

MARIA CECÍLIA GUAZZELLI

**PROJETO DE ESCORAMENTO DE VALAS
ATRAVÉS DE ÁBACOS**

Dissertação apresentada à Escola
Politécnica da Universidade de
São Paulo para a obtenção do
título de Mestre em Engenharia.

(Apêndice I)

São Paulo
1997

**ÁBACOS PARA A DETERMINAÇÃO
DOS ESFORÇOS SOLICITANTES EM
ESCORAMENTO COM UM NÍVEL
DE ESTRONCA**

**ÁBACOS PARA A DETERMINAÇÃO DOS
ESFORÇOS SOLICITANTES EM
ESCORAMENTO COM UM NÍVEL DE
ESTRONCA**

ÁBACOS ES1

EMPUXO RETIFICADO

**NÍVEL DE ÁGUA
NA SUPERFÍCIE**

H = 3,5 m

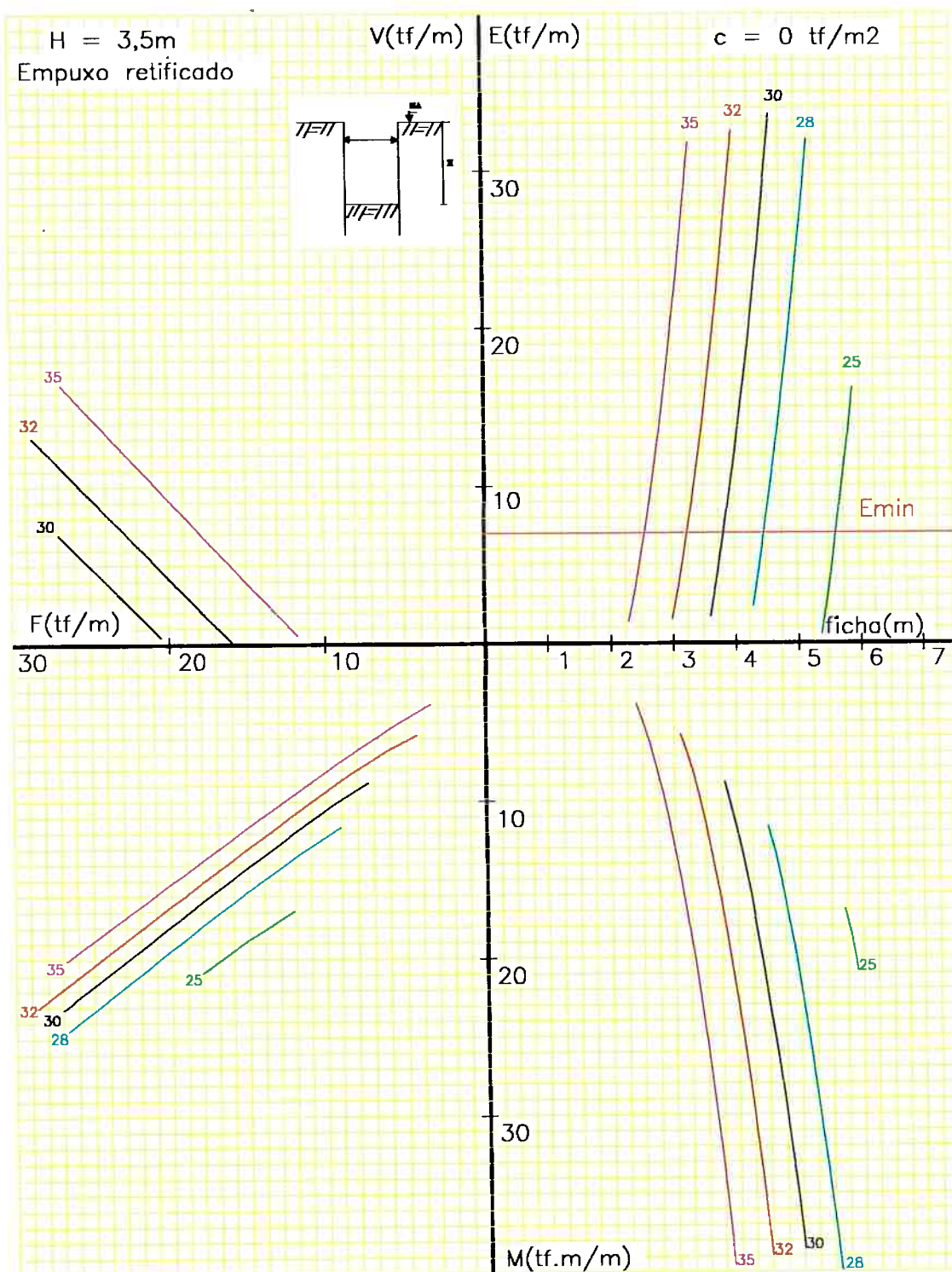


Fig. I.1- Ábaco tipo ES1

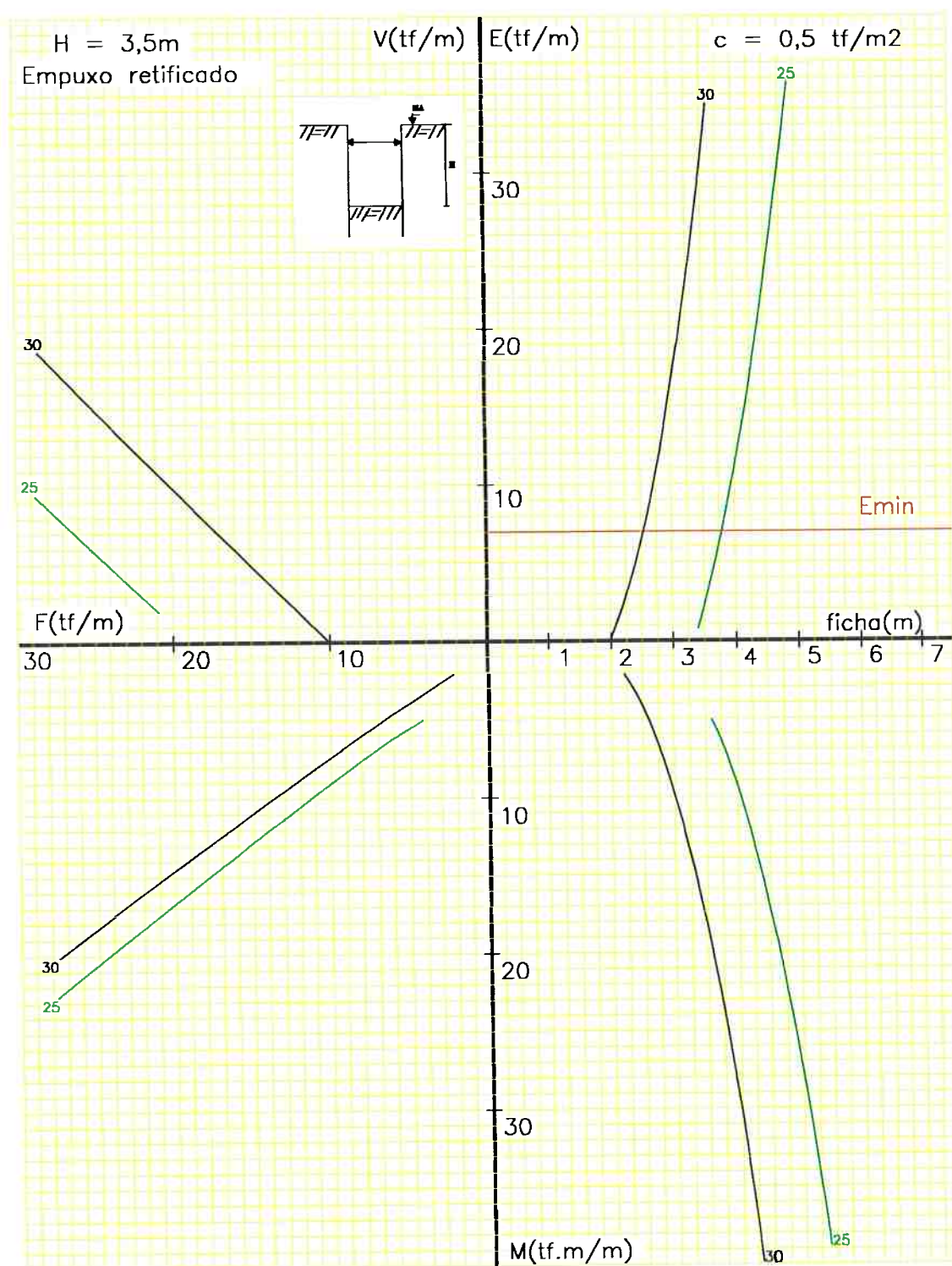


Fig. I.2- Ábaco tipo ES1

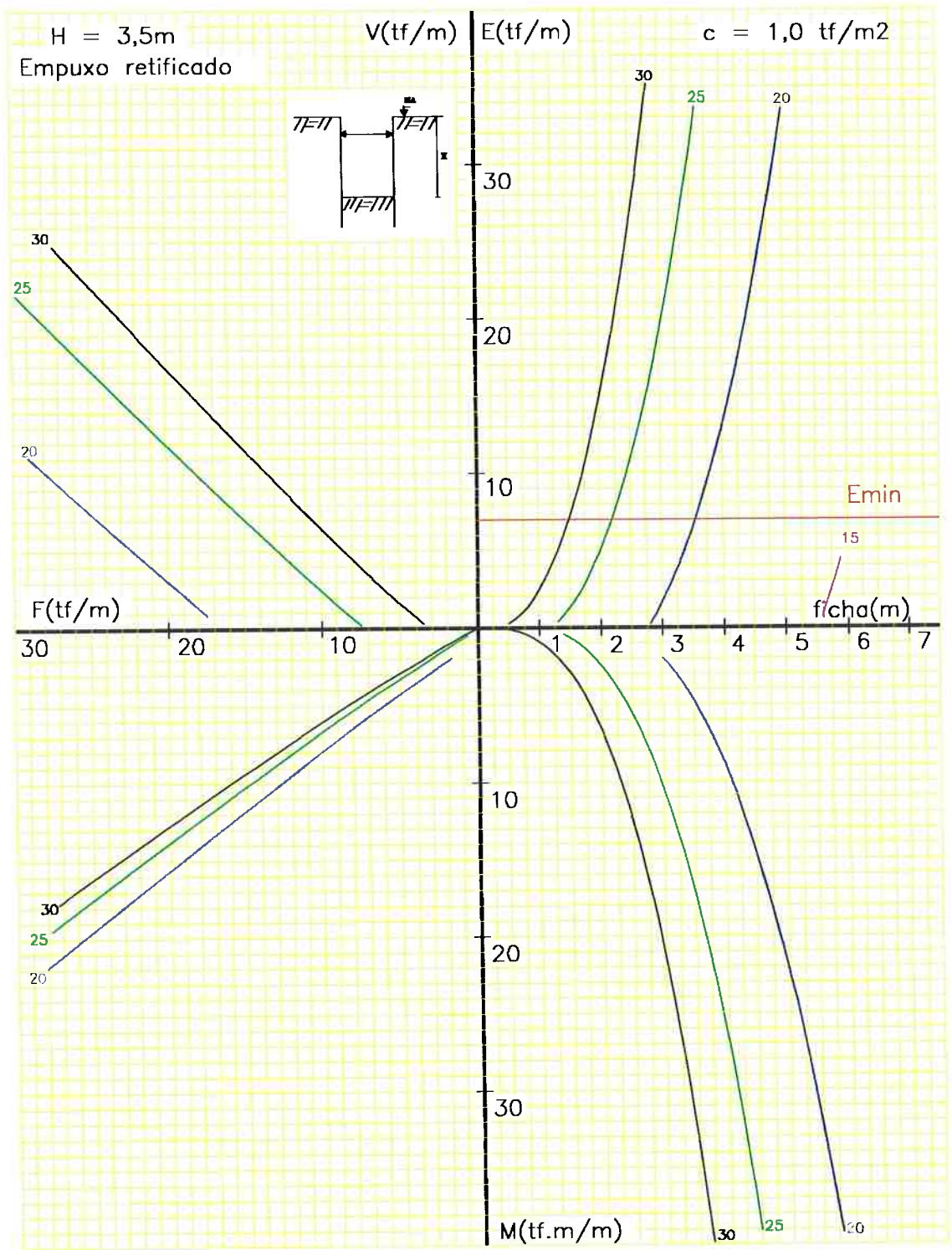


Fig. I.3- Ábaco tipo ES1

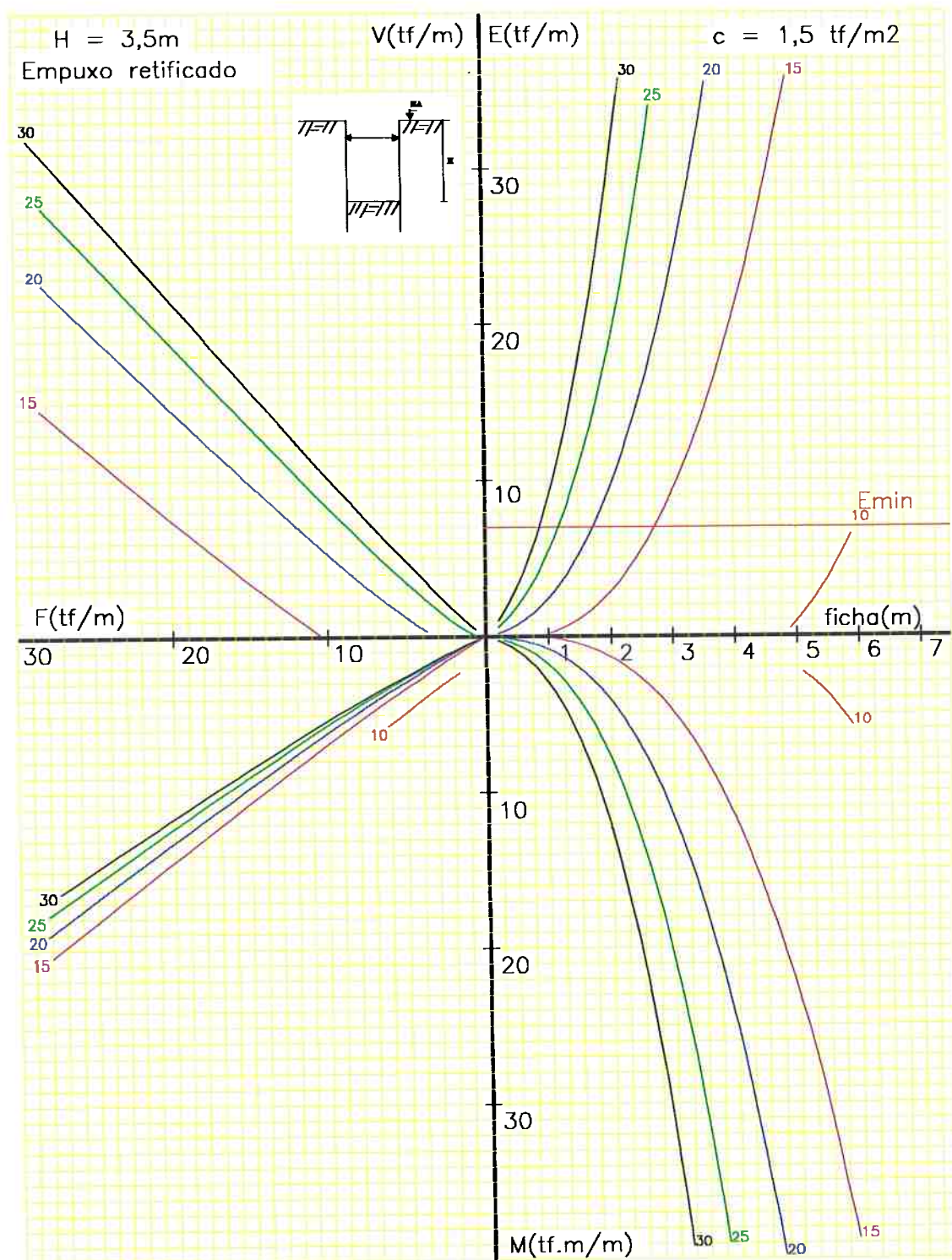


Fig. I.4- Ábaco tipo ES1

