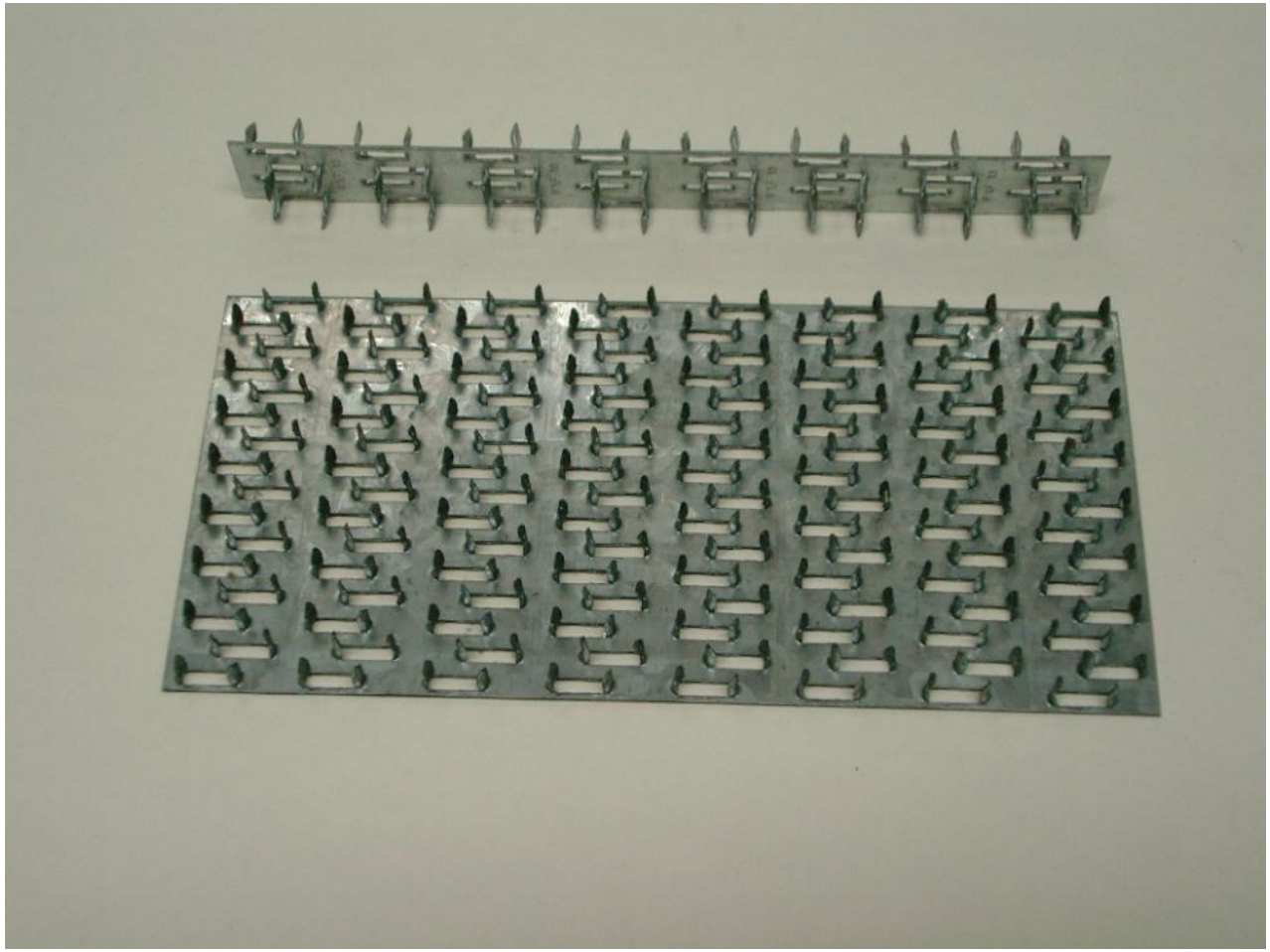
Ductility

With respect to punched metal plate fastener joints.

(Trondheim)

Typical punched metal plate fastener.



