purpose of the testing was to establish insight into the strength and deformation behaviour of the barriers.

This report contains the results of the tests. In chapter 2 a brief description of the tested barriers is given. Chapter 3 describes the method of testing. In chapter 4 the results of the test are presented. The conclusions are contained in chapter 5.

2. DESCRIPTION OF THE BARRIERS

Since the only difference in the barriers is in the detailing of the top rail, of the three barriers supplied only one has been tested, namely a barrier with a square top rail. The dimensions of the barriers differ slightly from the traditional MOJO barriers but have not been noted.

3. METHOD OF TESTING

The barrier has been tested with regard to two different modes of failure:
- sliding without structural failure
- structural failure (sliding prohibited)

For the purpose of the test, the barriers have been placed on a smooth concrete floor. The crowd area of the barrier has been loaded by dead weight up to the following levels:
- 0 N
- 2 kN
- 4 kN
- 6 kN
- 8 kN
- 10 kN

The plan area of the base plate at the crowd side measures 0.725 x 1.0 m, so the dead loads applied represent the following loads per square meter: 2.8, 5.5, 8.3, 11.0 and 13.8 KN/m^2.

A horizontal force has been applied at the height of the centre of the top rail of the barrier. This force has been increased gradually until sliding of the barrier occured. The force and the horizontal displacement of the barrier has been measured continuously during the increase of loading. Also, the horizontal displacement of the top rail of the barrier has been measured.

In the first series of tests sliding was not prohibited, and the sliding load has been defined as the load where a displacement of 5 mm had occured.

In the second series of tests, sliding has been prohibited by placing a beam parallel to the barrier. In this case the horizontal displacement of the top rail of the barrier has been measured. Additional, two displacement transducers have been installed to measure the vertical uplift displacement of the barrier's base at the crowd side. The failure load has been defined as the load where an uplifte of more than 2 mm occured or where displacement of the horizontal rail increased without load increase, indicating plastic deformation in the barrier structure.

4. TEST RESULTS

4.1 Sliding tests

The results of the tests have been summarized in Table 3.

Table 1: horizontal sliding load in kN at various dead load steps

barrier	0 kN	2 kN	4 kN	6 kN	8 kN	10 kN
1	-	1.2	2.2	3.4	4.8	-

- indicates not tested.

4.2 Strength tests

The results of the tests have been summarized in Table 2. It indicates the horizontal failure load where either uplift or plastic deformation occurs, gives a specification of the type of failure (uplift, bending or a combination of these) and gives the horizontal displacement measured at the top rail of the barrier at the load where the onset of failure occurs.

Table 2: results of strength tests

result	0 kN	2 kN	4 kN	6 kN	8 kN	10 kN
horizontal load in kN	-	1.8	3.5	5.1	6.6	8.2
mode of failure	-	u	u	u	ub	b
displacement in mm	-	50	70	90	120	160

Note:
u: uplift without remaining bending deformation of frame
ub: uplift with some remaining bending deformation of frame
b: predominantly remaining bending deformation of frame

It appears that the predominant bending deformation occurs in the base frame, close to the connection to the vertical part of the barrier. Particular attention has been paid to the bracings of the barriers, but not instability of exceedence of strenght has shown in these parts of the barrier.

The width of the top rail amounts to 1.0 m.

5. CONCLUSIONS

From the test results, it can be concluded that the aluminium prototype of the MOJO barriers is able to withstand horizontal forces on the top rail of 5.1 kN/m without any (remaining) deformation in the barrier. A higher loads, a slight bending of the base frame near the connection to the vertical part of the barrier will show.

The sliding behaviour of the barrier does not significantly differ from the original (steel-type) MOJO barriers.

