ANNEXE 3

NICHOLSON
NEFCG 131/89

TMS

Health and Safety Executive
TECHNOLOGY DIVISION

Summary sheet of FCG inspector's report

FCG *(block caps)*
NORTH EAST

Name of firm(s) *(block caps)*
SHEFFIELD WEDNESDAY FC

Address
Hillsborough
Sheffield

Area no./PI group no.
Dr C E Nicholson, Deputy Director, SEL 1 RLSD

Area (name)
South Yorkshire & Humberside

Copies to
Mr C Pertee PSI NE/FCG

Subject of report
Examination of Crush Barriers
Leppings Lane End Central Pen

FCG file no. NE/FCG/131/89

FCG job no. 14/M/13/89

Date of report 9th May 1989

Key words *(block caps)*
SPORTS GROUNDS
(BARRIERS)

Initiation
Verbal following major incident. (Initially via AD Area 14 to assist LA)

Date(s) of visit(s)
16, 17, 18 April 1989

Visited by
Mr J B Hibbs, SI NE/FCG (All Dates)
Yourself (All Dates)
See separate list of other H & SE staff involved.

Relevant papers
HMSO Code of Practice 'Guide to Safety at Sports Grounds'.

Persons seen (names and positions)

Mr D Perchon (Director - Health & Consumer Services),	Sheffield MBC 17 4 89
Mr P Jackson, SEHO, " " "	(All Dates)
Mr M Ford, EHO " " "	(All Dates)
Mr W Eastwood, Eastwood & Partners, Sheffield)	Club Safety Consultants & Testing
Mr R Eastwood, " " ")	Engineers 17/4/89

Summary

Detailed examination of both halves of the central pen, the entrance/exit tunnel and the crush barriers was made.

Site measurements were obtained and photographs were taken.

Barrier tests by Mr Eastwood and his team were witnessed which revealed that the barriers tested met the load requirements for type 'A' installations as shown in the relevant Code of Practice.

Barrier heights and spacings did not fully agree with the recommendations in the Code of Practice 'Guide to Safety at Sports Grounds'.

JB Hibbs

Author's name J B HIBBS
Specialist Inspector (Mechanical Engineering)

Other HSE staff present

1.	Mr S Nattrass, Area Director, Area 14	16/4/89
2.	Mr M James, PSI, HQ TD3	17/4/89
3.	Mr C Pertee, PSI Construction NE/FCG	17 and 18/4/89
4.	Mr D Waterhouse, G7 RLSD SEL1	17/4/89
5.	Mr P Heyes, G7 RLSD SEL 1	17/4/89

NE/FCG/131/89

14/M/13/89

TECHNOLOGY DIVISION
NE FIELD CONSULTANT GROUP
HEALTH & SAFETY EXECUTIVE
WOODSIDE HOUSE
261 LOW LANE
HORSFORTH
LEEDS
LS18 5TW

9th May 1989

Dr C E Nicholson
Deputy Director
SEL 1
RLSD
SHEFFIELD

SUBJECT: EXAMINATION OF CRUSH BARRIERS

USER: SHEFFIELD WEDNESDAY FCG, HILLSBOROUGH, SHEFFIELD

MAKER: NOT KNOWN

TESTED BY: EASTWOOD & PARTNERS, KINGFIELD ROAD, SHEFFIELD (LAST TEST JULY 1988)

INTRODUCTION

I visited the Sheffield Wednesday Football Ground on the 16th, 17th and 18th of April 1989 at the request of Mr S Nattrass, Area Director, H & SE, South Yorkshire & Humberside Area following the tragedy which occurred on the 15th of April 1989.

The initial purpose of my visit was to assist in investigating the incident with particular reference to the crush barriers.

Other members of H & SE staff present during the first 3 days of the site investigation are shown on the attached list.

During the visits I spoke to Mr D Perchon (Director - Health & Consumer Services, Sheffield MBC), Mr P Jackson (SEHO, Sheffield MBC) and Mr M Ford (EHO, Sheffield MBC).

Mr W Eastwood and Mr R Eastwood of Messrs Eastwood & Partners, Kingfield Road, Sheffield were also present on site on the 17th of April 1989 and conducted a number of tests on the crush barriers which were witnessed.

CRUSH BARRIERS

Two types of barrier were seen in the central area, the older type having half 'A' frames embedded in the concrete steps were reported to have been installed in 1966.

New types of barrier utilizing steel box section support pillars had been installed at several locations and again the pillars were embedded in the concrete steps. Both types of barriers carried horizontal tubular type handrails of between 60 and 75 mm diameter. In general the spacing across each handrail between vertical supports was of the order of 1.23 m (7 ft 6 inches). Barrier heights varied between 0.83 and 1.15 m and the corresponding details for each barrier in the central pen are given in Table 1 and on Ralph Brade & Associates drawing No.1340/02.

Barrier height recommended by the Code of Practice 'Guide to safety at Sports Grounds' should be a minimum of 1.02 metres with a preferred height of 1.1 metres.

A site plan and end elevation is shown in Fig. 1 which also indicates spacings between barriers etc and confirms the position of the two sections which collapsed at barrier no. 124A. Similar details are also included in Ralph Brade & Associates Drawing No. 1340/02.

A sectional view of the entry/exit tunnel is shown in Fig. 2 and in Ralph Brade & Associates Drawing No. 1340/03.

A general view of the collapsed section of barrier 124A is shown in Fig. 3 where it can be seen that both of the horizontal tubes had been severely bent prior to the bending over and collapse of the leg supports. The bottom ends of the latter had remained in position in the ground although the right hand front column at the end of the barrier had broken away a small section of the concrete step.

The failure at the top of the central leg of this section of barrier designated 124A/1 is shown in Figs 4 and 4A where it can be seen that the strap has remained in position although distorted and the rear leg has torn from a point adjacent to the lower bolt hole. The horizontal tubes which were badly corroded in the areas underneath each strap at the top of the respective pillars appear to have fractured after the support pillars have been bent over and although the tube section is considerably thinned it appears to have been capable of carrying sufficient shear force at the strap positions to enable the vertical pillars to be bent over under the pressure generated by the crowd.

An inner view of the top end of the right hand pillar at connection 124A/4 (see Fig. 5) indicates the extent of corrosion underneath the strap and underneath the pillar head behind the gusset plate and again confirms the tearing mode of failure from the inner edge of the rear pillar at the section through the lower bolt hole. The metal angles forming the legs were nominally 50 mm x 50 mm x 6 mm thickness (2 inch x 2 inch x 0.25 inches).

The fracture of the tube section from connection 124A/4 is shown in Fig. 6 where it can be seen that the end of the tube has been bent and approximately half its section has broken away at the time it separated from the pillar connecting strap.