Tests determine:

Anchorage capacity

Tension capacity

Compression capacity

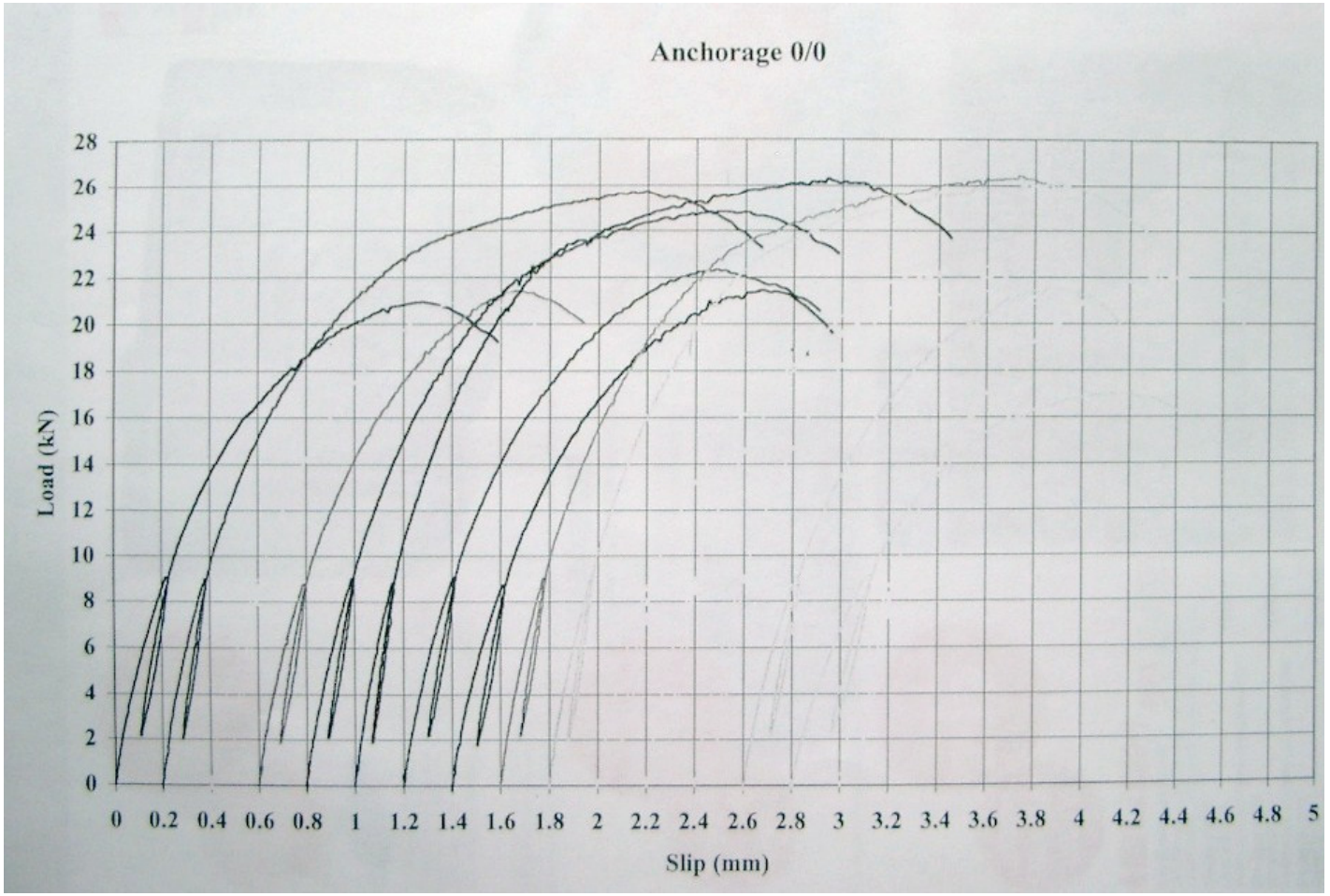
Shear capacity.