ANNEX A: PHOTOGRAPHS


H1S
600 KG
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TNO Bouw
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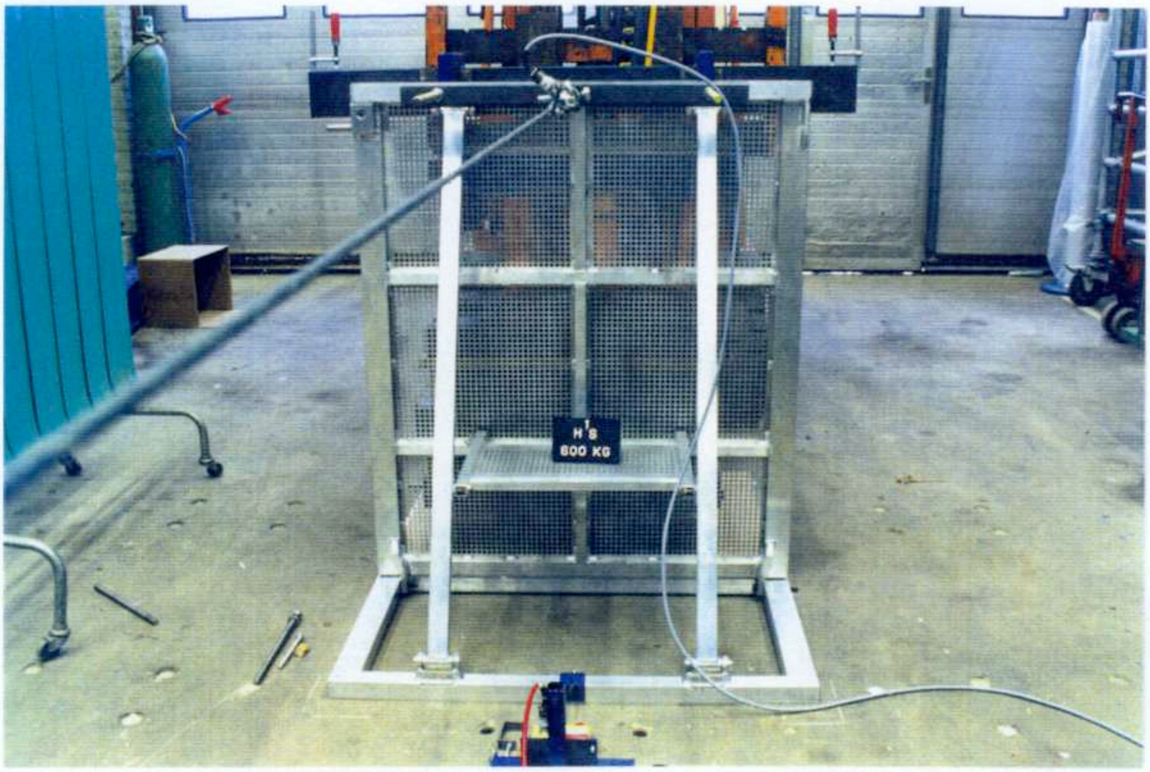