The tube which was originally in position between connections 124A/2 and 124A/3 is shown lying on the terrace steps in Fig. 7 and the fractures at the corresponding ends of this tube are shown in Figs 8 and 9 respectively. The grass at the left hand side of the fracture in Fig. 8 confirms that the tube was recovered from the pitch after the incident.

The top of pillar 124A/2 is shown in Fig. 10 where extensive corrosion can again be seen, particularly at the gusset plate which has corroded through. This connector had been repaired at some time during its life and it can be seen that a section of steel tubing had been inserted inside the original tubing. The insert was found to be 50 mm OD x 35 mm ID and was approximately 127 mm long (2.0 inches OD x 1.375 inches ID x 5 inches long).

BARRIER TESTS

During my visit to the football ground on the 16th of April 1989 I was shown a test rig used for load testing of the crush barriers under the supervision of Mr W Eastwood of Eastwood & Partners, Kingfield Road, Sheffield who were the Engineering Consultants to the Club and carried out routine tests annually on barriers at the terraces. A general view of the front section of the test rig is shown in Fig. 11. The front pusher arms of the rig are designed with various fulcrum points to enable a single load from each of the main pusher arms to be distributed to 4 points equally spaced along each section of barrier rail. The

main pusher arms were driven forward by a pair of hydraulic rams which were pressurized from a small hand operated pump unit with calibrated load gauge. A copy of a calibration certificate for the test rig is shown at Appendix I.

During testing, the forward load on the barrier was gradually increased to a figure of 1.4 tons in each of the main pusher arms and simulated a load of 400 lbs/ft run across the barrier as recommended for class A barriers in the Code of Practice 'Guide to Safety at Sports Grounds' at Annex C paragraph 1. The forward deflection of the barrier rail was measured as shown in Fig. 12 and the tests were conducted in accordance with the Code of Practice.

The left hand end of barrier 136 in the south west pen adjacent to the central pen was found to deflect by approximately 16 mm in the forward direction on application of the test load. The barrier recovered fully at the end of the test.

Similar tests were performed on barrier 137 in the central pen area and this was found to deflect by 13 mm on application of the test load (400 lbs/ft run). Barrier 137 recovered fully at the end of the test.

A further load was applied to this barrier to initiate its failure and at 500 lbs/ft run the deflection was 20 mm which gradually increased to 29 mm. The barrier recovered to 11 mm and had undoubtedly failed under this load. The condition of the barrier after this overload test is shown in Fig. 13. Initiation of fracture/tearing had been produced at the central leg immediately below the gusset plate and adjacent to the lower of the 2 rivets in the rear section of the leg as shown in Fig. 14. The commencement of twisting of the leg is shown in Fig. 15.

Further tests were also carried out on barrier no. 128 which was seen to have already been damaged. One of its tubes was bent outwards by approximately 55 mm and was also bent downwards by approximately 25 mm close to its centre. These tests were again carried out in accordance with the guidance given in the Code of Practice and at a load of 1.4 tons (400 lbs/ft run) the rail deflected by a further 16 mm and returned to approximately 4 mm. These figures indicate a 75% recovery as required by the Code of Practice.

The load was then increased to 1.75 tons and later to 2.1 tons where a deflection of 40 mm was recorded together with a recovery back to 13 mm. This severe overload was equivalent to approximately 600 lbs/ft run on the barrier but its recovery was outside the recommended levels.

CONCLUSIONS/BARRIER TESTING

The barriers tested were seen to meet the load testing requirements of the Code of Practice 'Guide to Safety at Sports Grounds' Appendix C Para 1 for class 'A' type. The results of tests carried out in July 1988 on the barriers in the central pen also confirm that the units in this area met the load test requirements of the Code of Practice at the time of their last test although barrier 124A did not recover fully until the third of the 3 tests recommended by the Code of Practice. (See Appendix II).

SITE DATA

As indicated earlier in the report a site plan to scale is shown in Fig. 1 and a sectional plan of the entry/exit tunnel is shown in Fig. 2. These details are also shown in Ralph Brade & Associates Drawings Nos. 1340/02 & 1340/03 respectively.

CDW

DRAFT

NE/FCG/131/89
14/M/13/89

Technology Division
NE Field Consultant Group
Health & Safety Executive
Woodside House
261 Low Lane
HORSFORTH
Leeds LS18 5TW

22nd May 1989

Dr C E Nicholson
Deputy Director
SEL 1
RLSD
SHEFFIELD

(For insertion at Page 4 of my report prior to 'Conclusions/Terrace Layout'.)

I also examined gates 3 and 4 leading from the central terrace area onto the pitch. These gates were of similar construction and opened outwards to the left as viewed from the terrace.

The effective width of the gate openings were found to be 0.81 - 0.82 m (32 inches approx) for gate 3 and 0.77 - 0.79 m (30.75 inches approx) for gate 4. The gaps in the low wall at the gate positions were found to be 1.0 m wide (39.4 inches) and the walls were approximately 1.07 m high (42 inches) from the lowest terrace step.

The effective opening heights at the two gates were found to be 2.11 - 2.16 m (83 - 85 inches).

It was noted that the step configurations at the two gates were slightly different. Both level concreted approach areas (plinths) commenced at the third terrace step level but at gate 3, two risers of 0.165 m (6.5 inches) and 0.22 m (8.6 inches) with an intermediate tread of 0.480 m (19 inches) were seen. (See FIG 16, Negs 94 & 95 ~~8904-106/38~~). The approach plinth at gate 3 was found to be 1.185 m (46.75 inches) wide and the step-up from the lowest terrace step at each side was 0.340 m (13.5 inches high).

At gate 4 the level concreted approach area (plinth) again commenced from step 3 of the terrace and extended forwards to the wall by a distance of 0.86 m (34 inches) to a single step up through the gateway which was 0.340 m (13.5 inches) high. The concreted plinth area to gate 4 was 1.125 m (44.25 inches) wide and the step-up from the lowest terrace step at each side was approximately 0.190 m (7.5 inches). See FIGS 17 - 19 which confirm the step arrangements at gate 3 and 4.

Further Text Addition on P 4

PEN CAPACITY

The area of the central pen was approximately 376 square metres and allowing 54 persons per 10 square metres* gives a maximum capacity of 2030 persons. The rated capacity for the pen was stated at 2200 persons on the drawing of the site provided by the club.

In view of the variations in barrier openings in the central pen, further calculations have been made of the pen capacity based on the recommendations of Para 286 of the Code of Practice. S16

The total length of barriers in the left-hand side of the pen behind gate 3 including the 14.3 metres of the front fence was approximately 45.5 metres, giving 45.5 x 3.8 x 5.4 = 934 persons.

The total length of barriers in the right-hand side of the pen behind gate 4 including the 14.4 metres of the front fence was approximately 48.3 metres giving 48.3 x 3.8 x 5.4 = 991 persons.

