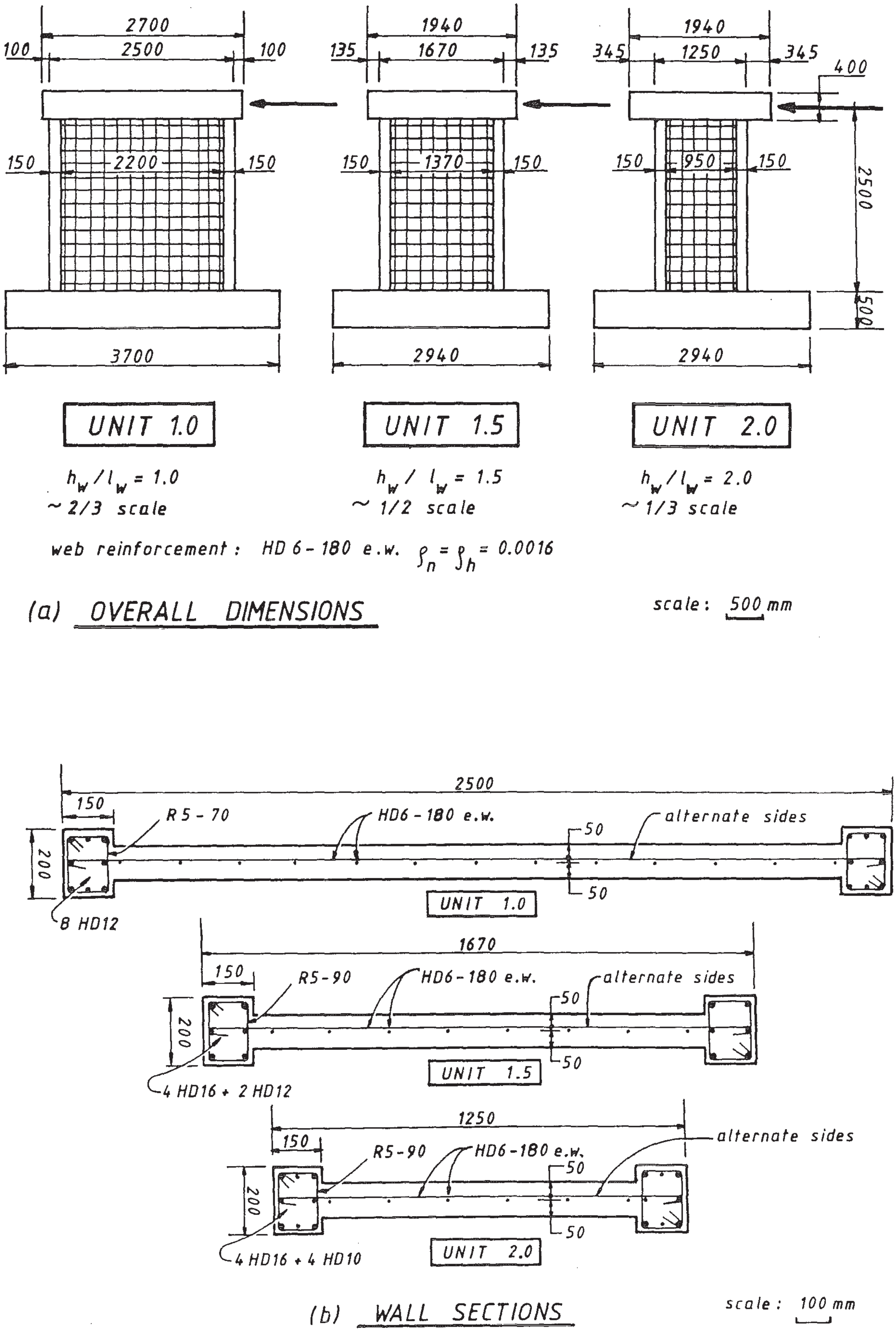

Fig. 5.2 - Details of test units

SECTION 6

DETAILS OF TEST PROGRAMME

6.1 TEST RIG

The test rig, shown in Fig. 6.1, consisted of three independent systems: an in-plane loading system, and in-plane base beam reaction system, and an out-of-plane bracing system.

