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FIELD MEASUREMENTS OF AN ELECTRICAL WIRE LYING IN DIFFERENT KINDS OF REINFORCED CONCRETE

1. Instruction

The test objective is to measure the value of the electromagnetical field of a wire with an electrical current of 0,035 Amp. of a frequency of 5200 Hz. This wire is placed successively in a groove of the three blocks in different kinds of reinforced concrete.

2. Survey of the test

Date : Monday, May 13th 1985

Executed by : ir. A. Peytier and Ing. F. Lescrauwaet of the section "Power and Industrial Applications" of the Electrical Engineering Department of the K.U.Leuven".

2.1. Description of the test elements

Fig. 0 shows the three slabs in concrete.
The composition for 1 m^3 of concrete is as follows :

gravel 4/28	1.300 kg
sand 0/5	600 kg
cement P40	320 kg
water	140 litres

and a plastification product

The concrete resistance after 28 days on 200 mm cubes is :

- concrete without fibres : mean value : 34,5 N/mm^2
- concrete with fibres : mean value : 39,5 N/mm^2

2.2. Measuring instruments used

1. Oscillator : Functiongenerator type 3310 A - Hewlett-Packard
2. Frequency : Hewlett-Packard type 5300 A en 5302 A
3. Amplifier : Bruel & Kjaer type 2706
4. Current meter : Unigor 35
5. Oscilloscope : Philips type PH 3233

2.3. Equipment used

1. A flexible wire. This wire placed in the groove of the test element, has on both extrimities a weight so that this wire rests everywhere on the bottom of this groove.
2. Coaxial cables for the necessary connections.
3. An electrical circuits; the axis of the coil of the tuned circuit can be placed at different distances from the ground plate.

3. Test procedure

This procedure consists of the following points :

a) Adjustement of the frequency 5200 Hz.

b) Adjustement of the value of the current at 0,035 Ampère.

c) Adjustment of the height of the coil of the tuned circuit with regard to the surface of the test element; this height had respectively a value of 3 cm, 4 cm and 5,5 cm.

d) Then the tuned circuit was positioned in such a way with regard to the wire that the middle of the coil and the wire lay on the same vertical line; this position served as the 0 cm reference for the horizontal distance.
In this position the tension of the captured signal on the tuned circuit was measured as a peak-to-peak voltage, by means of a oscilloscope.

e) Next the tuned circuit was moved with regard to the 0 cm reference and the captured signal on the tuned circuit was measured every time for the following distances with regard to the reference : 1, 2, 3, 4, 5, 7,5 and 10 cm.

4. Results

The measured tensions of the captured signals are listed in the following tables.
As parameters we chose :

a. The given test frequencie
b. The height of the axis of the coil. This coil had a position parallel with the surface of the test element.
c. The horizontal distance of the tuned circuit with regard to the wire.

Conclusions

1. The measured value of the signal decreases with the height and the horizontal distance.
2. The values for the unreinforced and for the fiber reinforced block are nearly the same. They are higher than the values measured in the test element with the classical reinforcement.
3. The different tested elements have not given widely divergent results at all.

Ir. L. VAN DE LOOCK

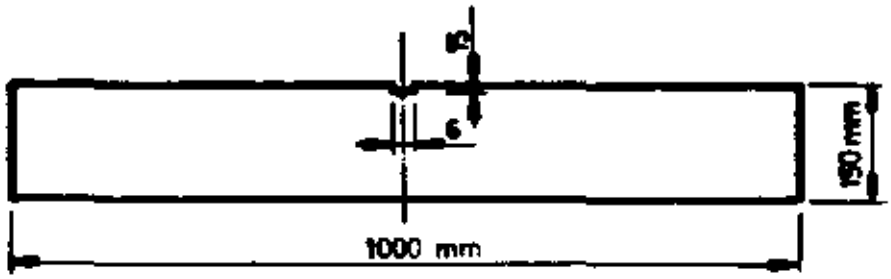
Prof.dr.ir. F. MORTELMANS

height cm	distance cm	unreinforced slab	slab with fibre reinforcement	slab with mesh reinforcement (depth 7cm)	slab with mesh reinforcement (depth : 3 cm)
3	0	32,5	33	30	31
	1	32	31	29	29,5
	2	26,5	27,5	26	25,5
	3	22	22,5	21,5	21,5
	4	16,8	18	17,5	17,5
	5	13,5	14,5	13,5	14
	7,5	7,5	7,8	7,5	7,5
	10	4,5	5	4	4,5
4	0	27	26,5	24,5	25
	1	26,5	26	24,5	23,5
	2	23,5	23	23	21
	3	20,5	20	20	18,5
	4	17,5	17	17	15,5
	5	14,5	14	14	13
	7,5	9,5	8,5	8,5	7,5
	10	6	5,5	5	4,5
5,5	0	20,5	20,5	18,5	19,5
	1	20,5	20	18,5	19
	2	19,5	19	17,5	17,5
	3	17,5	17,5	16	16,5
	4	15,5	15	14,5	14,5
	5	14	13,5	12,3	12,5
	7,5	9,5	9	8,5	8,5
	10	7	6	5	6