* As stipulated in the code of practice at section 16

The revised calculated capacity for the central pen was therefore 934 + 991 = 1925 persons.

DR NICHOLSON

Note:- Please amend figures on page 1 of my report to read

'Barrier heights varied between 0.83 and 1.15 m .....'

to comply with the revised data in Table 1.

J B HIBBS

Specialist Inspector (Mechanical Engineering)

The site plan indicates that many of the barrier spacings were outside those recommended by the Code of Practice where it is suggested that gaps between barriers should not exceed 1.4 m width.

The slope of the terrace was found to be approximately 14 degrees and Table 1 on page 37 of the Code of Practice recommends a horizontal distance between barriers in peak viewing areas for the type 'A' barrier of 3.8 m at a terrace gradient of 15 degrees. Examination of the site plan confirms that in general the barriers were arranged within this figure and consecutive gaps between rows of barriers were in accordance with Fig. 3 on page 36 of the Code except at the areas immediately in front of the entry/exit tunnel area.

Steps on the terraces were found to be approximately 75 mm depth with 380mm treads. These were within the limits laid down in the Code of Practice.

CONCLUSIONS/TERRACE LAYOUT

The spacing between rows of the barriers and gaps between barriers did not fully comply with the recommendations laid down in the Code of Practice 'Guide to Safety at Sports Grounds'. The areas giving rise for concern were those directly in front of the entry/exit tunnel which was seen to have a down gradient of approximately 10 degrees for a distance of some 8 - 10 m leading to the terrace doorway openings.

PEN CAPACITY

The area of the central pen was approximately 373 square metres and allowing 54 persons per 10 square metres gives a maximum capacity of 2015 persons. The rated capacity for the pen was stated at 2200 persons on the drawing of the site provided by the Club.

RECOMMENDATIONS

If the area is to be re-used as terracing it is recommended that a full site survey of the whole of this terrace and the other terrace at the opposite end of the football stadium should be made by a competent authority.

Where necessary, it is recommended that barrier heights should be increased slightly in order to comply with the guidance set out in the Code of Practice 'Guide to Safety at Sports Grounds' and any barriers which are found to be suspect should be either strengthened or replaced with barriers of the new design. The latter should preferably be fitted with flat or box section top rails which should be of the order of 100 mm vertical depth. Barriers heights should be a minimum of 1.02 metres with a preferred height of 1.1 metres.

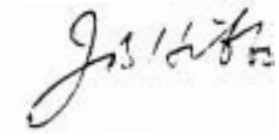
Where necessary the spacing of barriers should be adjusted to suit the recommendations given in the Code of Practice and additional barriers should be provided across the entry/exit tunnel opening area.

The arrangements for the control of spectators in the area between the turnstiles and the tunnel to ensure that the capacity of the central pen does not exceed the rated capacity should be reviewed and amended accordingly. In my opinion the capacity of this section should be reduced and at least be rounded off to the nearest hundred below the calculated capacity.

FUTURE ACTION

You may wish to arrange confirmation of the above recommendations with the Football Club via the H & SE Area Staff and the Local Authority as soon as the official enquiry is completed and if the terrace is to remain, most certainly before it is re-used.

It is anticipated that metallurgical work and an engineering assessment of the design and strength of the failed barrier will be undertaken by H & SE RLSD staff in due course. This work will be the subject of a separate report.



J B HIBBS
Specialist Inspector (Mechanical Engineering)

NE/FCG/131/89

14/M/13/89

TABLE 1

SHEFFIELD WEDNESDAY FC

LEPPINGS LANE TERRACE

LIST OF BARRIERS IN CENTRAL PENS

NO.	TYPE ø	LENGTH (M) *	RAIL DIA (MM)	RAIL HEIGHT M ◻
149	N	7.0	60	1.10 - 1.13
136	O	5.5+	60	0.83 - 0.86
136A	O	4.5	60	0.85 - 0.87
124A	O	6.8	60	0.95 - 1.00
125	O	5.3+	60	0.92 - 0.94
125 ⌀	O	1.8	60	0.92 - 0.96
144	O	2.4	60	1.08 - 1.10
150	N	6.0+	60	1.12 - 1.14
137	O	4.5	60	0.89 - 0.91
138	O	3.6+	60	0.89 - 0.91
132	N	4.6	60	1.12 - 1.14+
127	O	2.3	75	0.95 - 0.98
128	O	6.9	60	0.92 - 0.99
126	N	2.3	75	1.14 - 1.15

ø O = Old N = New

* To leg centres - overall

◻ From nose of step behind to top of rail

\+ From Fence

⌀ In RH pen

Note: Minimum recommended barrier height 1.02 metres. Preferred height 1.1 metres to top of rail measured from the step behind the barrier. (See Code of Practice 'Guide to Safety at Sports Grounds').