EN 1075 defines two important angles in relation to test specimen geometry

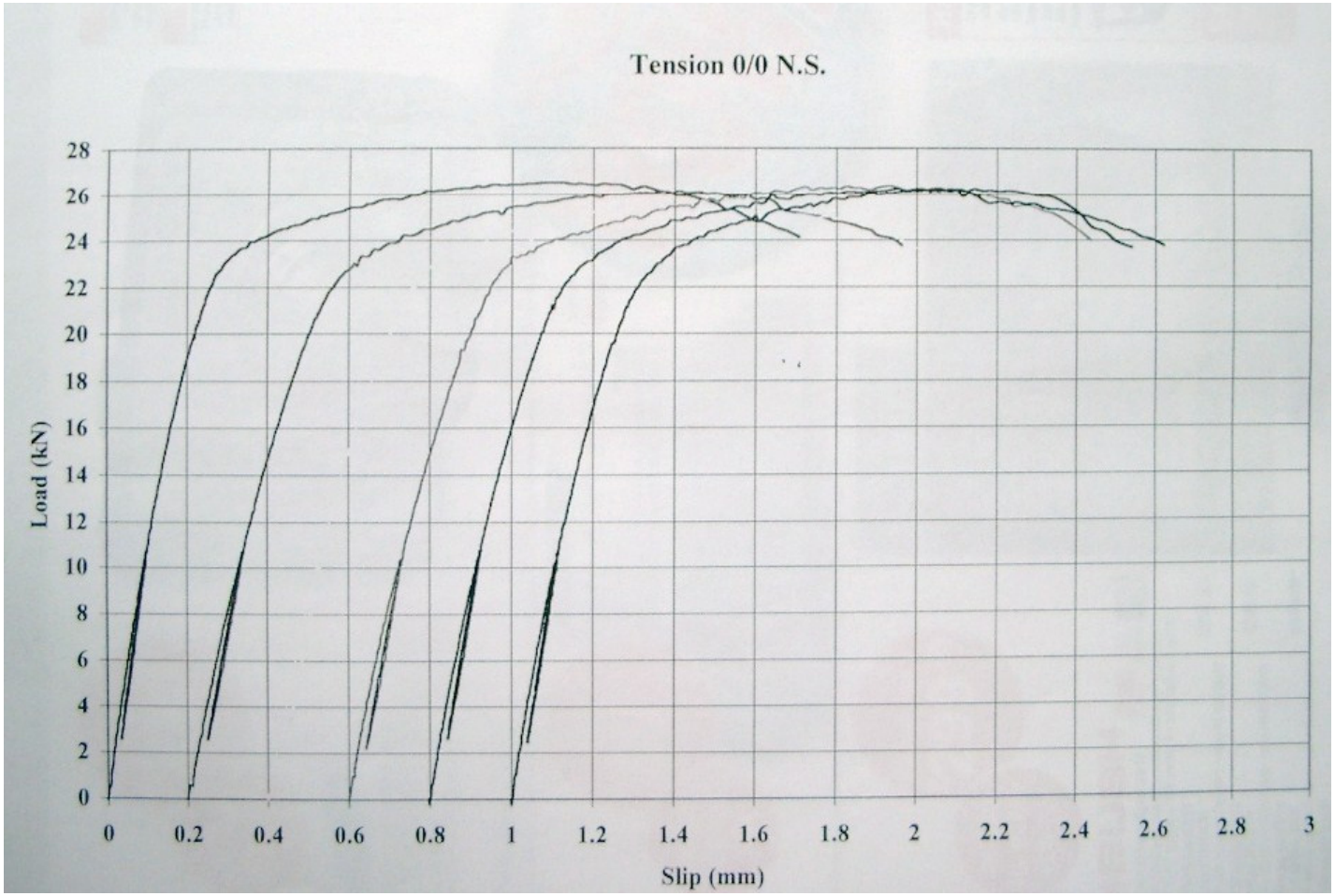
α = Angle of load with respect to the major axis of the fastener.

β = Angle of load with respect to the timber grain direction.