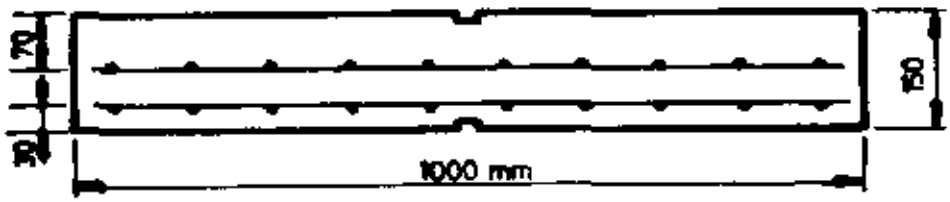
Figure 0

All test elements have a length of 2 m and a width of 1 m.

- unreinforced slab



- slab with mesh reinforcement 150 x 150 x 6 x 6



- slab with fibre reinforcement DRAMIX ZC 60/80 - 30 kg of fibres per m^3 concre

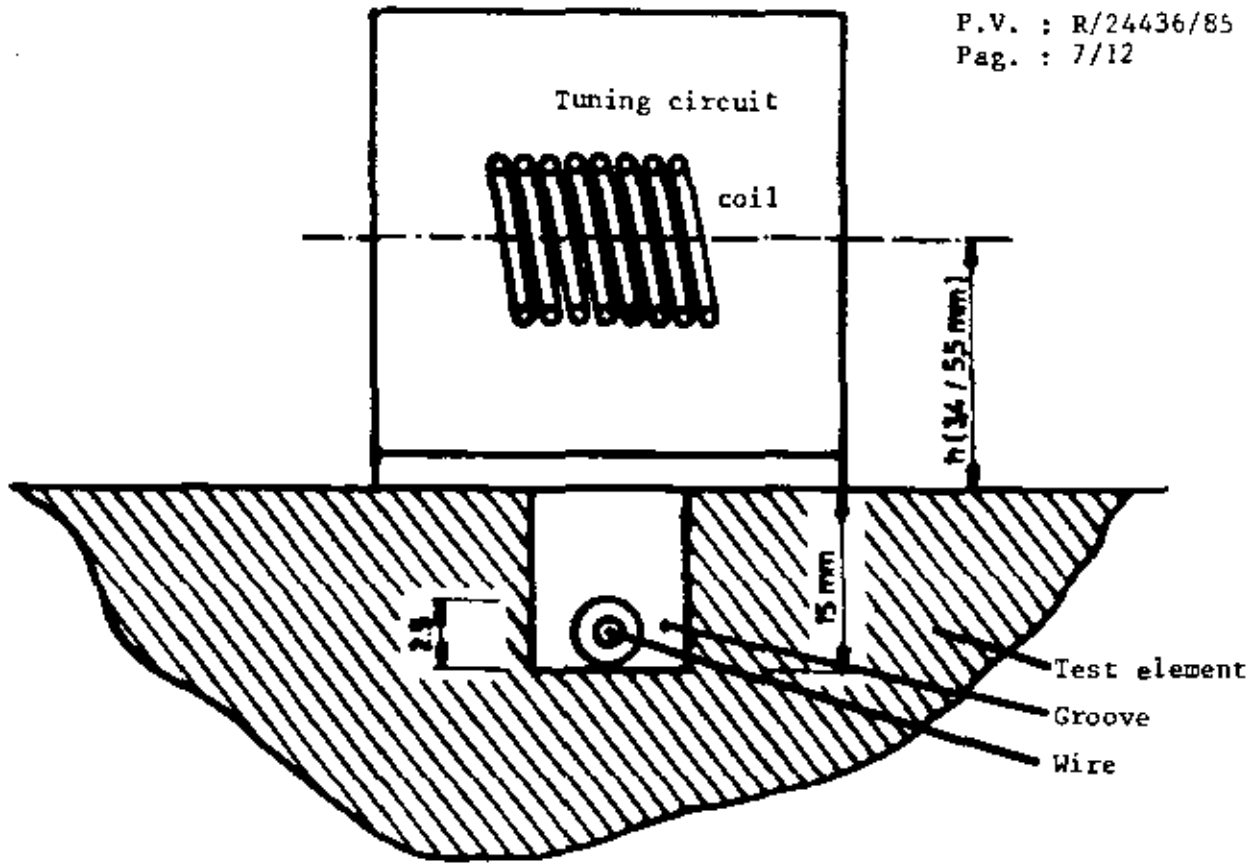


Figure 1

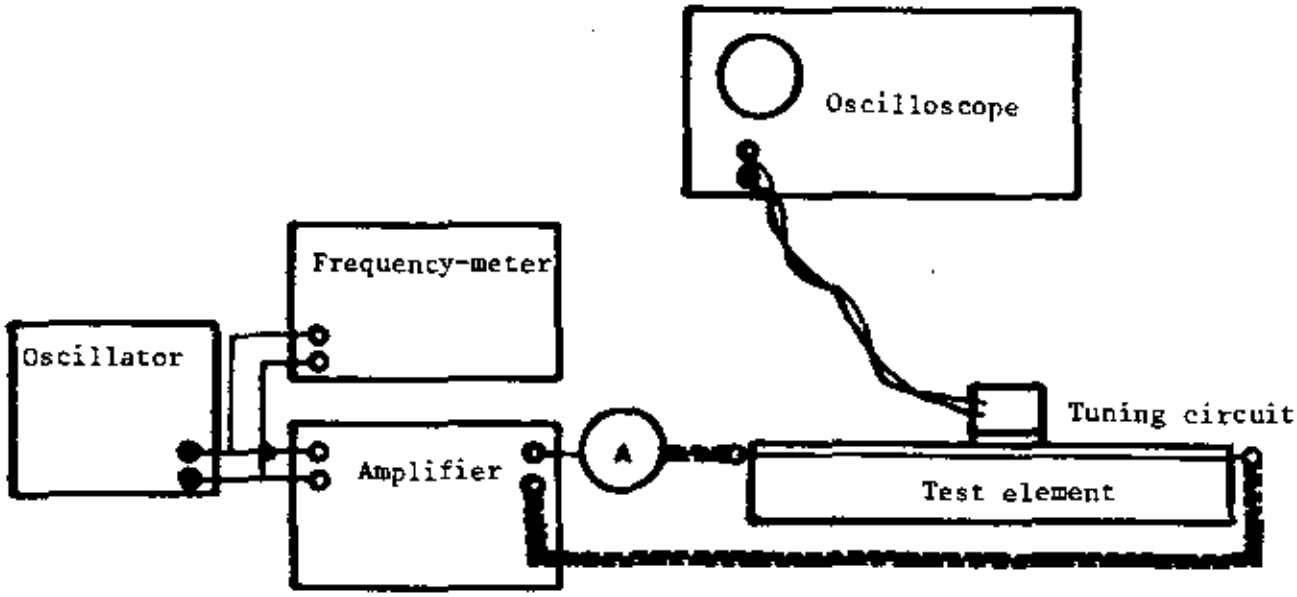
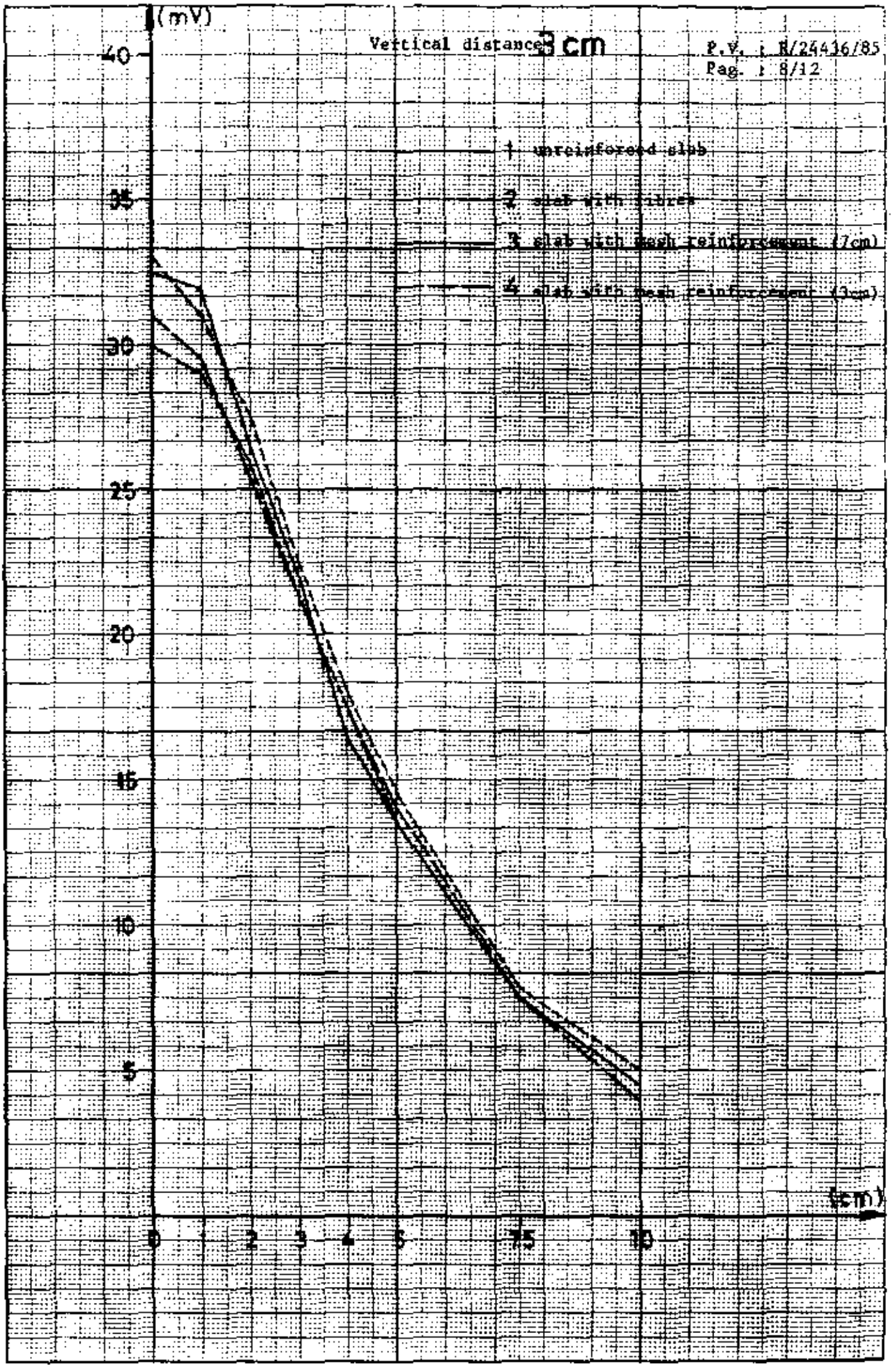