The wall units were subjected to in-plane, reversed cyclic loading from a hydraulic jack applied at the level of the top beam. The jack was a double-acting (compression and tension), displacement-controlled Victor Hydraulics brand hydraulic jack with a capacity of 1100kN in compression and 840kN in tension. The ram travel was $\pm$200mm. The jack was attached to the wall unit in such a way that, for either direction of loading, the load was introduced as compression on the end face of the top beam (Fig. 6.2). An existing structural steel frame, modified to increase its strength, was used to brace the jack in the plane of the wall.

In the past, researchers have attempted various methods of introducing shear into the test region of a unit. Although in prototype walls, lateral loads are usually introduced by means of floor or roof slabs acting as diaphragms, in the present tests, a massive top beam was considered more appropriate than a top loading slab because of its axial and flexural stiffness. The large stiffness of a massive top beam ensured that the significant deformations occurred in the region of interest of the wall and not in the top beam or other part of the loading system.

In Barda's test, a significant amount of deformation and cracking occurred in the top slab. Thus, a certain proportion of the lateral load was used in deforming the top slab. In the present tests, a massive top beam was used in order to minimize deformation in the loading member and to direct all deformations into the test region of the wall. Thus, the relationship between lateral load and wall deflection was thought to be less affected by variable boundary conditions at the top edge, although this was obtained at the expense of the less realistic simulation of