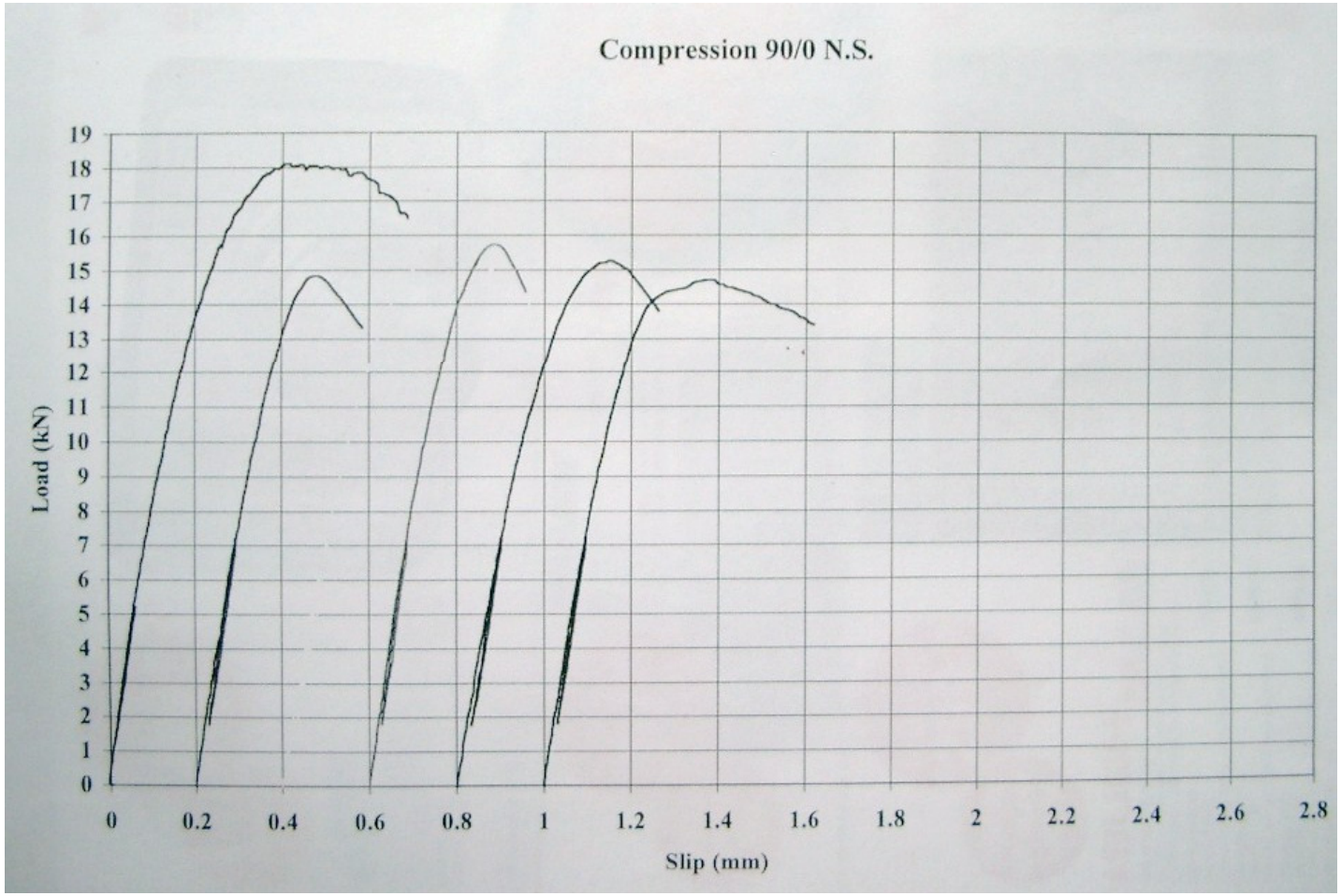
Anchorage 0/0



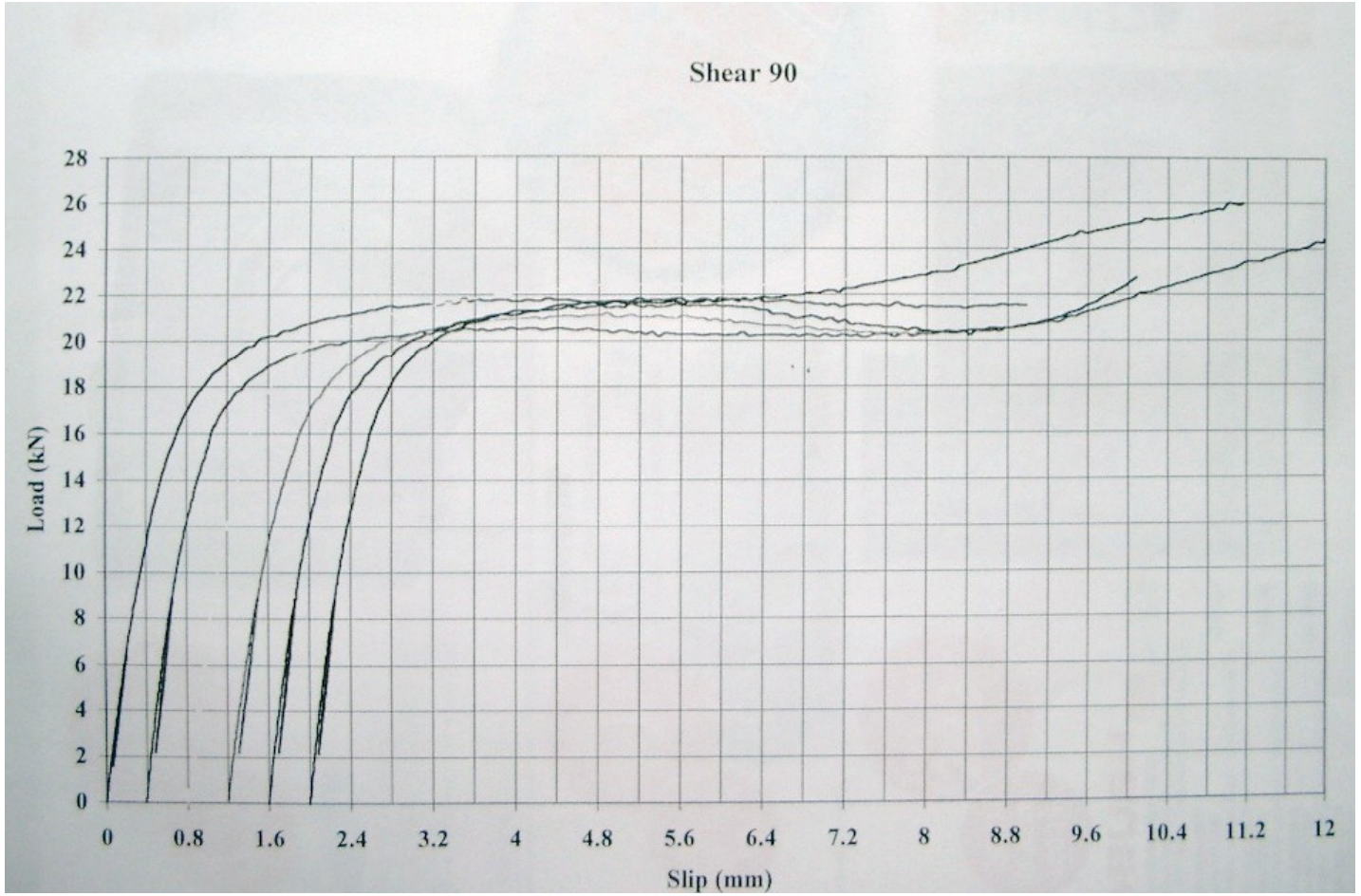
Tension 0/0


Tension 0/0 N.S.
Load (kN)
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
Slip (mm)