85
86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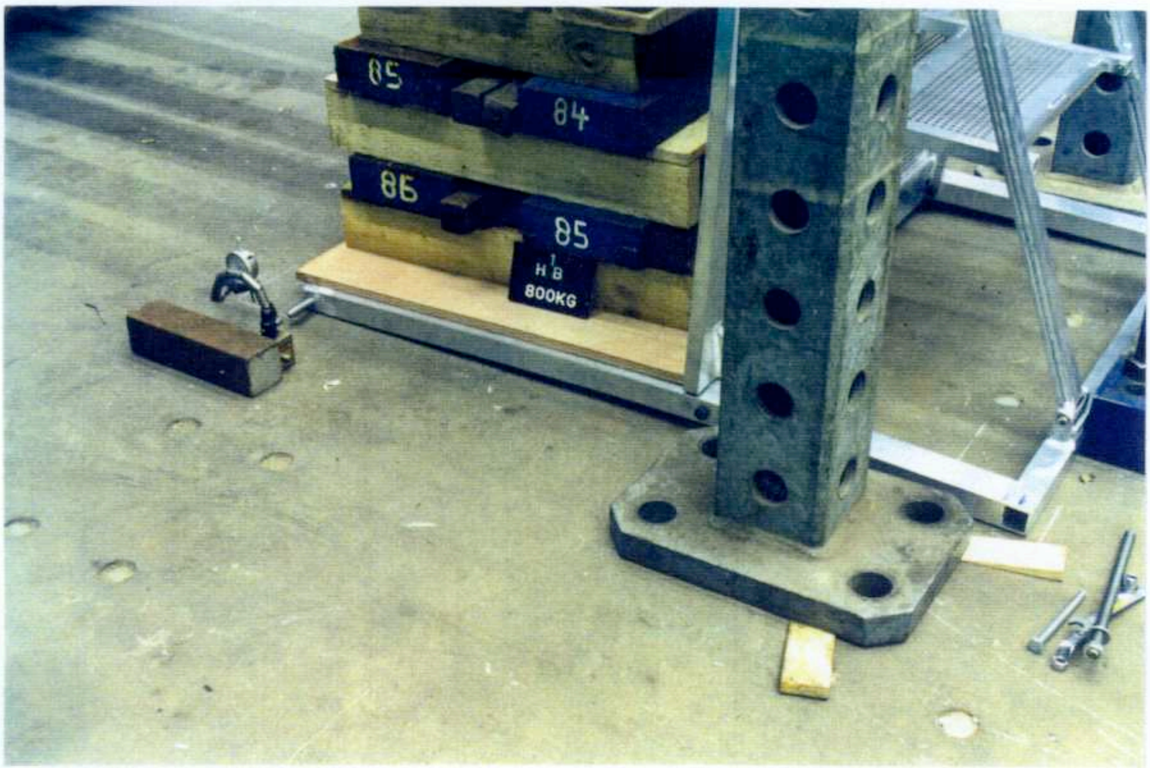
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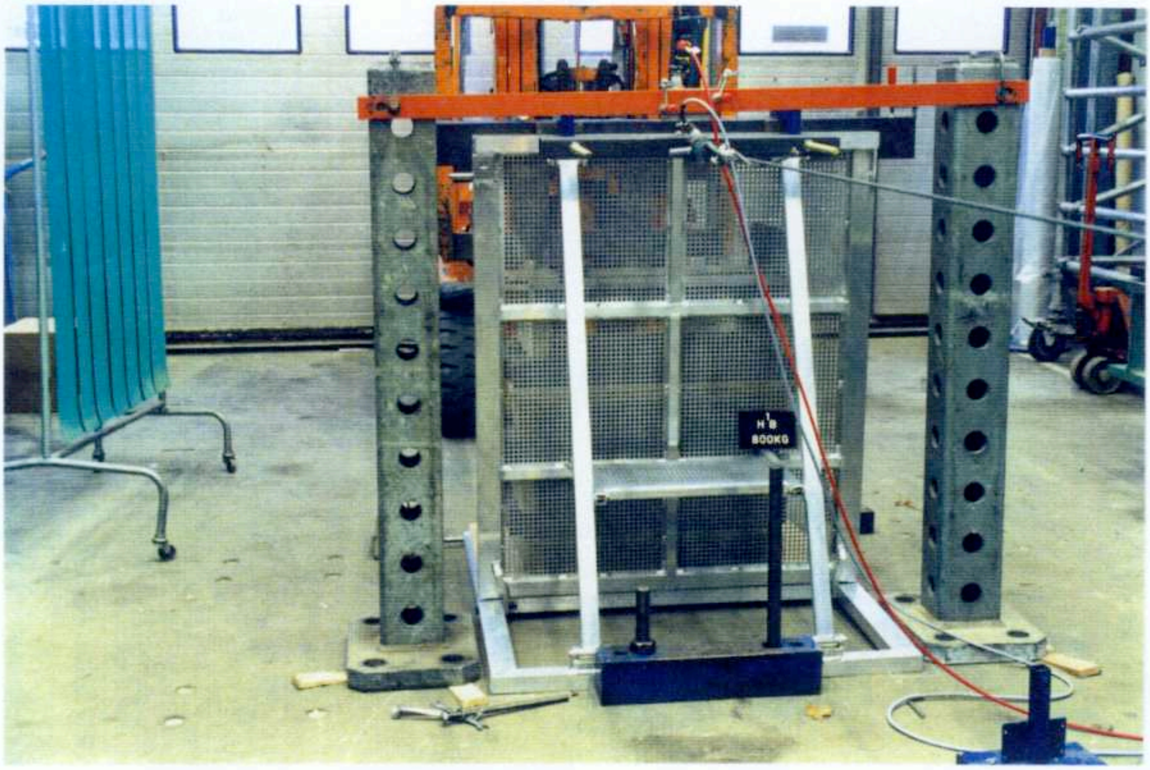