Fig.1 - Sheffield Wednesday F.C. - Leppings Lane end. Tunnel to central pen

NEFCG 131/89 14/M/13/89

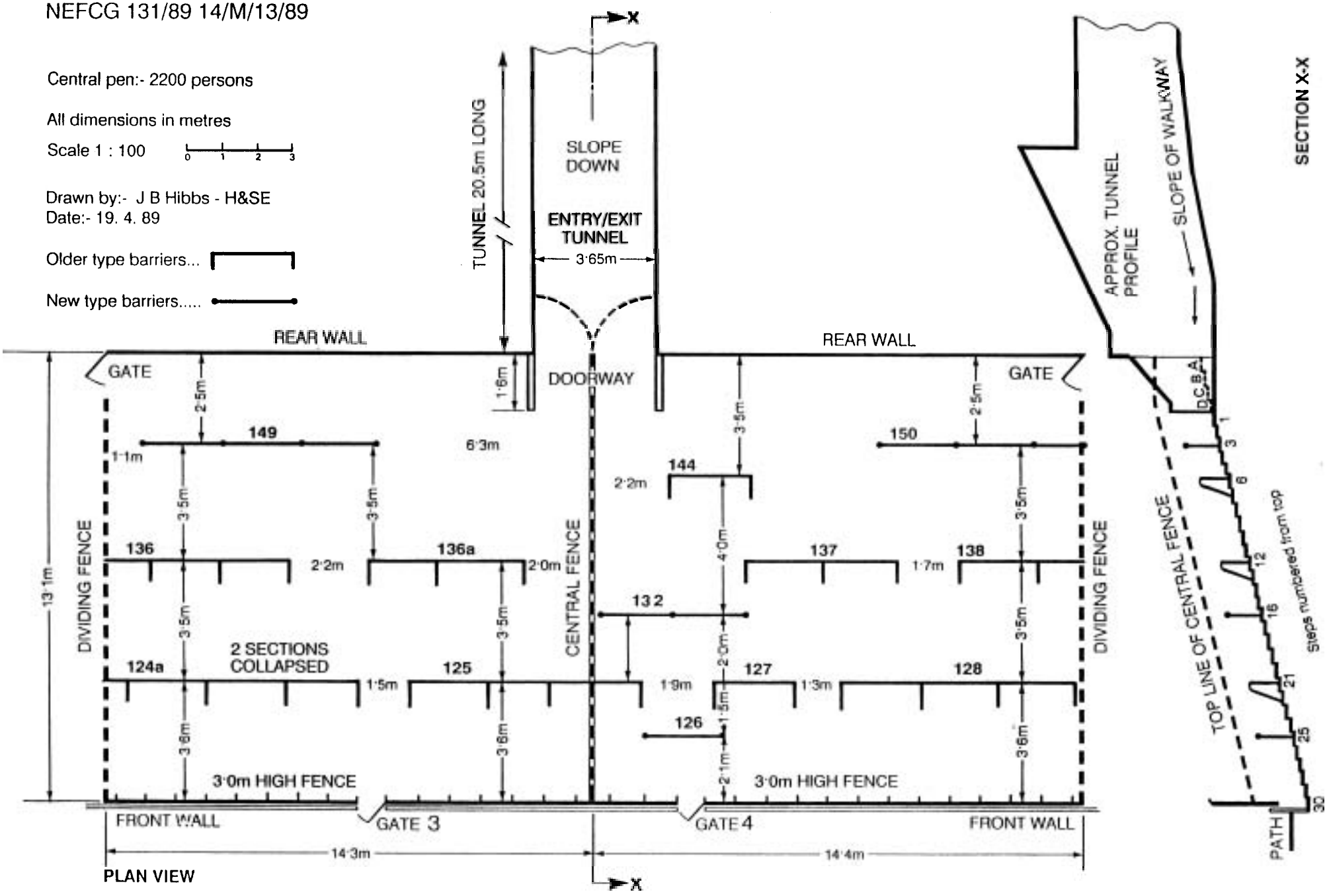
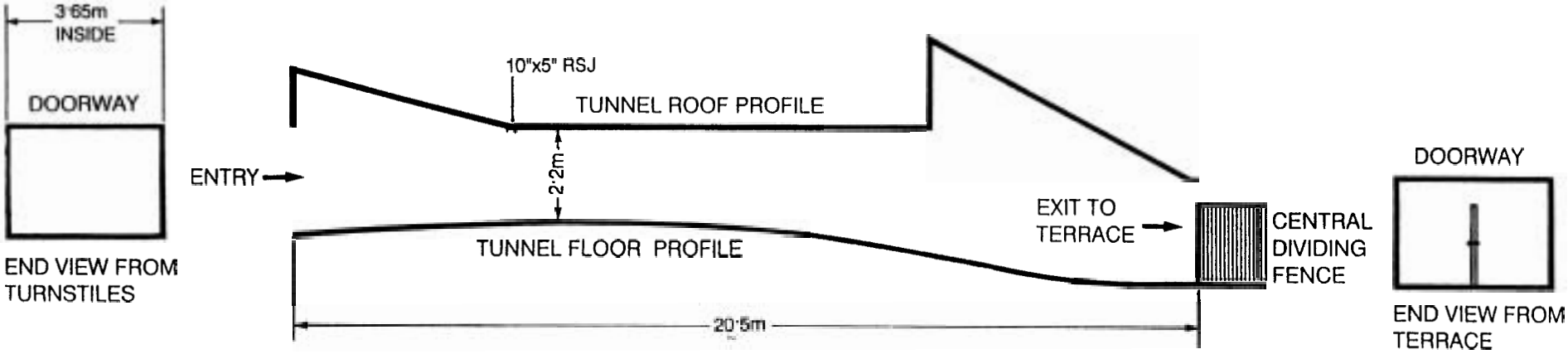
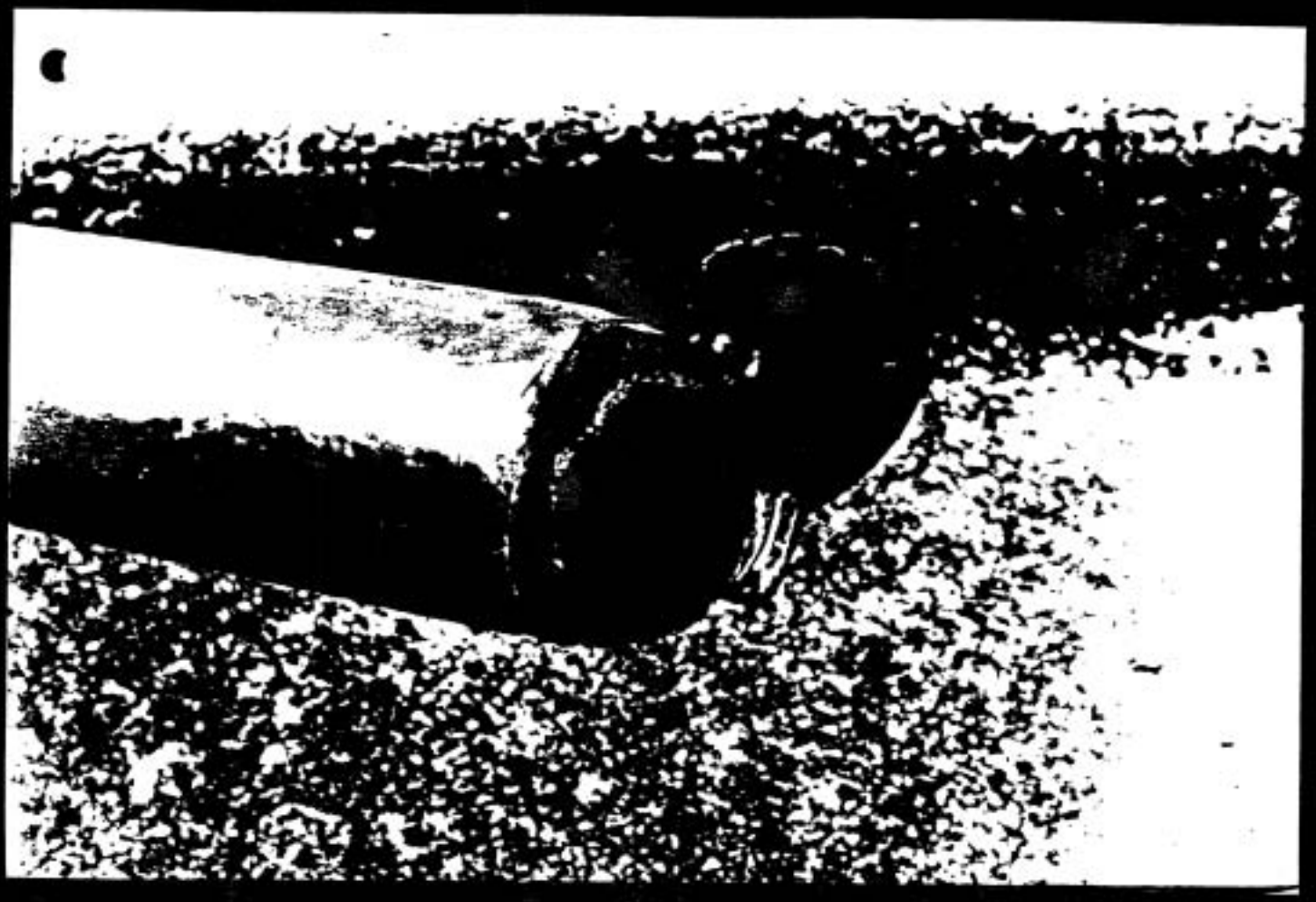