Compression 90/0



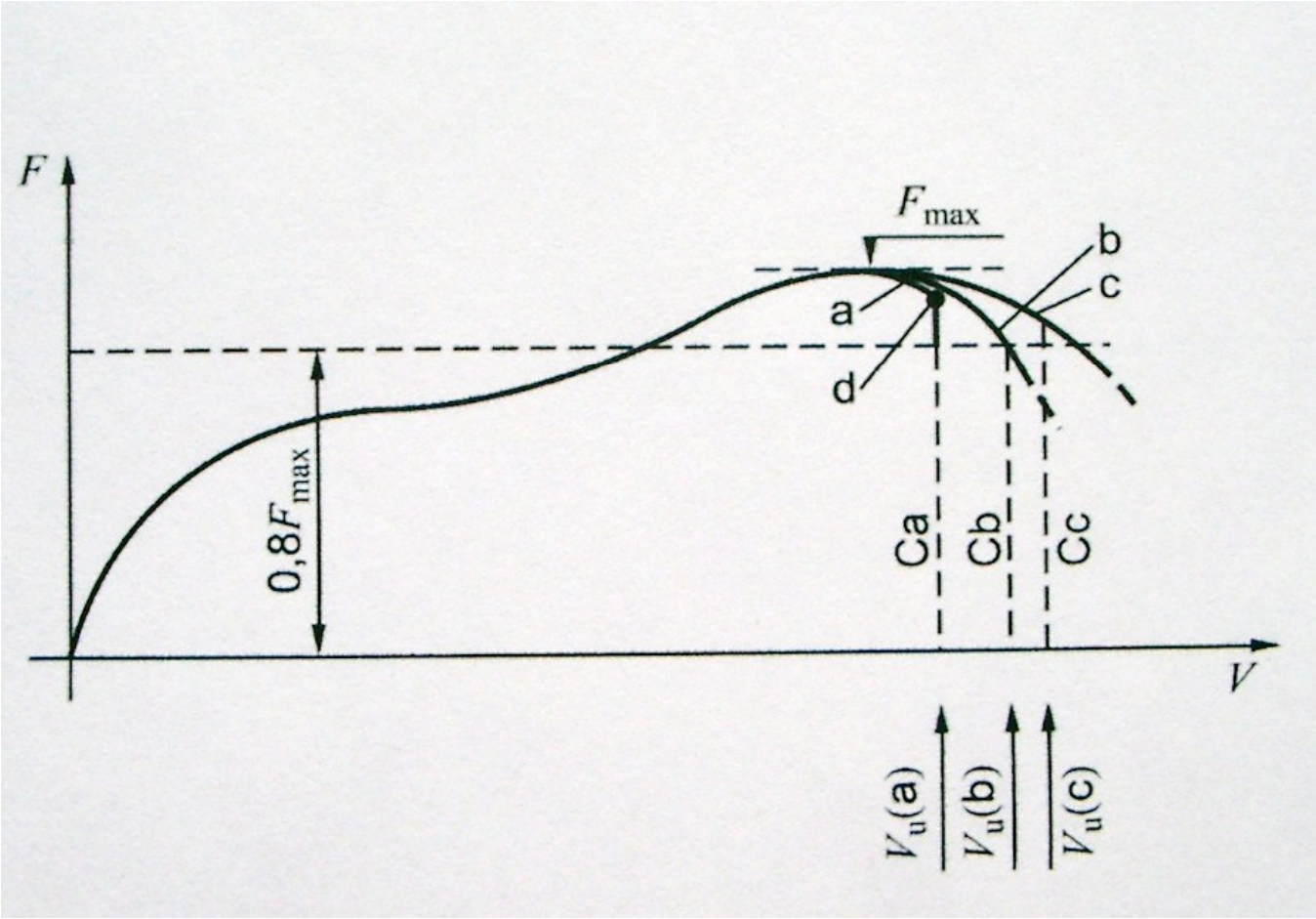
Shear 90/0


Shear 90
Load (kN)
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0
0.8
1.6
2.4
3.2
4
4.8
5.6
6.4
7.2
8
8.8
9.6