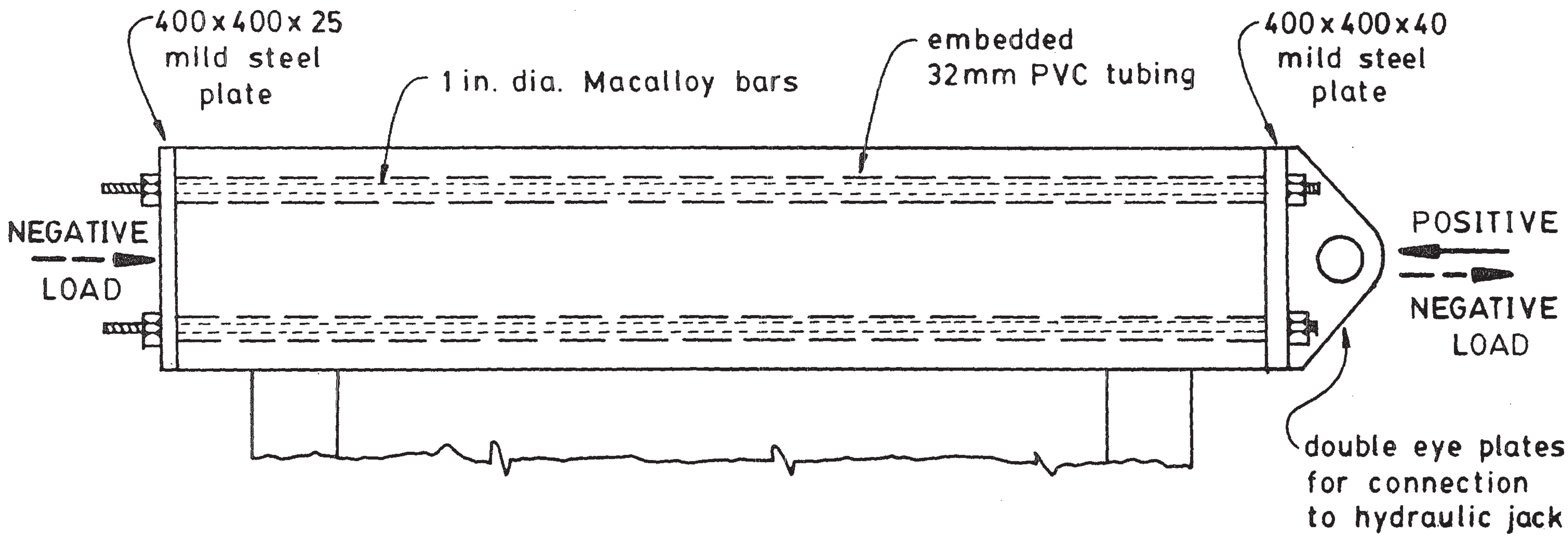

Fig. 6.2 - Introduction of lateral load to test unit

TABLE 6.1- CONCRETE PROPERTIES

	Batch	Fresh concrete				Hardened concrete						
		Target f'_c (MPa)	MSA(1) (mm)	Slump (mm) Ordered/ received	Supplier	Date tested	Age at test (days)	f'_c (MPa) Lab cured(2)	f'_c (MPa) Fog cured	f_t (MPa) Fog cured	E_c(3) (MPa) Lab cured	$(f'_c)_{28}$ (MPa) Fog cured
UNIT 1.0	Base beam	30	13	100/75	Ashby	30/9	198	33.2	38.9	-	27 081	-
	Wall pour 1	25	13	100/75	"	"	146	25.7	28.0	3.1	23 827	26.2
	Wall pour 2	25	13	100/75	"	"	144	28.3	30.8	3.2	25 003	24.8
	Top beam	30	13	100/100	"	"	109	27.7	31.9	3.3	24 736	29.5
UNIT 1.5	Base beam	30	13	100/100	"	"	109	27.7	31.9	3.3	24 736	29.5
	Wall pour 1	25	13	100/175	"	28/10	112	17.6	19.1	2.1	19 718	11.3(4)
	Wall pour 2	25	13	100/165	"	"	110	24.4	27.3	2.8	23 216	17.3(4)
	Top beam	30	13	100/85	Firth	"	94	32.8	32.1	-	26 918	32.7
UNIT 2.0	Base beam	25	13	100/115	"	7/11	108	23.9	26.7	2.8	22 977	22.6
	Wall	25	14	100/120	"	"	92	26.5	32.5	3.3	24 195	28.1
	Top beam	30	14	100/120	"	"	76	29.4	32.7	3.2	25 484	28.8

(1) MSA = maximum size aggregate

(2) Used for theoretical strength and stiffness calculations

(3) Used for theoretical stiffness calculations

(4) Tested at 7 days

steel moulds without top caps, although the top surface of the concrete cylinder was trowelled off to create a smooth surface. The cylinders stood in their moulds covered with damp hessian sacking and polyurethane sheets near the wall unit itself for 24 hours. Subsequently the cylinders were taken out of their moulds and placed immediately into a 20 degree C, 100 percent humidity room. In general, nine of the twelve cylinders remained in the 100 percent humidity room until they were tested. The three remaining cylinders were removed from the 100 percent humidity room after 7 days, when the forms on the wall unit were stripped. They were placed alongside the wall unit in the laboratory to be cured under the same conditions as the wall unit itself until the testing date, at which time they were tested in compression. Of the first nine, fog-cured cylinders, three were tested in compression after 28 days, three were tested in compression at the time of test of the wall unit, and three were tested in a split cylinder test at the time of test. The testing of the cylinders and the observed strengths are reported in Section 6.3.2.

6.3 MATERIAL PROPERTIES

6.3.1 Reinforcement

The tensile testing of reinforcement was carried out on Avery universal testing machines: a 100kN capacity, type 7109DCJ, grade A machine for 6mm diameter bars and a 1000kN capacity, type 7104DCJ, grade A machine for 10mm, 12mm, and 16mm diameter bars. Force in the bar was read directly from the machine while bar extension was measured over a 2 inch gauge length using a Baty extensiometer with a resolution of 1/20000 inch. Stress was taken as bar force divided by the nominal cross-sectional area of the bar (for a 6mm diameter bar, A=36mm2). The resulting stress strain curves are plotted in Fig. 6.6. Steel properties of the bars are summarized in Table 6.2.

The longitudinal bars in the vertical boundary elements were 10mm, 12mm, and 16mm diameter high strength deformed bars routinely stocked by local suppliers. The steel properties were as expected.

For the main grid of reinforcement in the web,

TABLE 6.2 - STEEL PROPERTIES

Bar designation	f_y (MPa)	f_{ult} (MPa)	ε_y	ε_{SH}	elongation at fracture	E_s (MPa)
HD 6 (1)	515(3)	760	-	-	0.1333	-
HD 6 (2)	472	658	0.00248	0.01420	0.2000	190 000
HD10	443	576	0.00233	0.01770	0.3100	190 000
HD12	451	608	0.00234	0.01840	0.2900	193 000
HD16	465	638	0.00235	0.01620	0.2600	198 000