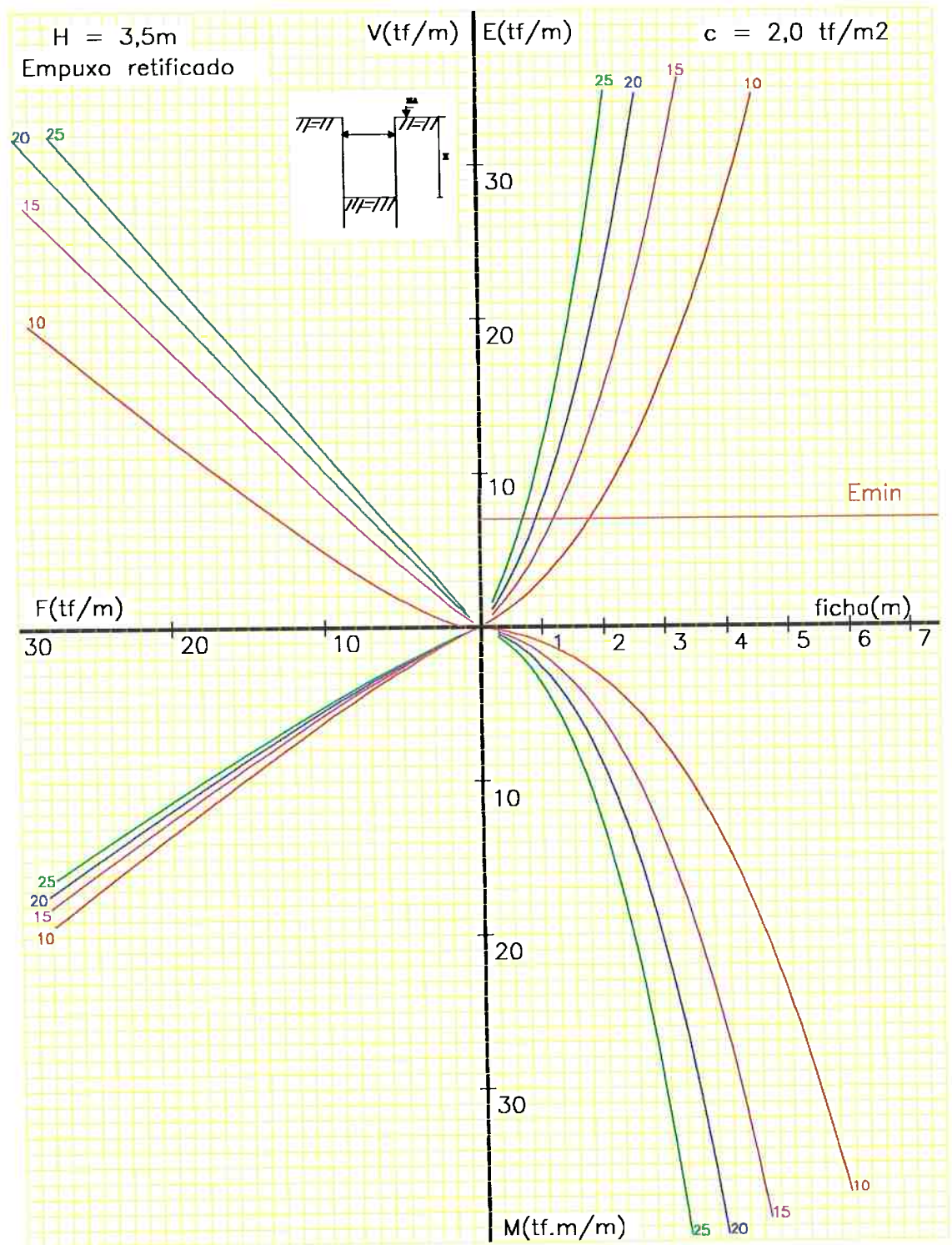


Fig. I.5- Ábaco tipo ES1

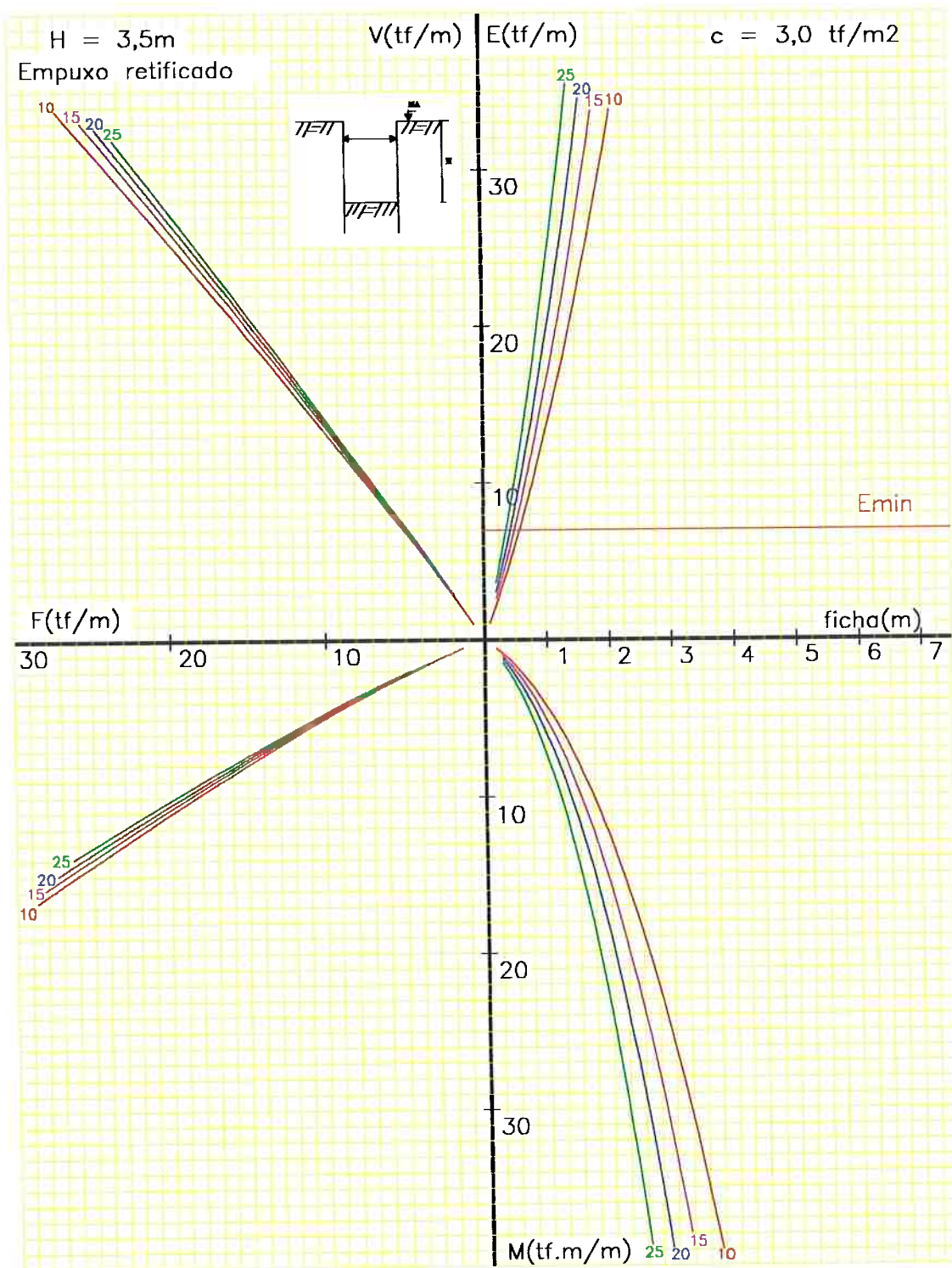


Fig. I.6- Ábaco tipo ES1

H = 4,5 m

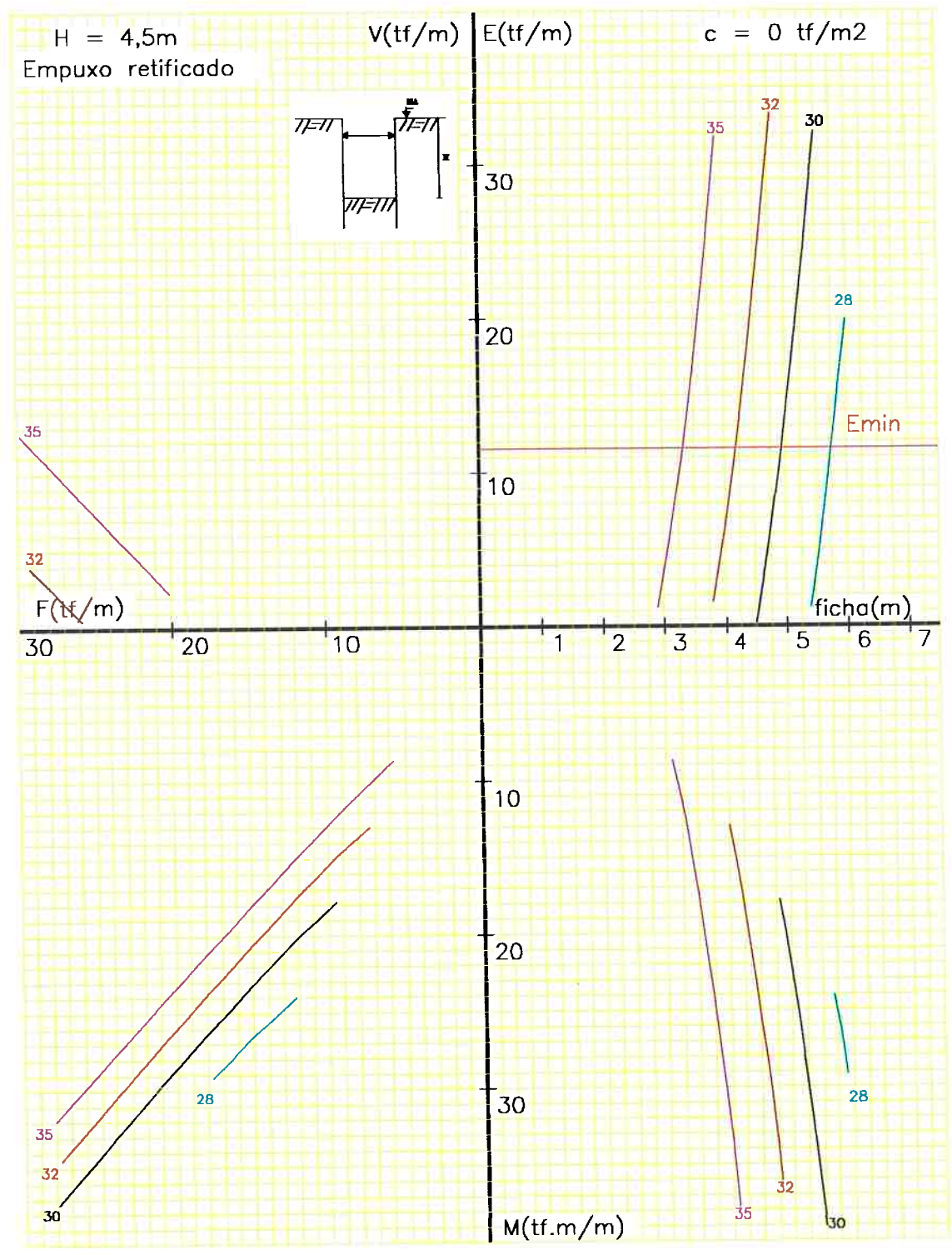


Fig. I.7- Ábaco tipo ES1

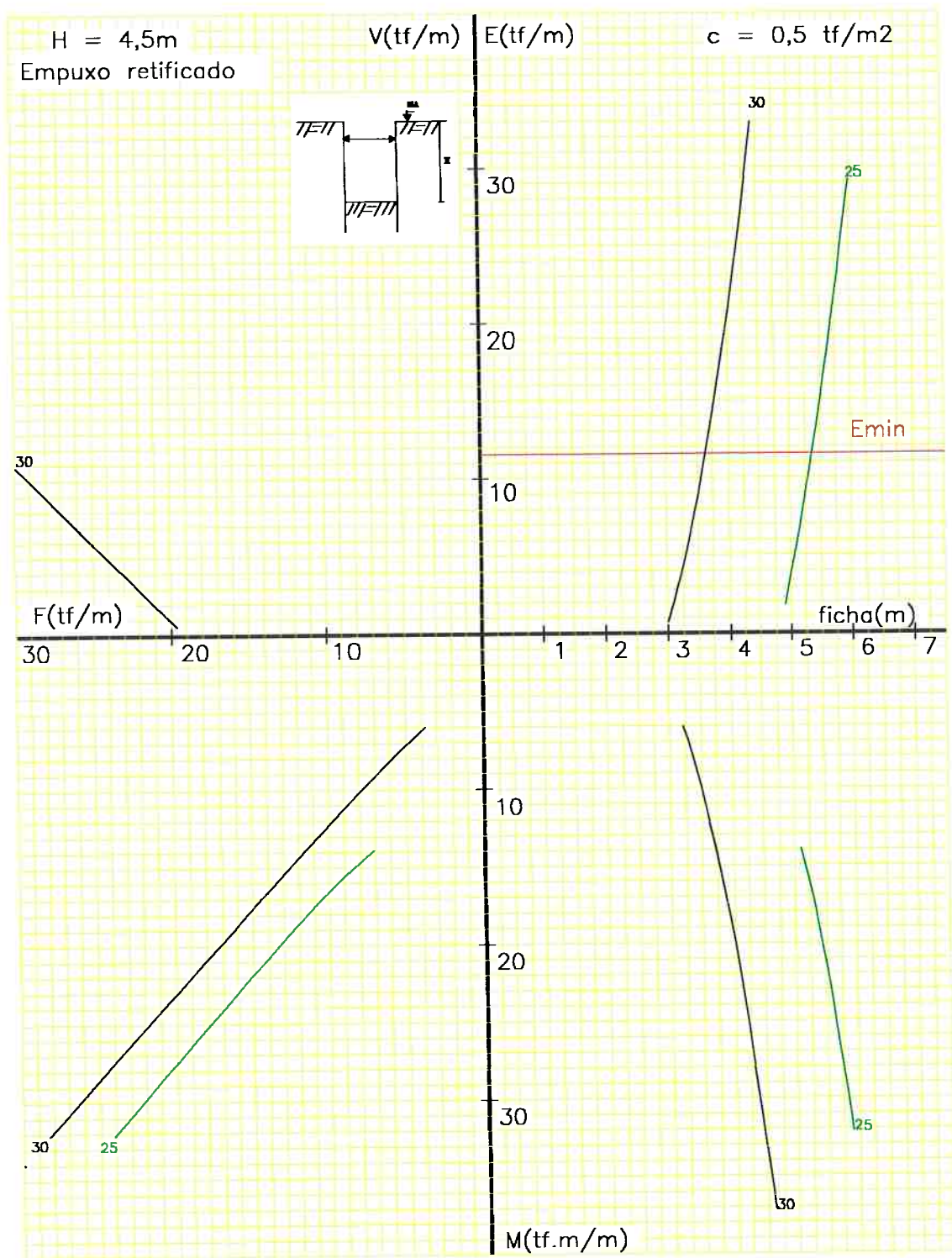