10.4
11.2
12
Slip (mm)

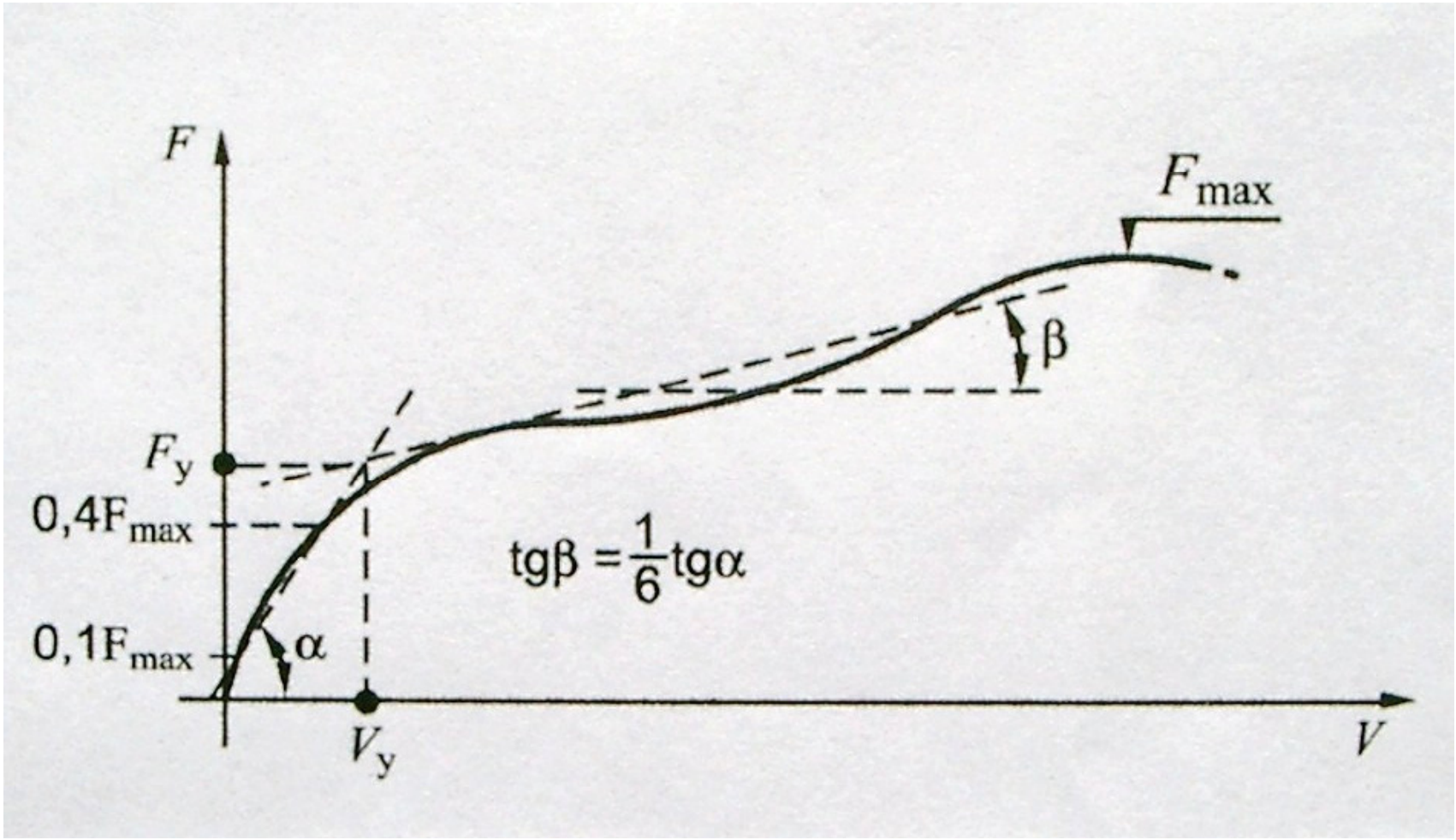
According to section 3.7 of EN 12512:1991 ductility is measured as the ratio between ultimate slip V_u and the yield slip V_y.