(1) Before heat treatment

(2) After heat treatment

(3) At 0.2% offset

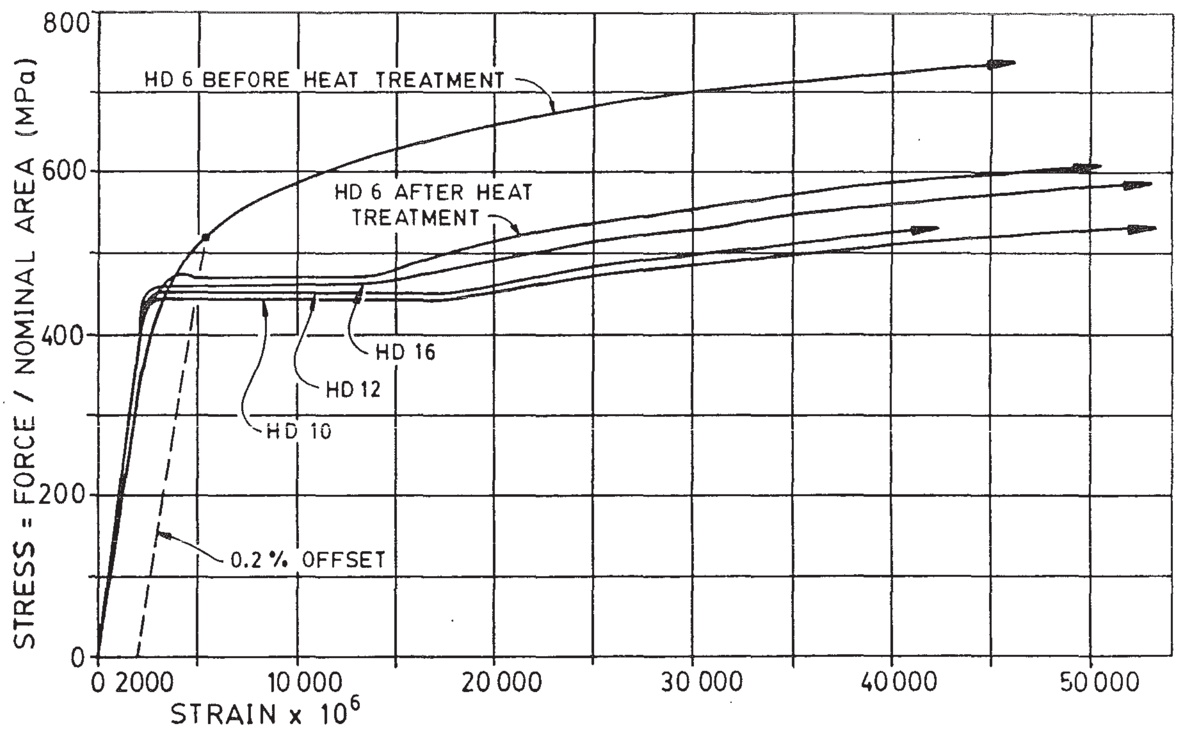

Fig. 6.6 - Stress-strain properties of reinforcement