Figure 2


(mV)
Vertical distance 3 cm
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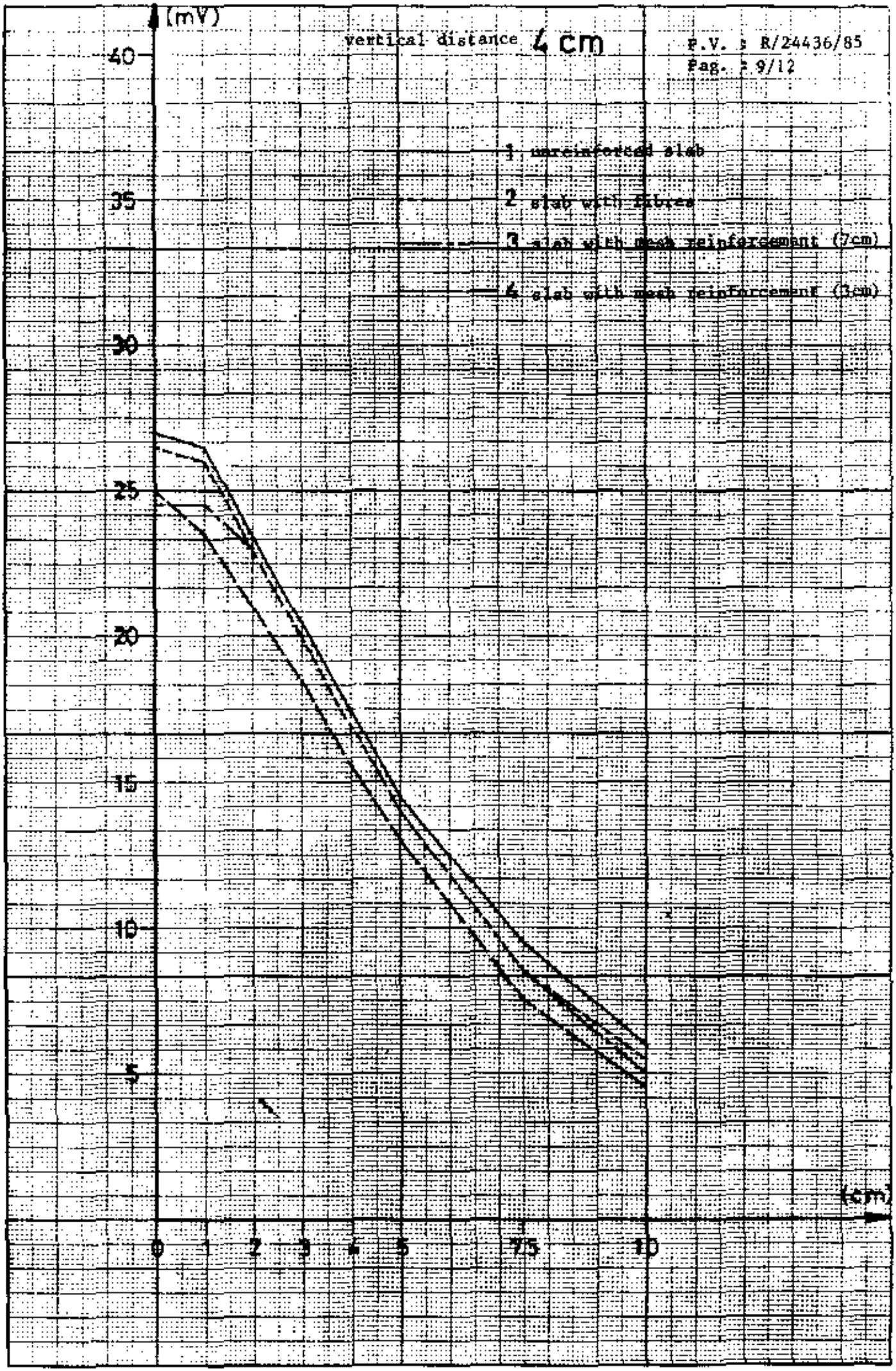
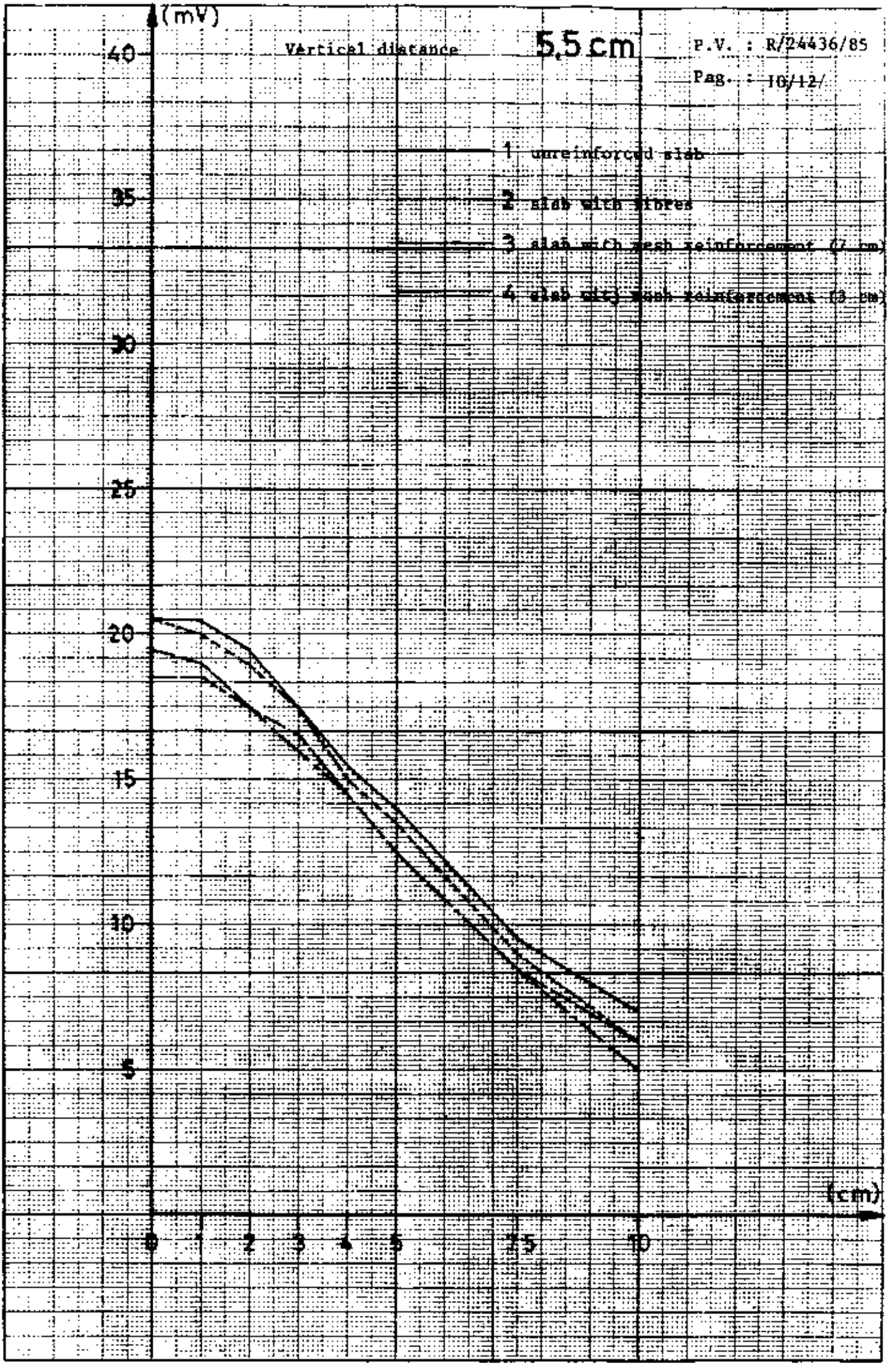
1 unreinforced slab
2 slab with fibres
3 slab with mesh reinforcement (7cm)
4 slab with mesh reinforcement (3cm)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
7.5
10
(cm)