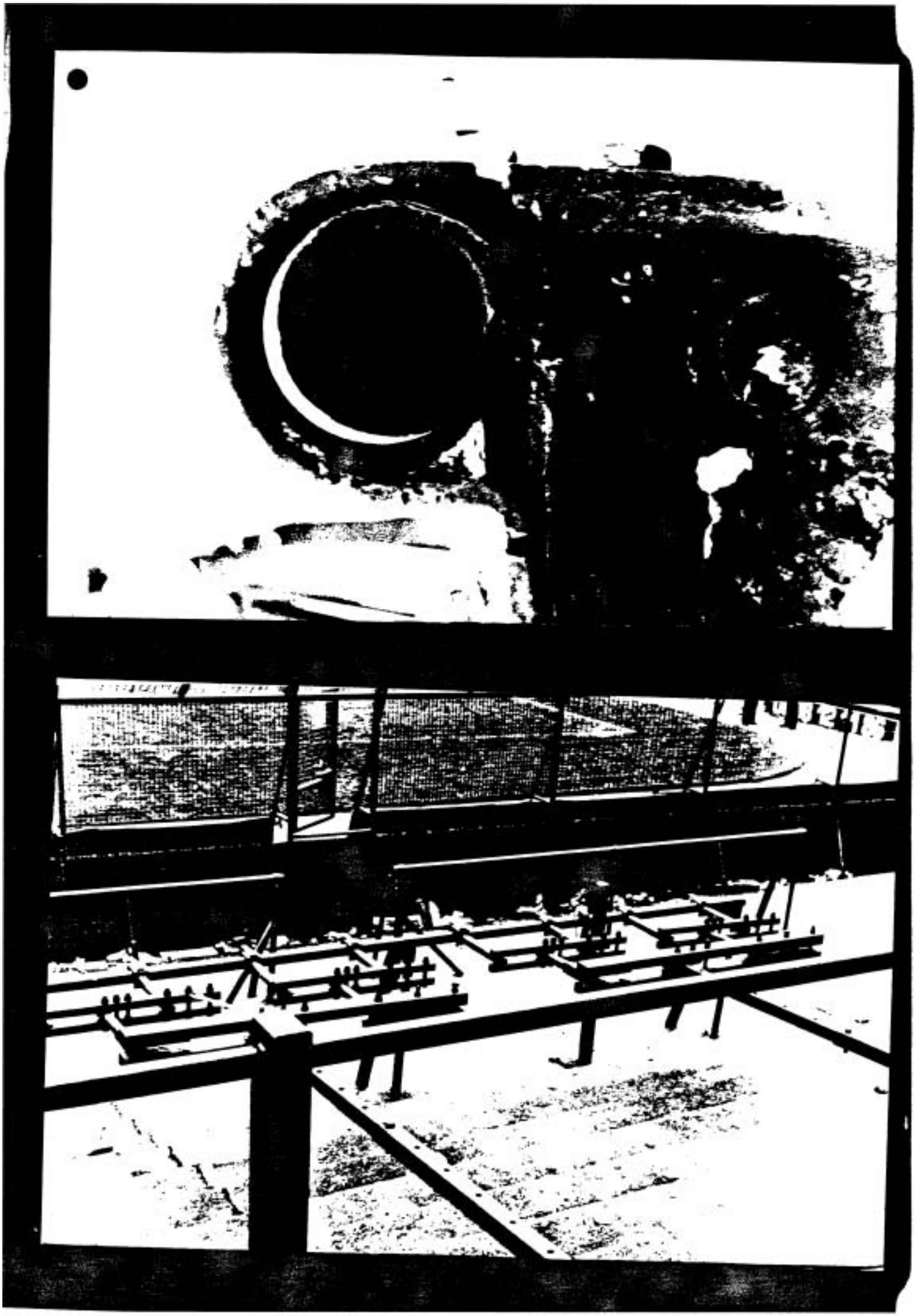
Fig.2 - Sheffield Wednesday F.C. Leppings Lane end. Tunnel to central pen
NEFCG 131/89 14/M/13/89