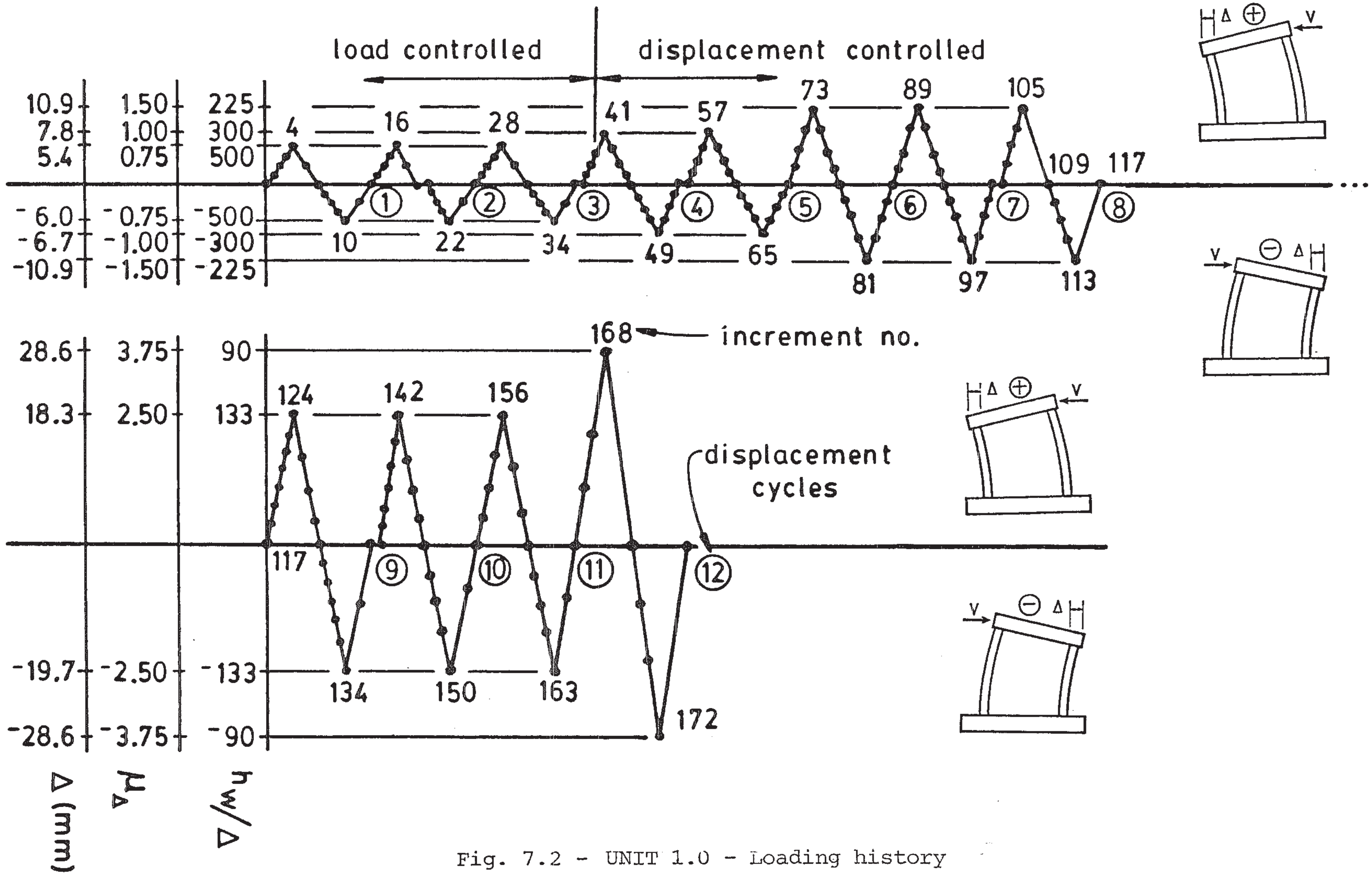

Fig. 7.2 - UNIT 1.0 - Loading history

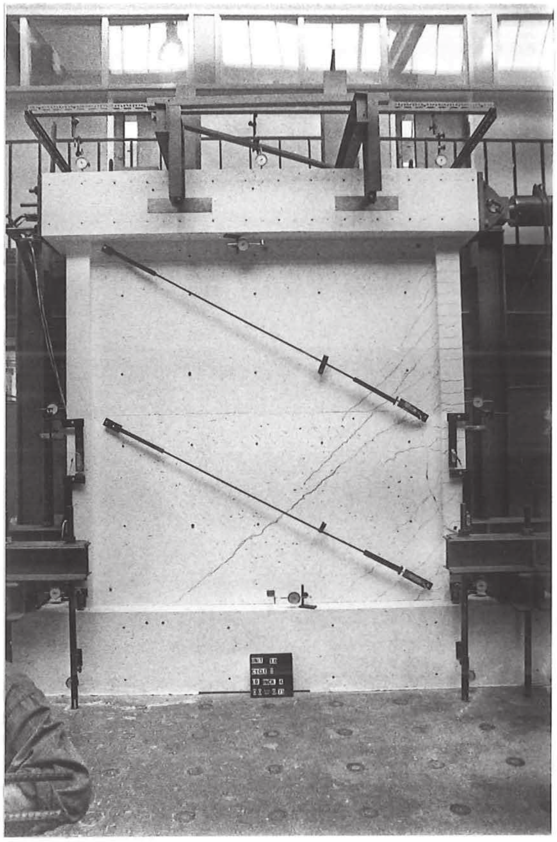

Fig. 7.3 - UNIT 1.0 - Crack pattern at increment 4