(mV)
vertical distance 4 cm
1 unreinforced slab
2 slab with fibres
3 slab with mesh reinforcement (7cm)
4 slab with mesh reinforcement (3cm)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
7,5
10
(cm)


(mV)
Vertical distance
5,5 cm
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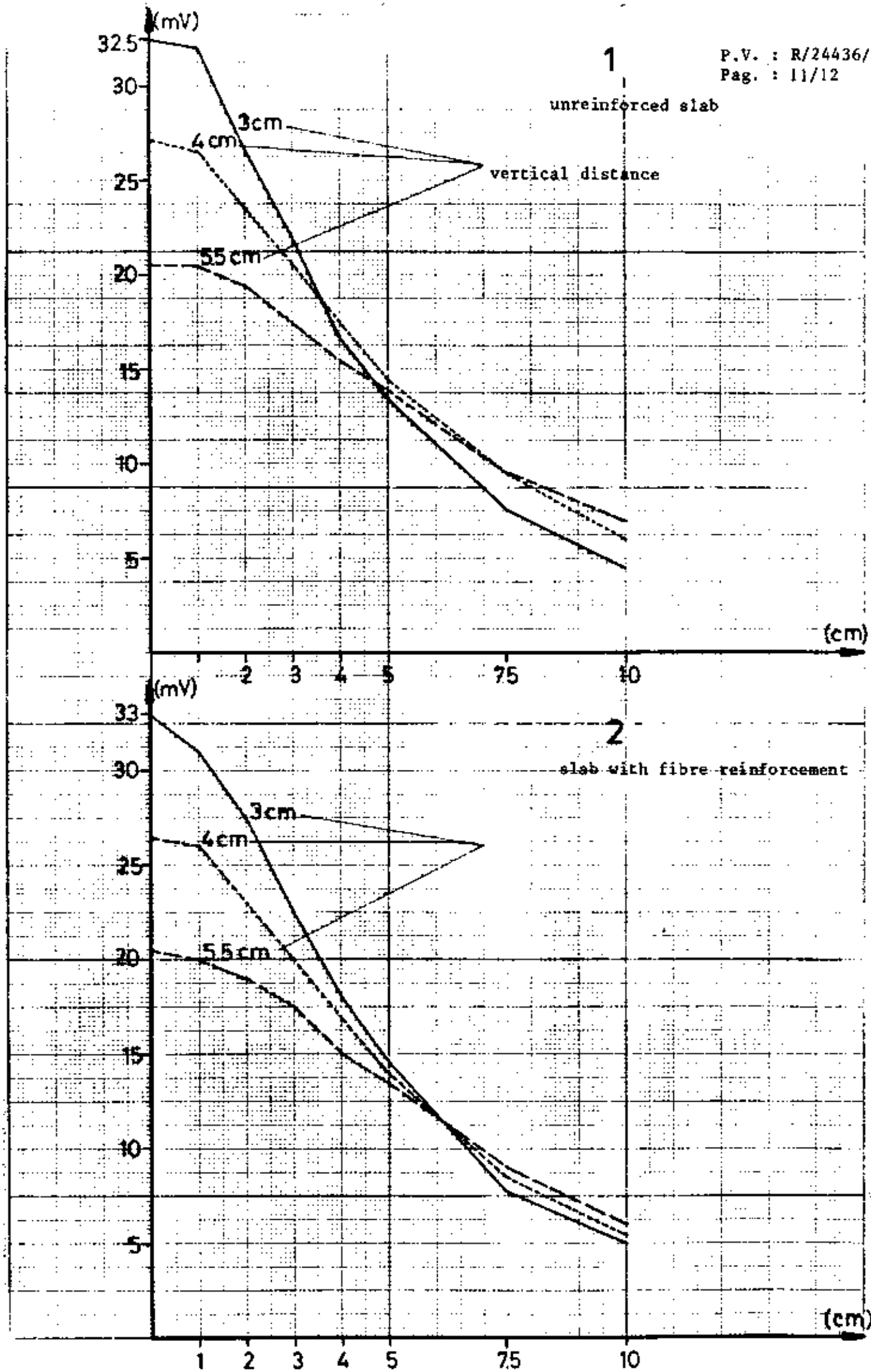
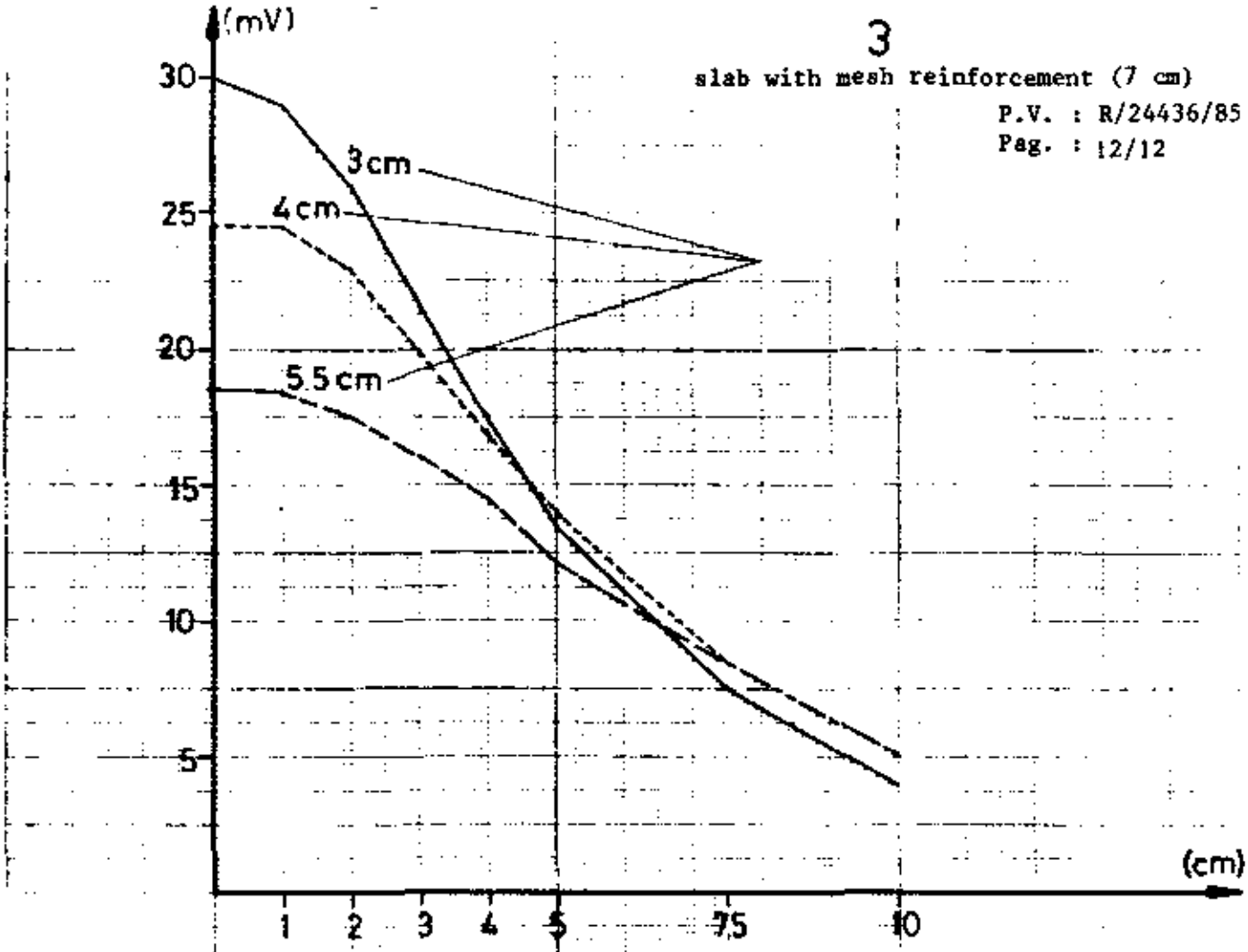
1 unreinforced slab
2 slab with fibres
3 slab with mesh reinforcement (7 cm)
4 slab with mesh reinforcement (3 cm)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
7,5
10
(cm)