$D = V_u/V_y$

EN 12512 definition of ultimate displacement V_u



EN 12512 definition of yield displacement V_y curves without two well defined linear portions



Some results

Anchorage

α/β	D
0/0	4.2
30/0	5.8
60/0	4.3
90/0	6.7
0/30	4.3
0/60	4.1
0/90	8.4
45/90	5.4
90/90	11.4

Tension

α/β	D
0/0	10.7
45/0	17+
90/0	9.3

Compression

α/β	D
0/0	9.6
45/0	7.4
90/0	4.7

Shear

α	D
0	12.8
15	14.1
30	10.0
45	8.2
60	8.8
75	22.5
90	20+
105	20+
120	9.1
135	33
150	32
165	43

Some results

Anchorage

α/β	D
0/0	4.2
30/0	5.8
60/0	4.3
90/0	6.7
0/30	4.3
0/60	4.1
0/90	8.4
45/90	5.4
90/90	11.4

Tension

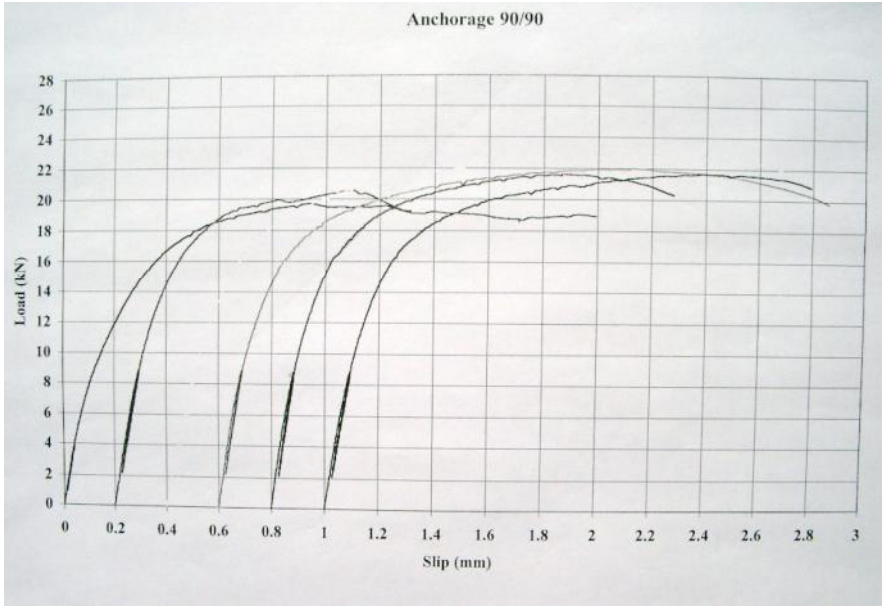
α/β	D
0/0	10.7
45/0	17+
90/0	9.3