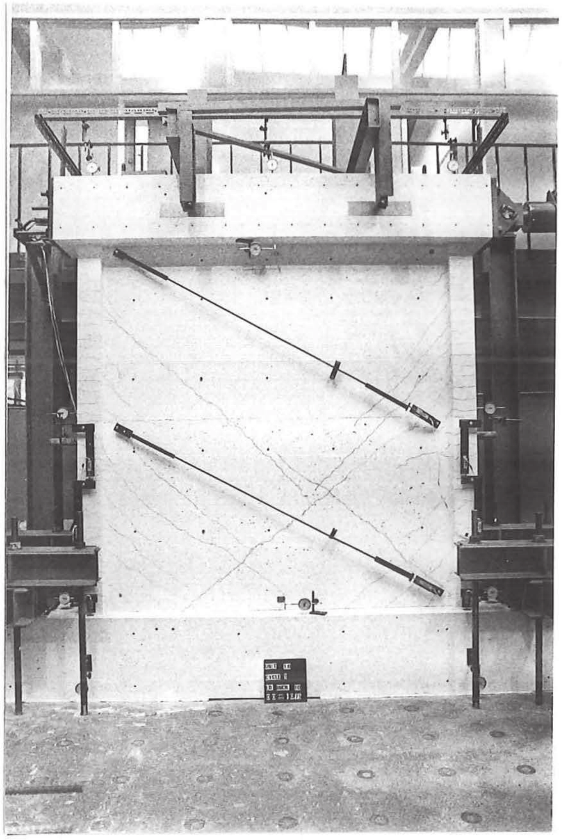

Fig. 7.4 - UNIT 1.0 - Crack pattern at increment 10

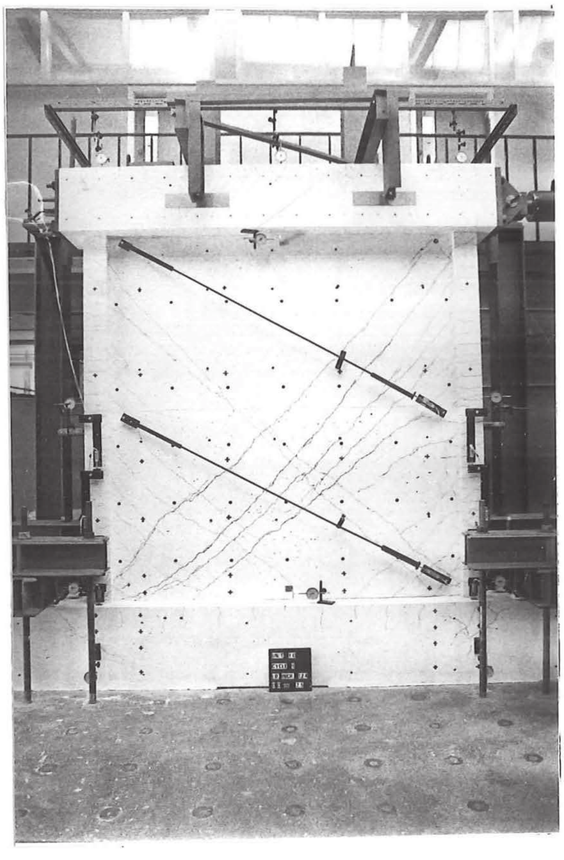

Fig. 7.5 - UNIT 1.0 - Crack pattern at increment 124