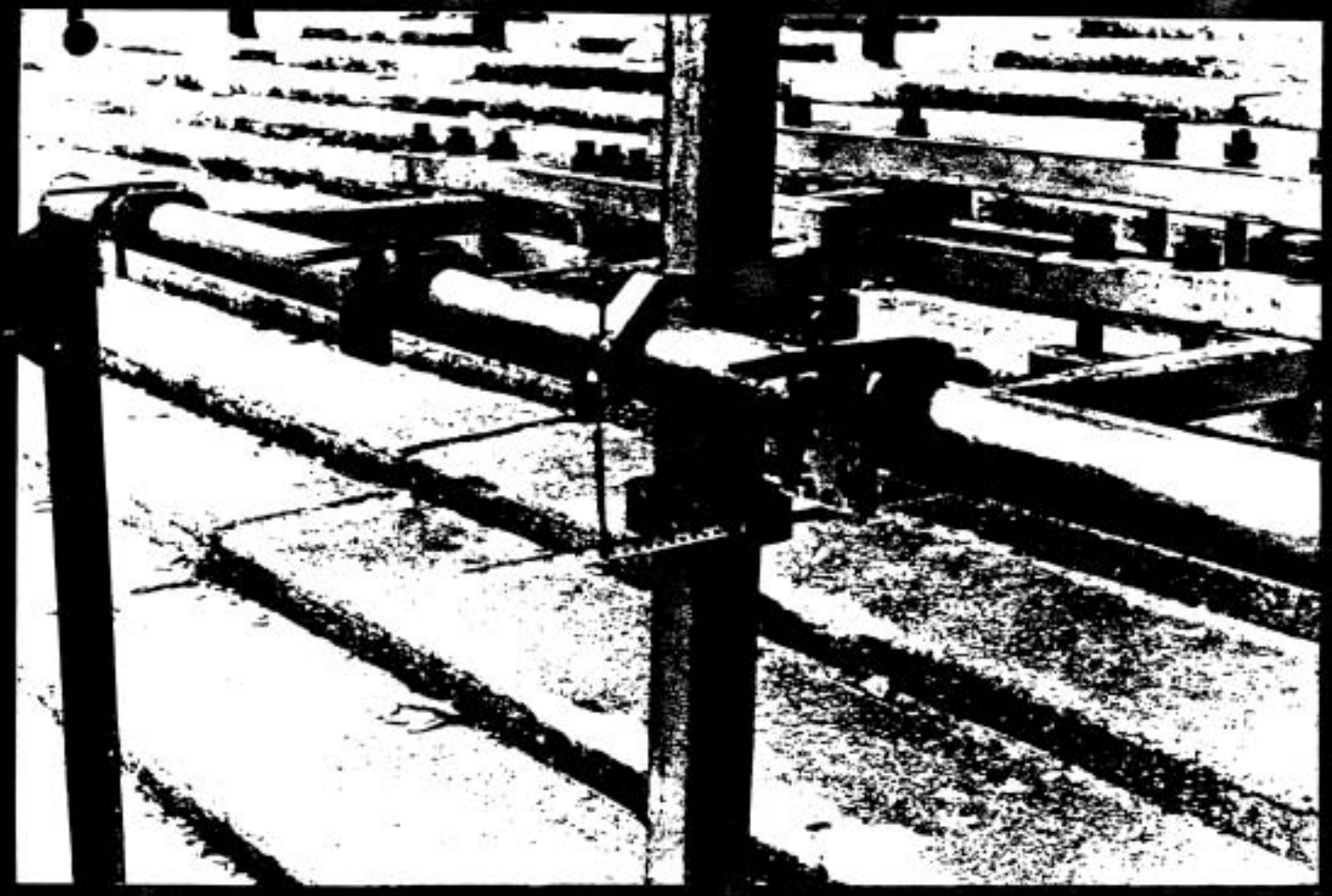
All dimensions in metres
Scale 1 : 100

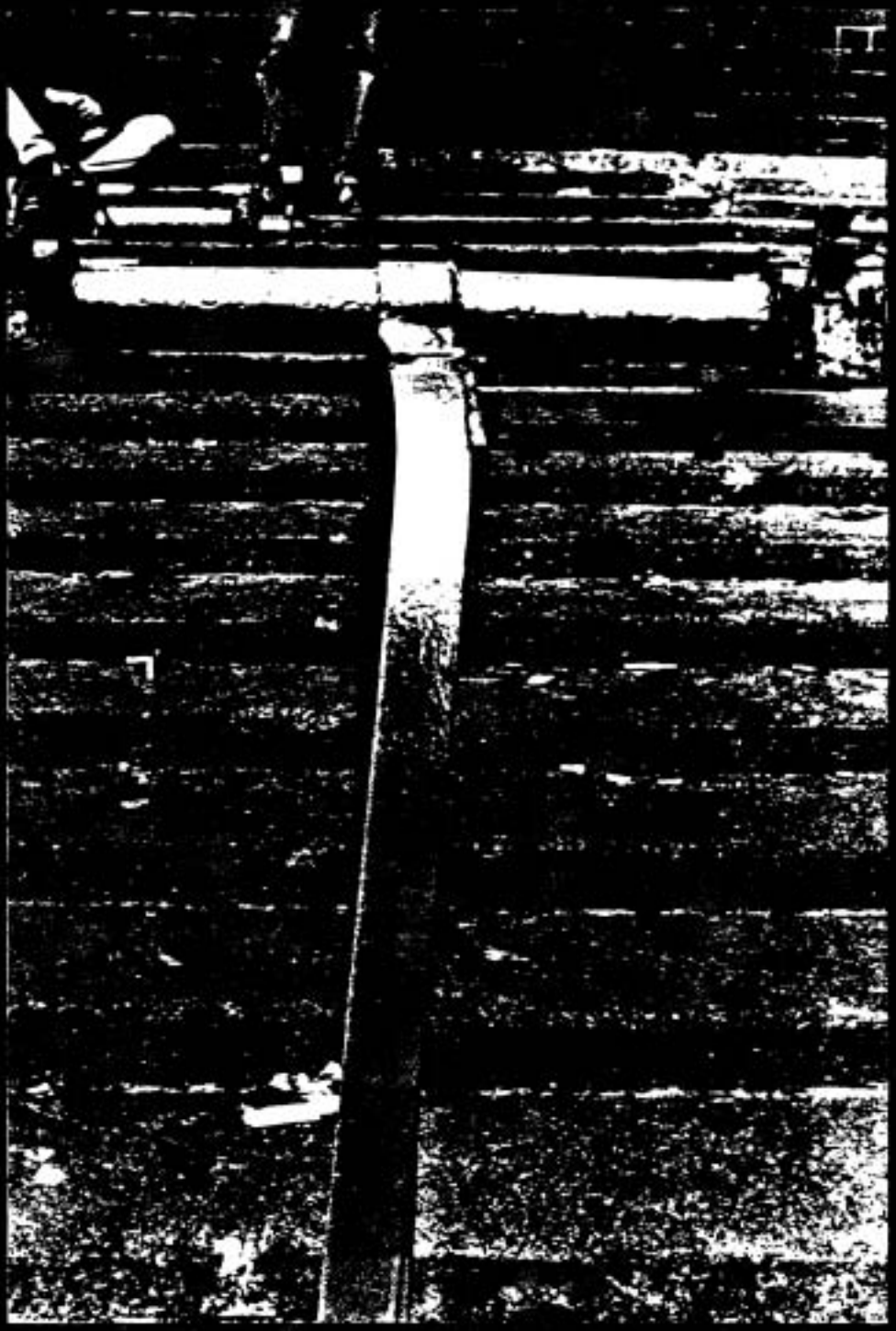
Drawn by:- J B Hibbs - H&SE
Date:- 19. 4. 89











(8)

Received from Eastwood & Partners
Monday, 24 April 1989

APPENDIX I

CERTIFICATE OF CALIBRATION

SERIAL NUMBER NO154

Sheffield Testing Works Ltd.

CERTIFICATE OF CALIBRATION

SHEFFIELD TESTING WORKS LTD.
Nursery Street
Sheffield S3 8GP
Telephone (0742) 726581/2
Telex (547676 Chamco G) STW

DATE OF ISSUE	15th July 1988
SERIAL NO.	N0154
PAGE OF PAGES	1 2

ISSUED TO: Eastwood & Partners
23 Kingfield Road
Sheffield
S11

ORDER No.: Verbal, K.E.Pinhorn.

MADE BY: Enerpac

DESCRIPTION: One hydraulic pump complete with two hydraulic cylinders. The force on the cylinders, under an applied force is measured by a pressure gauge mounted on the pump.