Fig. I.8- Ábaco tipo ES1

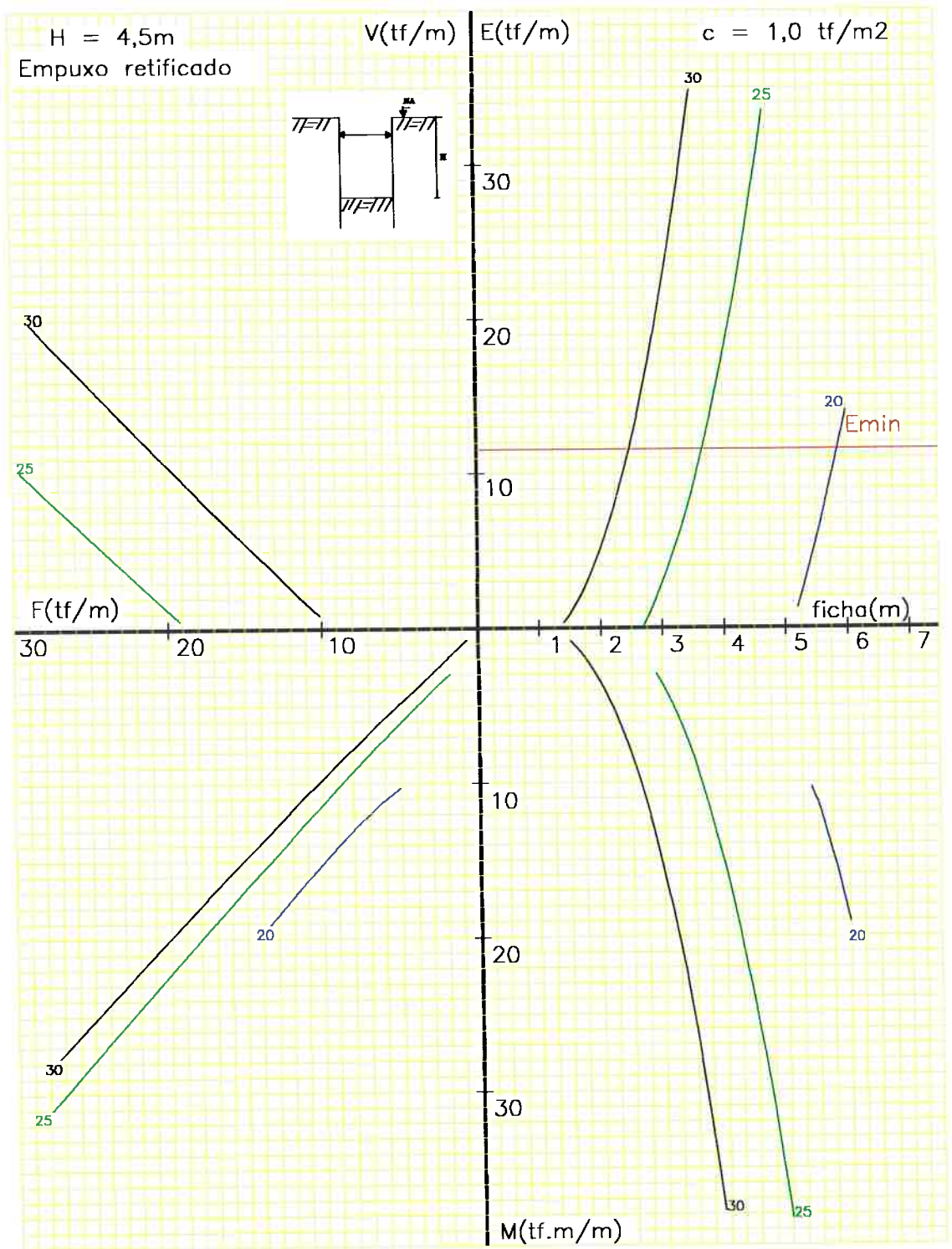


Fig. I.9- Ábaco tipo ES1

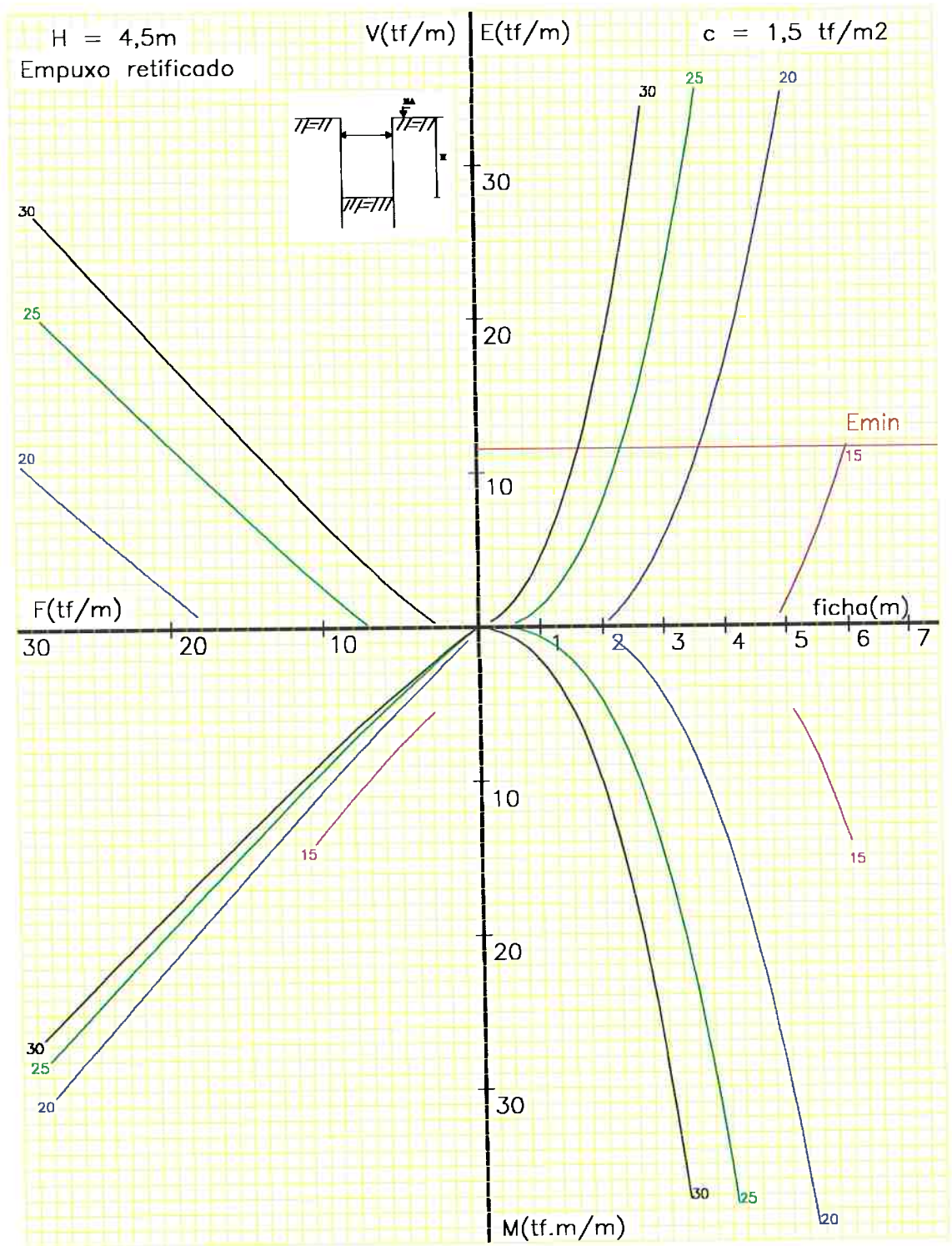


Fig. I.10- Ábaco tipo ES1

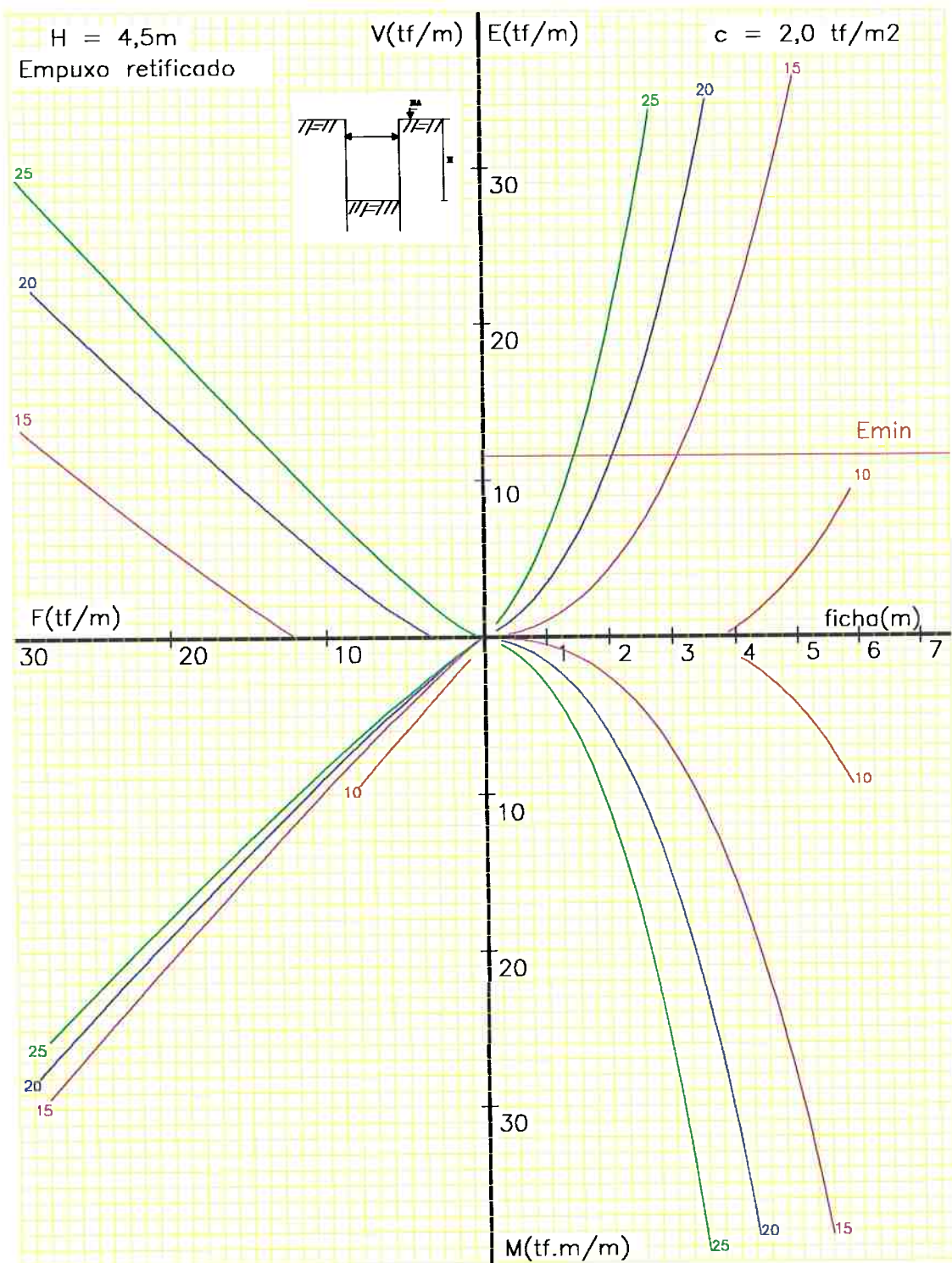


Fig. I.11- Ábaco tipo ES1

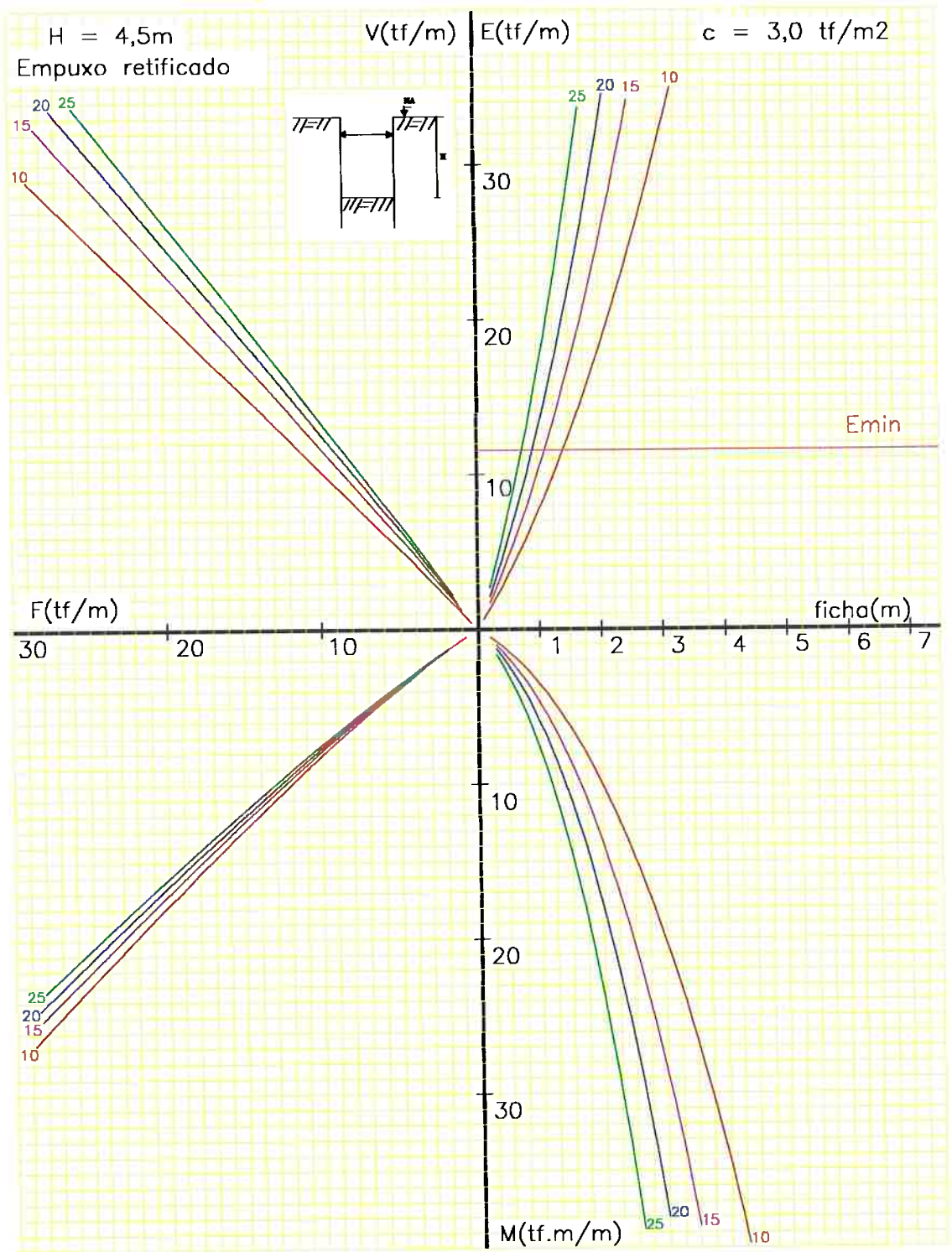