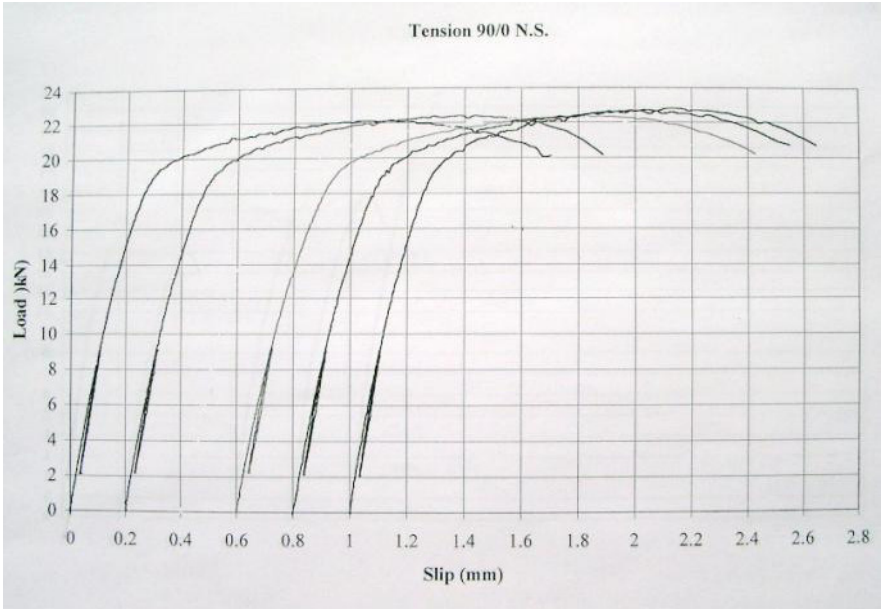
Compression

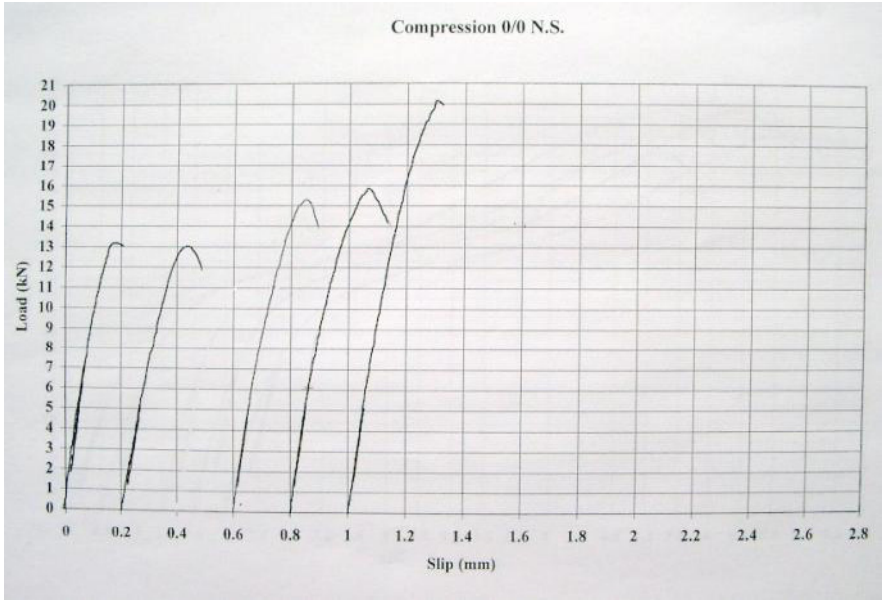
α/β	D
0/0	9.6
45/0	7.4
90/0	4.7

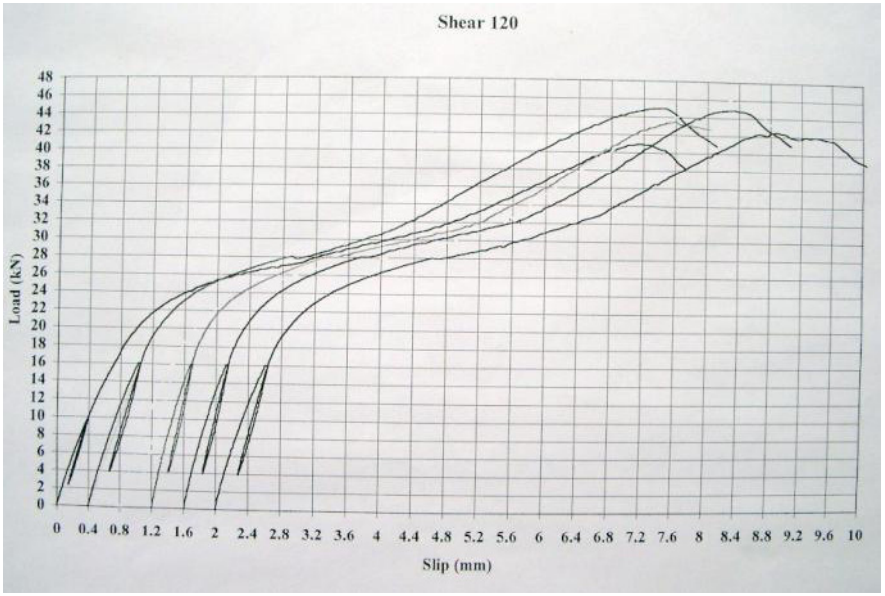
Shear

α	D
0	12.8
15	14.1
30	10.0
45	8.2
60	8.8
75	22.5
90	20+
105	20+
120	9.1
135	33
150	32
165	43


Anchorage 90/90
Load (kN)
Slip (mm)


Tension 90/0 N.S.
Load)kN)
Slip (mm)


Compression 0/0 N.S.
Load (kN)
Slip (mm)


Shear 120
Load (kN)
Slip (mm)

Concluding thoughts

- The results presented here are incomplete and provisional but appear to indicate that load/slip characteristics which look very different can produce similar ductility numbers
- Is ductility a sufficiently discerning characteristic for use in reliability studies?