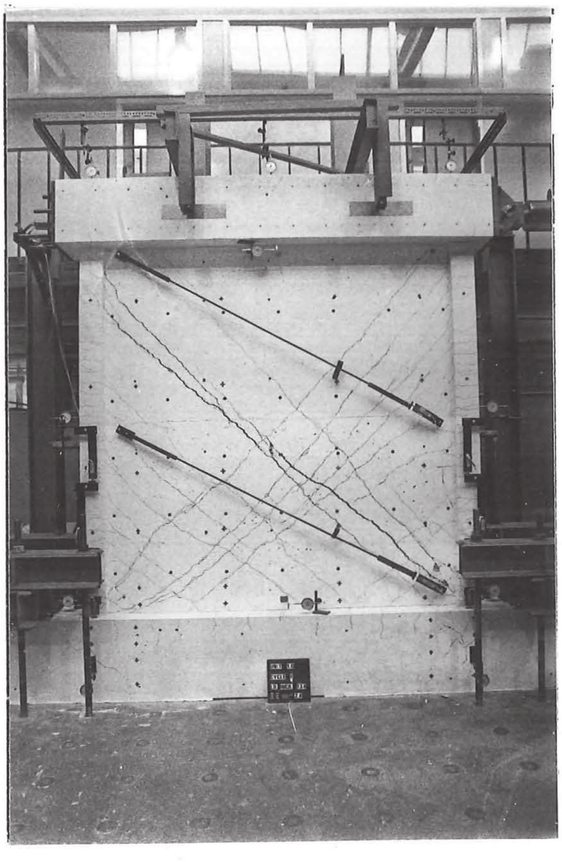

Fig. 7.6 - UNIT 1.0 - Crack pattern at increment 134

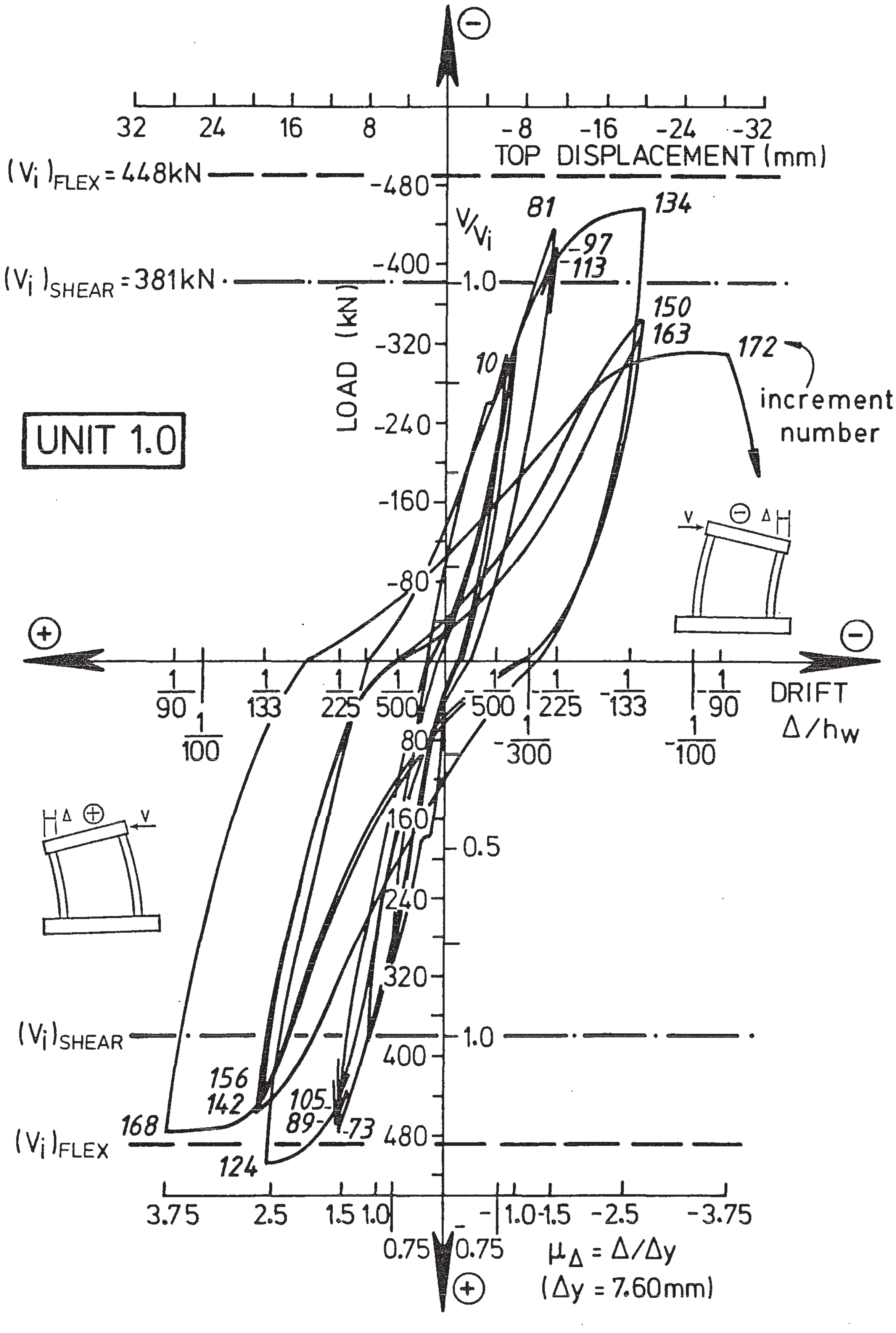

Fig. 7.10 - UNIT 1.0 - Lateral load vs. top displacement