Fig. I.12- Ábaco tipo ES1

H = 5,5 m

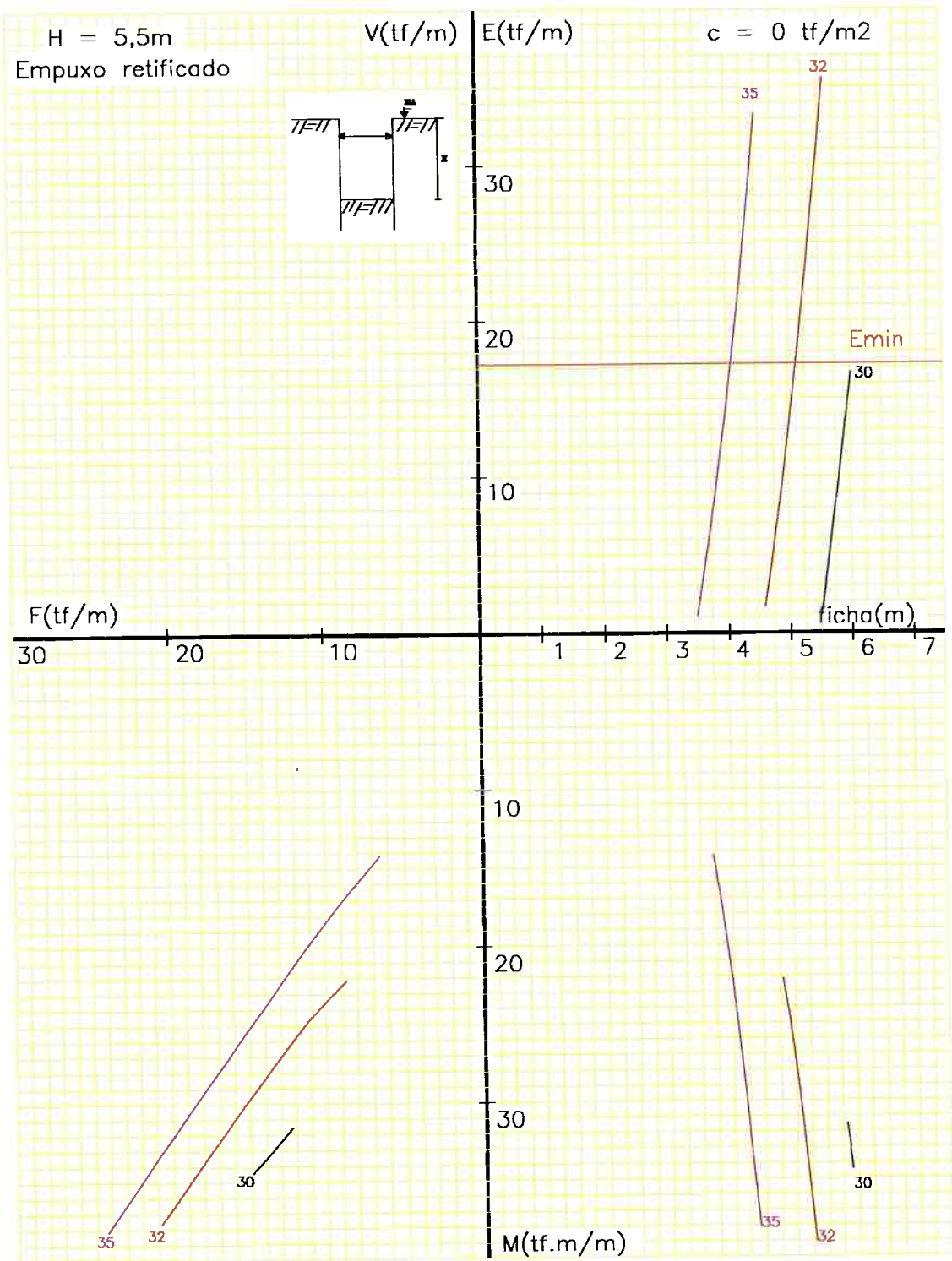


Fig. I.13- Ábaco tipo ES1

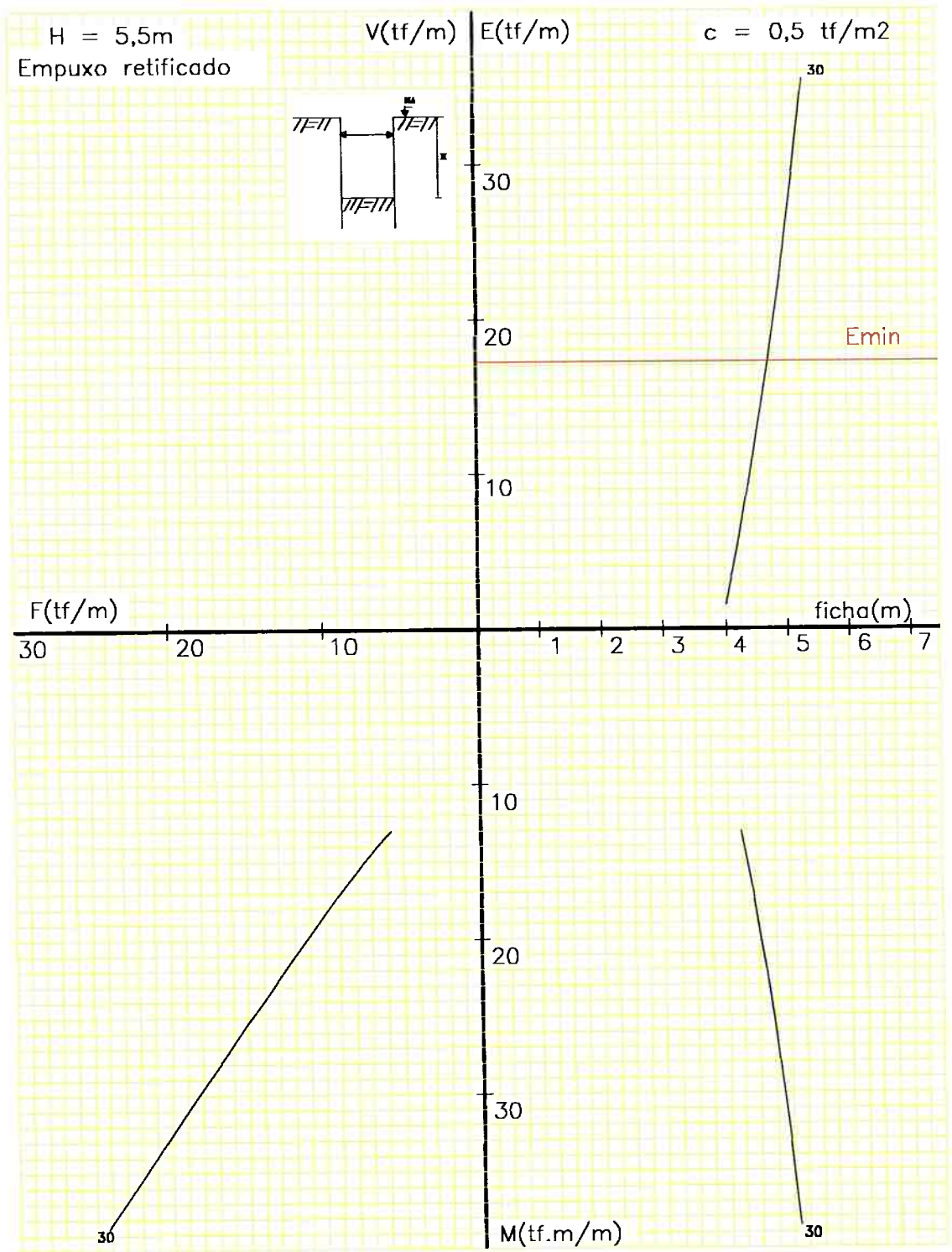


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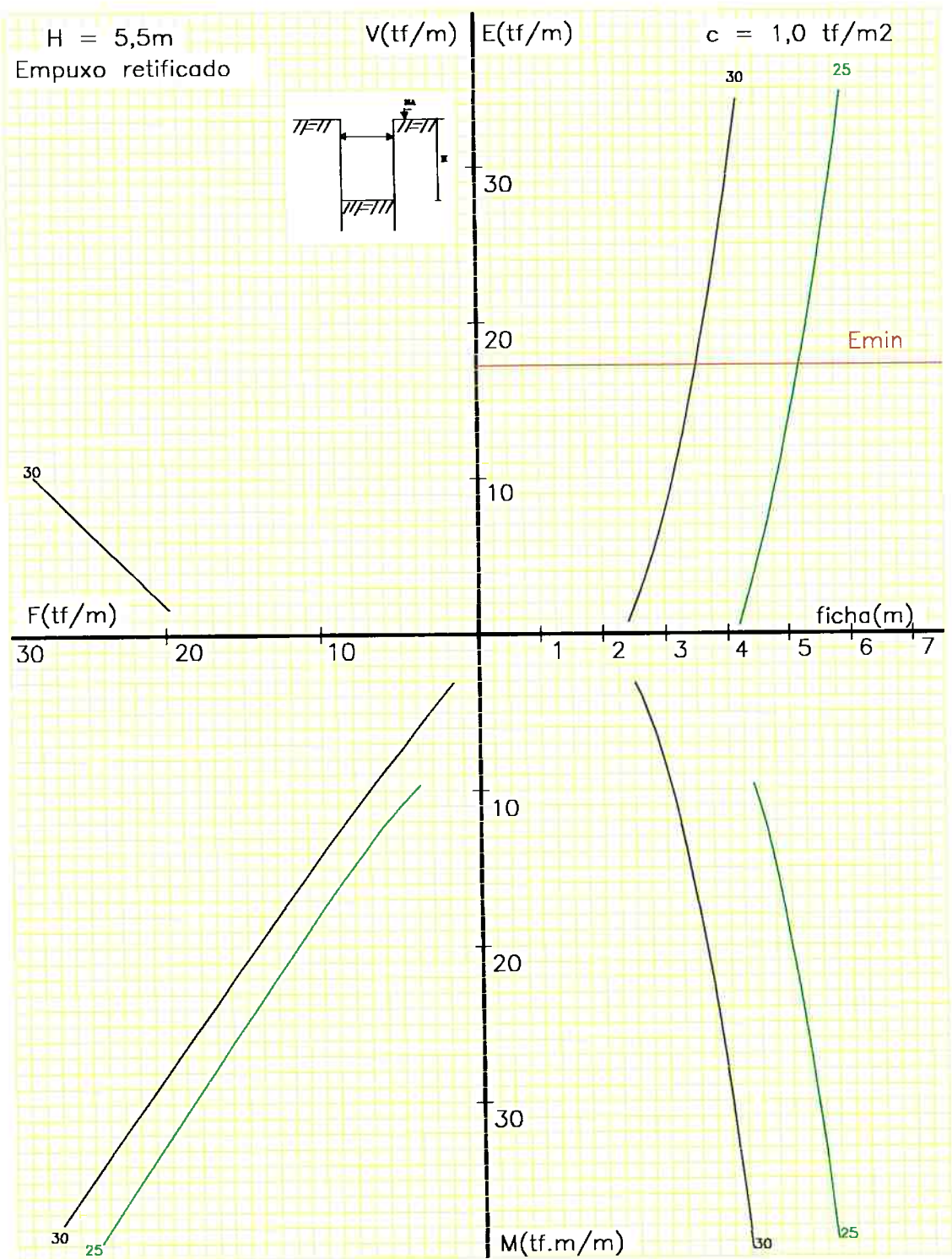