IDENTIFICATION:
Pump: D948005
Gauge: BGF 168 SR
Cylinder 1: 04773 Model RC 53AF9N
Cylinder 2: 04772 Model RC 530J8N

METHOD

The calibration was carried out in a Grade 0.5 lever arm testing machine in terms of the Technical unit of force the ton force (tonf). The uncertainty of the forces applied during the calibration is ±0.5%.

Three tests were made on each cylinder.

Tests were made to determine the reading indicated on the gauge at fixed loads.

DATE OF CALIBRATION: 8th July 1988

Certified .....

Authorised Signatory

CERTIFICATE OF CALIBRATION

SHEFFIELD TESTING WORKS LTD.

SERIAL NUMBER

NO154

RESULTS

Cylinder 04773

Force Tons Compression	Reading on Gauge inner scale Tons Test 1	Test 2	Test 3	Average
0.5	0.5	0.5	0.5	0.5
1	1	1	1	1
1.5	1.5	1.5	1.5	1.5
2	2	2	2	2
2.5	2.5	2.5	2.5	2.5
3	3	3	3	3
3.5	3.5	3.5	3.45	3.5
4	4	4	4	4

Cylinder 04772

Force Tons Compression	Reading on Gauge inner scale Tons Test 1	Test 2	Test 3	Average
0.5	0.5	0.5	0.5	0.5
1	1	1	1	1
1.5	1.5	1.5	1.5	1.5
2	2	2	2	2
2.5	2.5	2.5	2.5	2.5
3	3	3	3	3
3.5	3.5	3.5	3.5	3.5
4	4	4	4	4

BARRIER TESTING RECORD SHEET

SHEFFIELD WEDNESDAY F.C. PLC.
HILLSBOROUGH
SHEFFIELD
S6 1SW

COMPLETED BY S.GIBBONS

DATE [illegible] 1989

JOB NO 10481

EASTWOOD & PART
CONSULTING ENGI
ST. ANDREWS HOU
23 KINGFIELD RO.
SHEFFIELD,
S11 9AS.

Received from Eastwood & Partners
Monday, 24 April 1989

APPENDIX 11

BARRIER	BARRIER SIZE & No. OF SPANS	TEST LOAD		ALL DIMENSIONS ARE IN MILLIMETRES									
		KN/M	APPLIED LOAD TONNES	TEST 1				TEST 2				TEST 3	
				REST	LOAD	U/LOAD	% REC	REST	LOAD	U/LOAD	%REC	REST	LOAD
152	1-2	6	1.44	0	14	0	100	0	14	0	100	0	13
	2-3	6	1.44	0	16	0	100	0	16	0	100	0	16
153	1-2	6	1.44	0	14	0	100	0	14	0	100	0	14
	2-3	6	1.44	0	16	0	100	0	15	0	100	0	15
187	1	6	1.44	0	17	0	100	0	16	0	100	0	16

(7)

BARRIER TESTING RECORD SHEET

SHEFFIELD WEDNESDAY F.C.PLC.
HILLSBOROUGH
SHEFFIELD
S6 1SW

COMPLETED BY S.G. HIGGINS

DATE 19TH JUNE 1

JOB NO 10481

EASTWOOD & PARTNERS,
CONSULTING ENGINEERS,
ST. ANDREWS HOUSE,
23 KINGFIELD ROAD,
SHEFFIELD,
S11 9AS.

ALL DIMENSIONS ARE IN MILLIMETRES

BARRIER POST NO.	BARRIER SIZE & No. OF SPANS	TEST LOAD KN/M	TEST LOAD APPLIED LOAD TONNES	TEST 1 REST	TEST 1 LOAD	TEST 1 U/LOAD	TEST 1 % REC	TEST 2 REST	TEST 2 LOAD	TEST 2 U/LOAD	TEST 2 %REC	TEST 3 REST	TEST 3 LOAD	TEST 3 U/LOAD	TEST 3 %
148	1-2	6	1.44	0	14	0	100	0	15	0	100	0	14	0	1
	2-3	6	1.44	0	11	0	100	0	11	0	100	0	11	0	1
149	1-2	6	144	0	17	0	100	0	18	0	100	0	17	0	
	2-3	6	1.44	0	12	0	100	0	11	0	100	0	12	0	
150	1-2	6	1.44	0	17	0	100	0	16		100	0	17	0	
	2-3	6	1.44	0	15	0	100	0	9	0	100	0	9	0	
151	1-2	6	1 44	0	15	0	100	0	14	0	100	0	14	0	

BARRIER TESTING RECORD SHEET

SHEFFIELD WEDNESDAY F.C.PLC.
HILLSBOROUGH
SHEFFIELD
S6 1SW

COMPLETED BY S G HIGGINS

DATE 19TH JUNE 1988

JOB NO 10481

EASTWOOD & PARTNERS,
CONSULTING ENGINEERS.
ST. ANDREWS HOUSE,
23 KINGFIELD ROAD,
SHEFFIELD,
S11 9AS.

ARRIER OST O.	BARRIER SIZE & No. OF SPANS	TEST LOAD KN/M	TEST LOAD APPLIED LOAD TONNES	ALL DIMENSIONS ARE IN MILLIMETRES TEST 1 REST	TEST 1 LOAD	TEST 1 U/LOAD	TEST 1 % REC	TEST 2 REST	TEST 2 LOAD	TEST 2 U/LOAD	TEST 2 %REC	TEST 3 REST	TEST 3 LOAD	TEST 3 U/LOAD	TEST 3 % REC
121	1-2	6	1.44	0	16	0	100	0	14	0	100	0	14	0	100
	2-3	6	1.44	0	14	0	100	0	16	0	100	0	15	0	100
122	1-2	6	1.44	0	18	0	100	0	17	0	100	0	17	0	100
123	1-2	6	1.44	0	19	0	100	0	19	0	100	0	21	0	100
124	1-2	6	1.44	CLIP BROKE				NEW CLIP REQUIRED							
124A	1-2	6	1.44	0	29	12	59	0	19	5	74	0	19	0	100
	2-3	6	1.44	0	21	5	76	0	18	0	100	0	16	0	100

BARRIER TESTING RECORD SHEET

SHEFFIELD WEDNESDAY F.C.PLC.
HILLSBOROUGH
SHEFFIELD
S6 1SW

COMPLETED BY S Gilligans

DATE 17th June 1988

JOB NO 10481

EASTWOOD & PARTNERS,
CONSULTING ENGINEERS
ST. ANDREWS HOUSE,
23 KINGFIELD ROAD,
SHEFFIELD,
S11 9AS.