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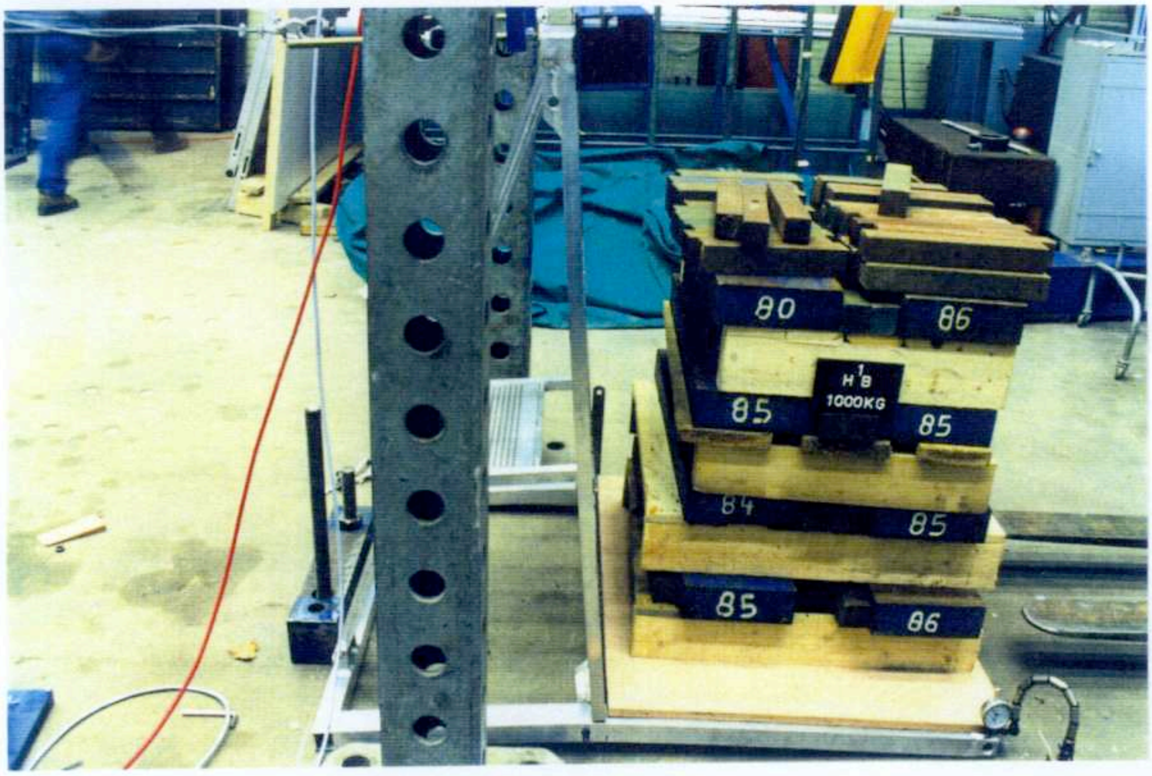
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