Fig. I.15- Ábaco tipo ES1

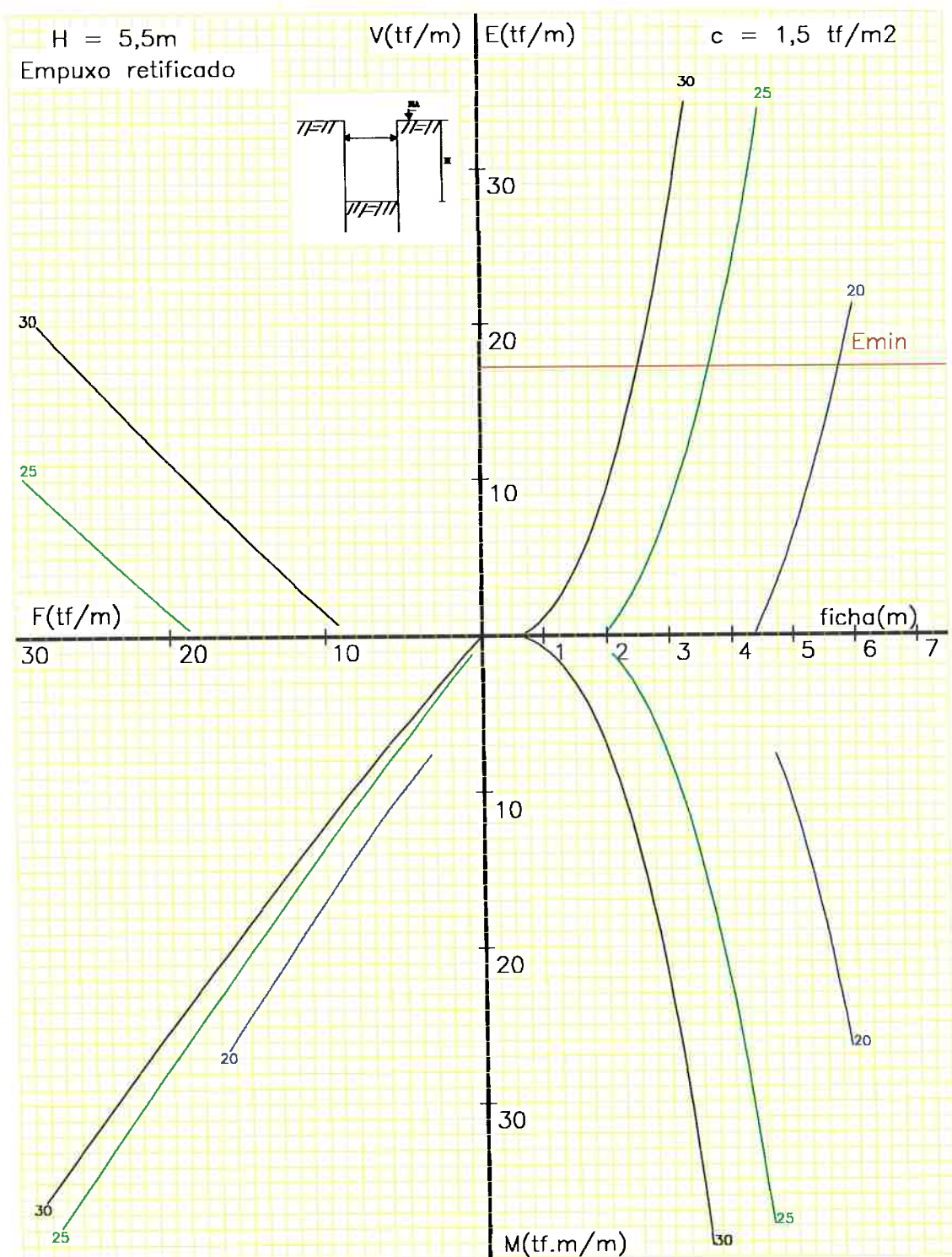


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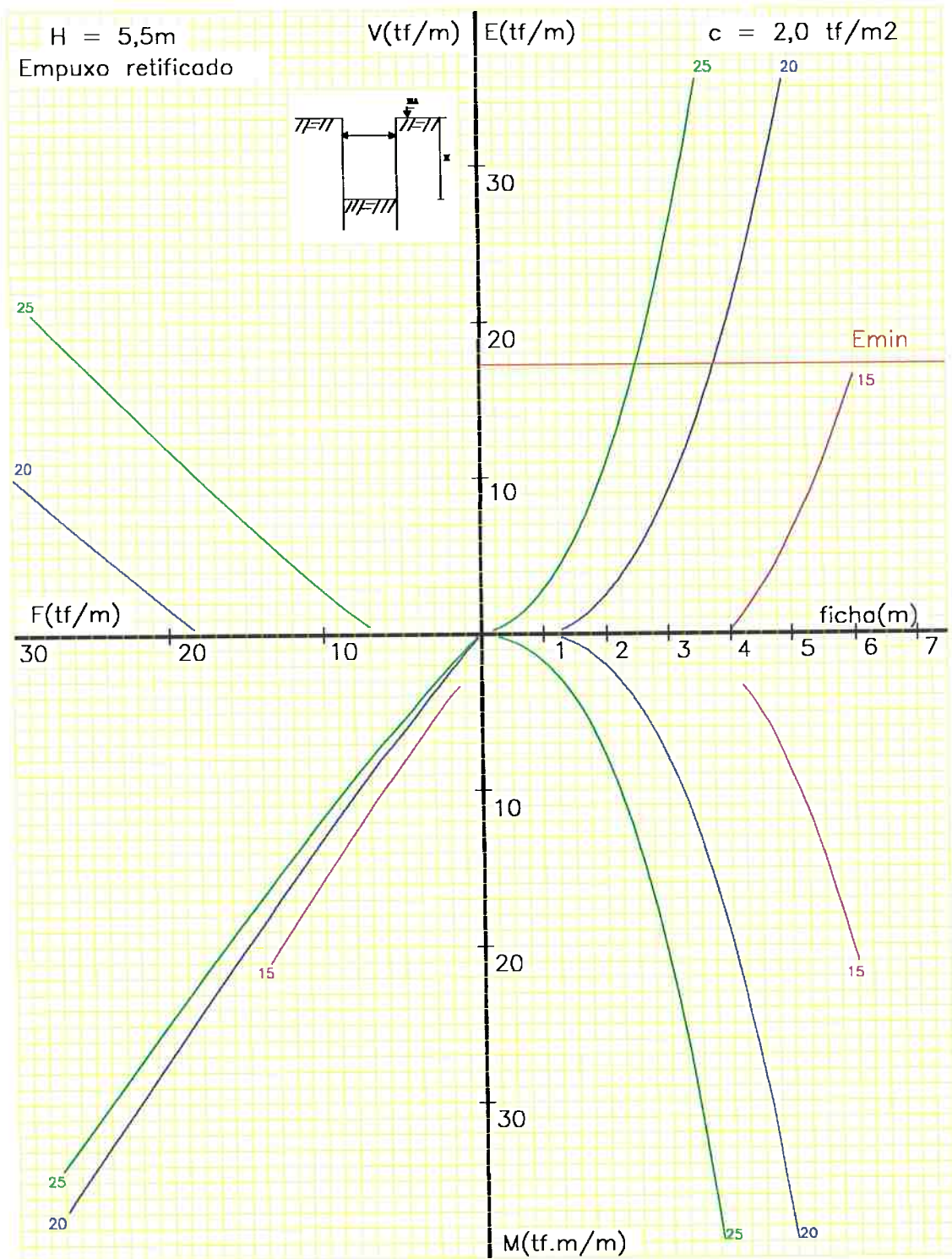