RIER T	BARRIER SIZE & No. OF SPANS	TEST LOAD KN/M	TEST LOAD APPLIED LOAD TONNES	ALL DIMENSIONS ARE IN MILLIMETRES TEST 1 REST	TEST 1 LOAD	TEST 1 U/LOAD	TEST 1 % REC	TEST 2 REST	TEST 2 LOAD	TEST 2 U/LOAD	TEST 2 %REC	TEST 3 REST	TEST 3 LOAD	TEST 3 U/LOAD	TEST 3 % REC
25	1-2	6	1.44	0	19	0	100	0	19	0	100	0		0	100
126	1	6	1 44	0	17	0	100	0	16	0	100	0	16	0	100
127	1	6	1 44	0	15	0	100	0	15	0	100	0	15	0	100
128	1-2	6	1 44	0	14	0	100	0	14	0	100	0	14	0	100
	2-3	6	1 44	0	16	0	100	0	16	0	100	0	16	0	100
128A	1-2	6	1 44	0	21	0	100	0	23	0	100	0	23	0	100

BARRIER TESTING RECORD SHEET

SHEFFIELD WEDNESDAY F.C. PLC.
HILLSBOROUGH
SHEFFIELD
S6 1SW

COMPLETED BY S GIGGINS

DATE 19th June 1988

JOB NO 10481

EASTWOOD & PARTNERS,
CONSULTING ENGINEERS,
ST. ANDREWS HOUSE,
23 KINGFIELD ROAD,
SHEFFIELD,
S11 9AS.

IER	BARRIER SIZE & No. OF SPANS	TEST LOAD		ALL DIMENSIONS ARE IN MILLIMETRES											
		KN/M	APPLIED LOAD TONNES	TEST 1				TEST 2				TEST 3			
				REST	LOAD	U/LOAD	% REC	REST	LOAD	U/LOAD	%REC	REST	LOAD	U/LOAD	% REC
29	1-2	6	144	0	21	2	90	0	25	3	88	0	19	0	100
	2-3	6	144	0	8	0	100	0	8	0	100	0	8	0	100
	3-4	6	144	0	23	3	91	0	22	0	100	0	21	0	100
	4-5	6	144	0	22	0	100	0	24	0	100	0	24	0	100
	5-6	6	144	0	19	0	100	0	19	0	100	0	19	0	100
30	1	6	144	0	15	0	100	0	17	0	100	0	20	0	100
31	1-2	6	144	0	19	0	100	0	21	0	100	0	32	0	100
32	1-2	6	144	0	17	0	100	0	17	0	100	0	17	0	100

BARRIER TESTING RECORD SHEET

SHEFFIELD WEDNESDAY F.C.PLC.
HILLSBOROUGH
SHEFFIELD
S6 1SW

COMPLETED BY S.G. HIGGINS

DATE 8TH SEPT 1988

JOB NO 10481

EASTWOOD & PARTNERS,
CONSULTING ENGINEERS,
ST. ANDREWS HOUSE,
23 KINGFIELD ROAD,
SHEFFIELD,
S11 9AS.

IER	BARRIER SIZE No. OF SPANS	TEST LOAD		ALL DIMENSIONS ARE IN MILLIMETRES											
		KN/M	APPLIED LOAD TONNES	TEST 1				TEST 2				TEST 3			
				REST	LOAD	U/LOAD	% REC	REST	LOAD	U/LOAD	%REC	REST	LOAD	U/LOAD	% REC
33	1-2	6	1.44	0	33	0	100	0	34	0	100	0	40	0	100
34	1-2	6	1.44	0	20	0	100	0	17	0	100	0	18	0	100
35	1	6	1.44	0	22	0	100	0	24	0	100	0	30	0	100
36	1-2	6	1.44	0	28	4	86	0	26	5	81	0	26	0	100
	2-3	6	1.44	0	21	4	81	0	20	2	90	0	20	0	100
	3-4	6	1.44	0	20	4	80	0	14	0	100	0	14	0	100
	4-5	6	1.44	0	21	2	90	0	19	0	100	0	19	0	
	5-6	6	1.44	0	20	5	75	0	15	0	100	0	16	0	100

BARRIER TESTING RECORD SHEET

SHEFFIELD WEDNESDAY F.C. PLC
HILLSBOROUGH
SHEFFIELD
S6 1SW

COMPLETED BY S.G. HIGGINS

DATE 19th June 1993

JOB NO 10481

EASTWOOD & PARTNERS,
CONSULTING ENGINEERS,
ST. ANDREWS HOUSE,
23 KINGFIELD ROAD,
SHEFFIELD,
S11 9AS.

IER	BARRIER SIZE & No. OF SPANS	TEST LOAD		ALL DIMENSIONS ARE IN MILLIMETRES											
		KN/M	APPLIED LOAD TONNES	TEST 1				TEST 2				TEST 3			
				REST	LOAD	U/LOAD	% REC	REST	LOAD	U/LOAD	%REC	REST	LOAD	U/LOAD	% REC
36A	1-2	6	1 44	0	12	0	100	0	14	0	100	0	14	0	100
37	1-2	6	1·44	0	32	4	88	0	30	4	87	0	25	0	100
38	1-2	6	1 44	0	27	4	85	0	24	1	96	0	22	0	100
39	1	6	1 44	0	15	0	100	0	15	0	100	0	15	0	100
40	1-2	6	1·44	0	18	2	89	0	17	0	100	0	17	0	100
41	1-2	6	1·44	0	22	2	91	0	20	0	100	0	20	0	100

BARRIER TESTING RECORD SHEET

SHEFFIELD WEDNESDAY F.C. PLC.
HILLSBOROUGH
SHEFFIELD
S6 1SW

COMPLETED BY [illegible]

DATE [illegible]

JOB NO 10481

EASTWOOD & PARTNERS,
CONSULTING ENGINEERS,
ST. ANDREWS HOUSE,
23 KINGFIELD ROAD,
SHEFFIELD,
S11 9AS.

ALL DIMENSIONS ARE IN MILLIMETRES

ER	BARRIER SIZE & No. OF SPANS	TEST LOAD KN/M	TEST LOAD APPLIED LOAD TONNES	TEST 1 REST	TEST 1 LOAD	TEST 1 U/LOAD	TEST 1 % REC	TEST 2 REST	TEST 2 LOAD	TEST 2 U/LOAD	TEST 2 %REC	TEST 3 REST	TEST 3 LOAD	TEST 3 U/LOAD	TEST 3 % REC
2	1-2	6	1.44	0	27	0	100	0	26	0	100	0	27	0	100
3	1-2	6	1.44	0	28	0	100	0	28	0	100	0	28	0	100
4	1	6	1.44	0	30	3	90	0	29	21	28*	0	31	1	97
	(Rail & clips not in good condition, replaced with new)														
5	1-2	6	1.44	0	18	0	100	0	18	0	100	0	18	0	100
[illegible]	1	6	1.44	0	19	0	100	0	18	0	100	0	19	0	100
7	1-2	6	1.44	0	11	0	100	0	11	0	100	0	12	0	100
	2-3	6	1.44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]