1
unreinforced slab
(mV)
32.5
30
25
20
15
10
5
3cm
4 cm
5.5 cm
vertical distance
(cm)
2
3
4
5
7.5
10
2
slab with fibre reinforcement
(mV)
33
30
25
20
15
10
5
3cm
4cm
5.5cm
(cm)
1
2
3
4
5
7.5
10



3

slab with mesh reinforcement (7 cm)

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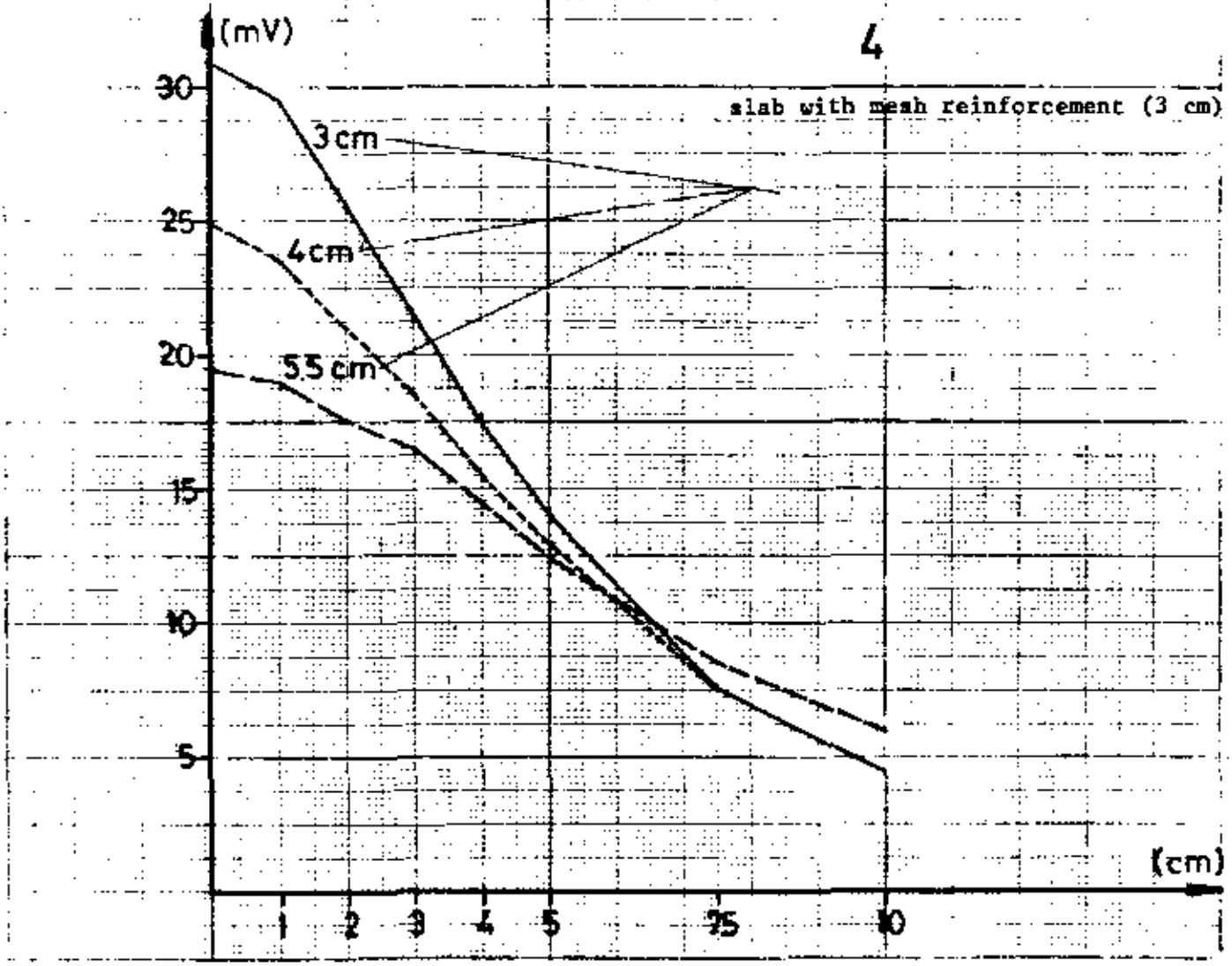

4

slab with mesh reinforcement (3 cm)