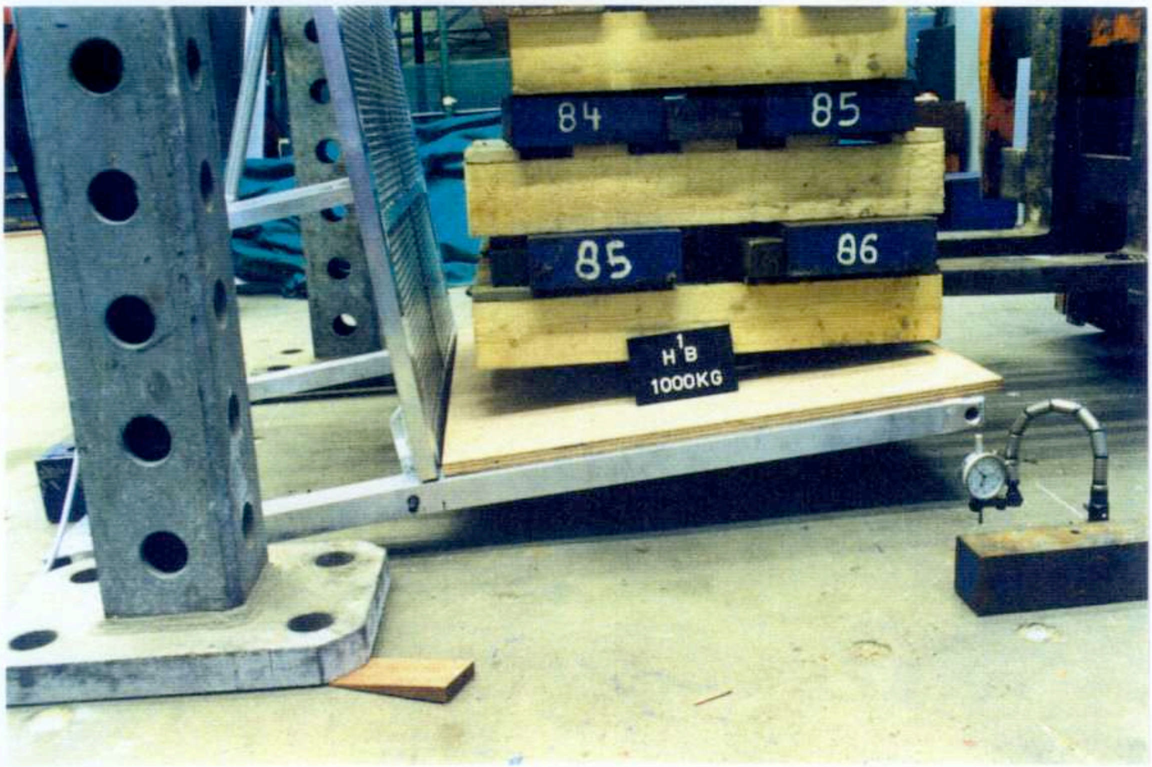
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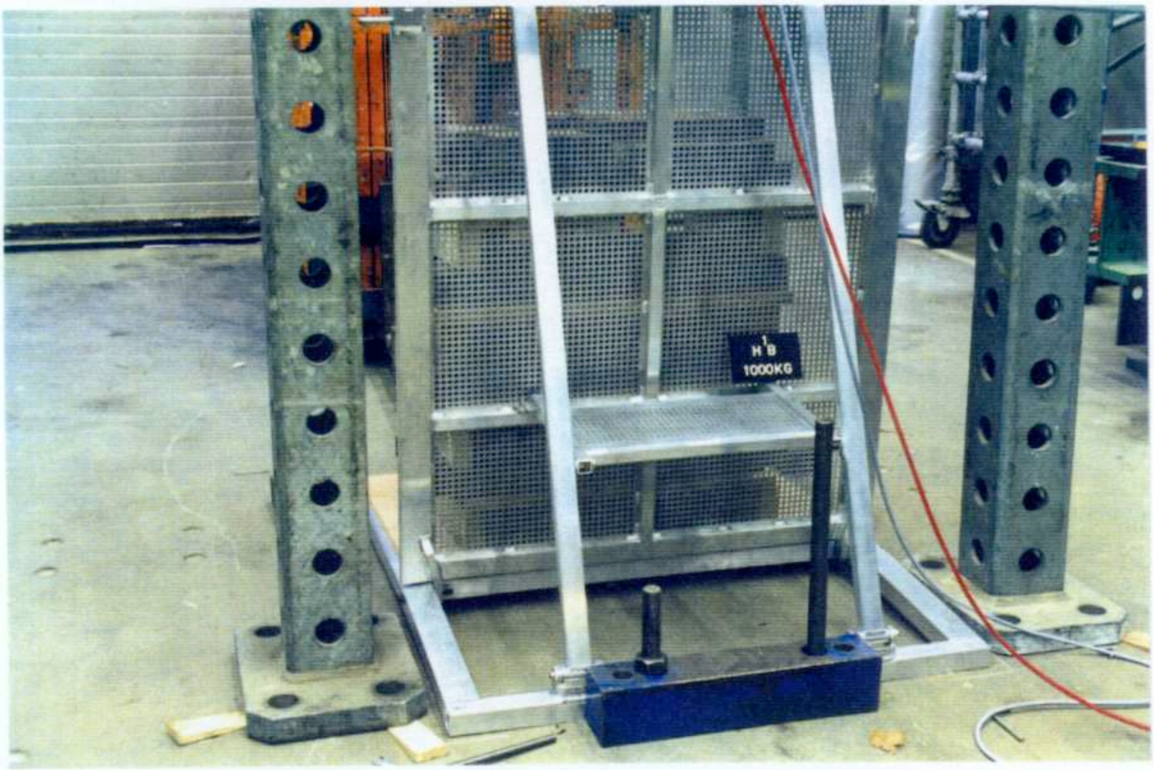

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