Fig. I.17- Ábaco tipo ES1

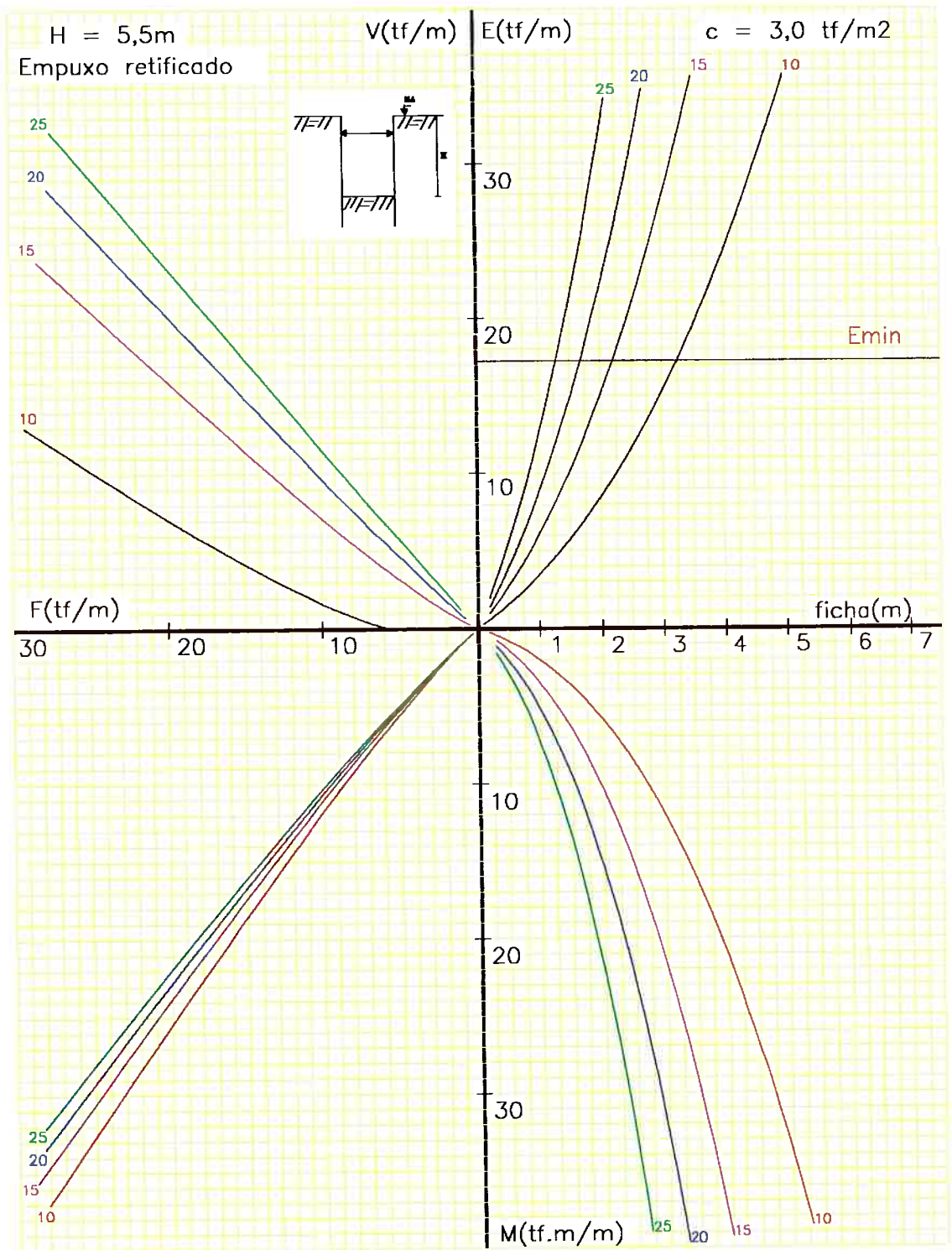


Fig. I.18- Ábaco tipo ES1

H = 6,5 m

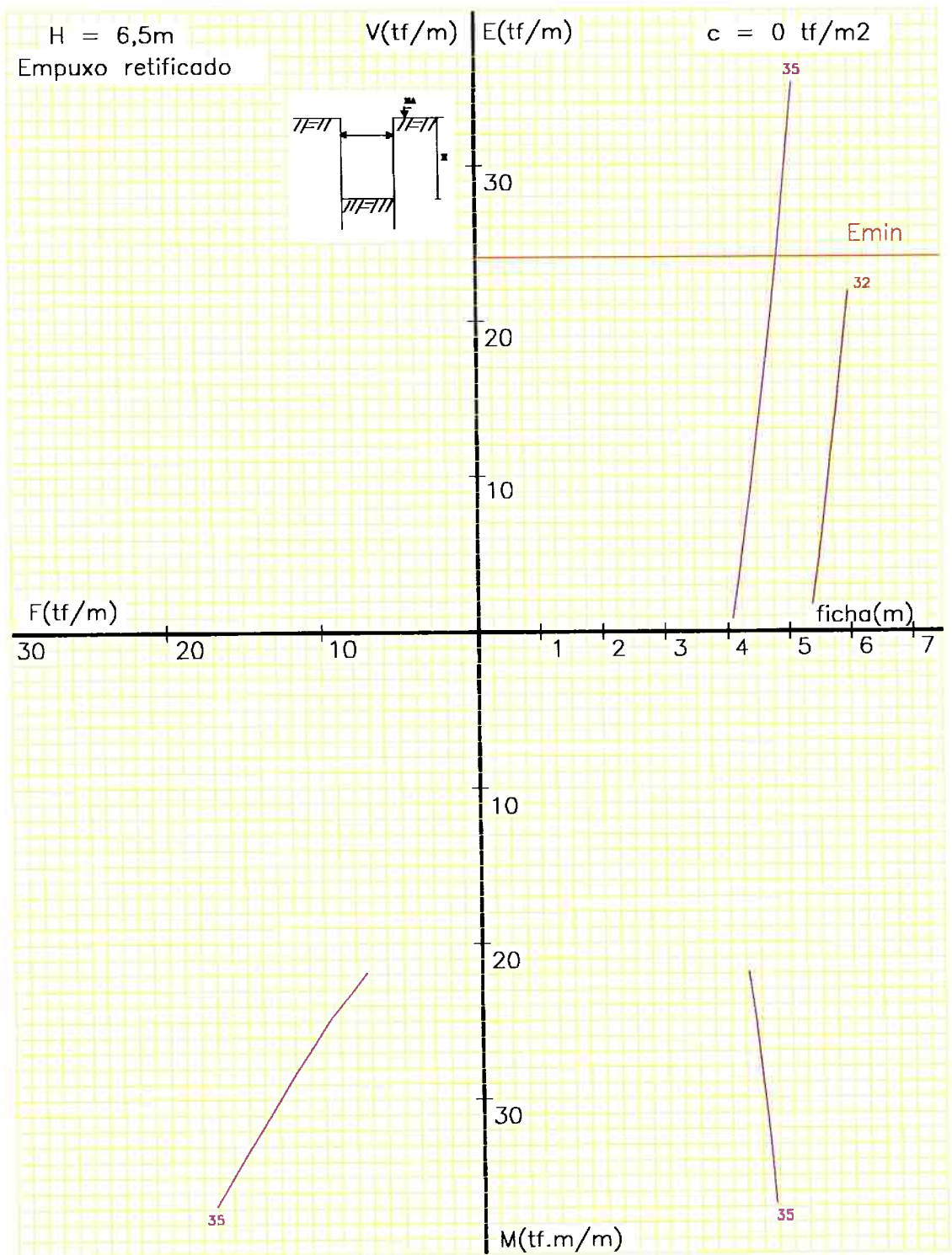


Fig. I.19- Ábaco tipo ES1

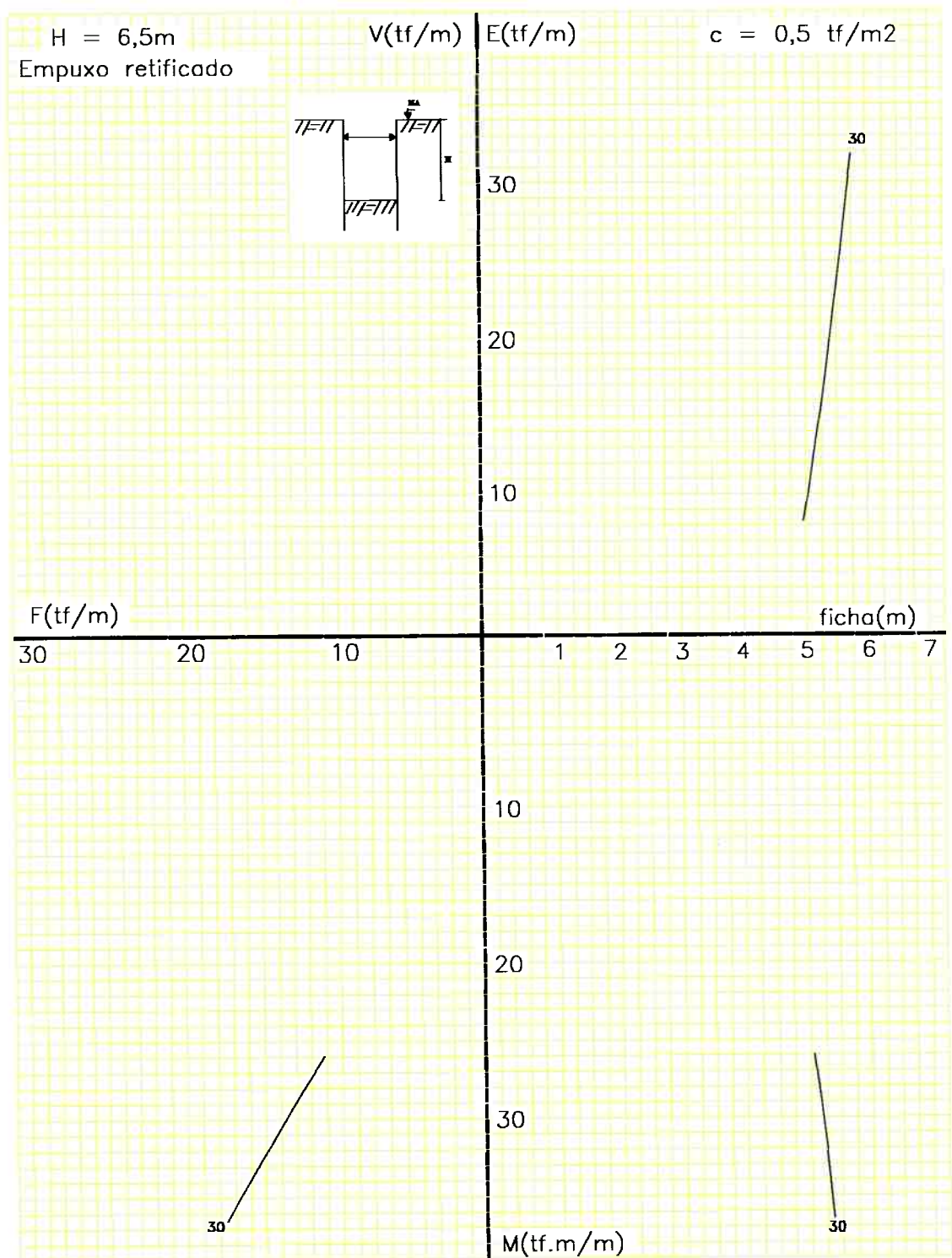


Fig. I.20- Ábaco tipo ES1

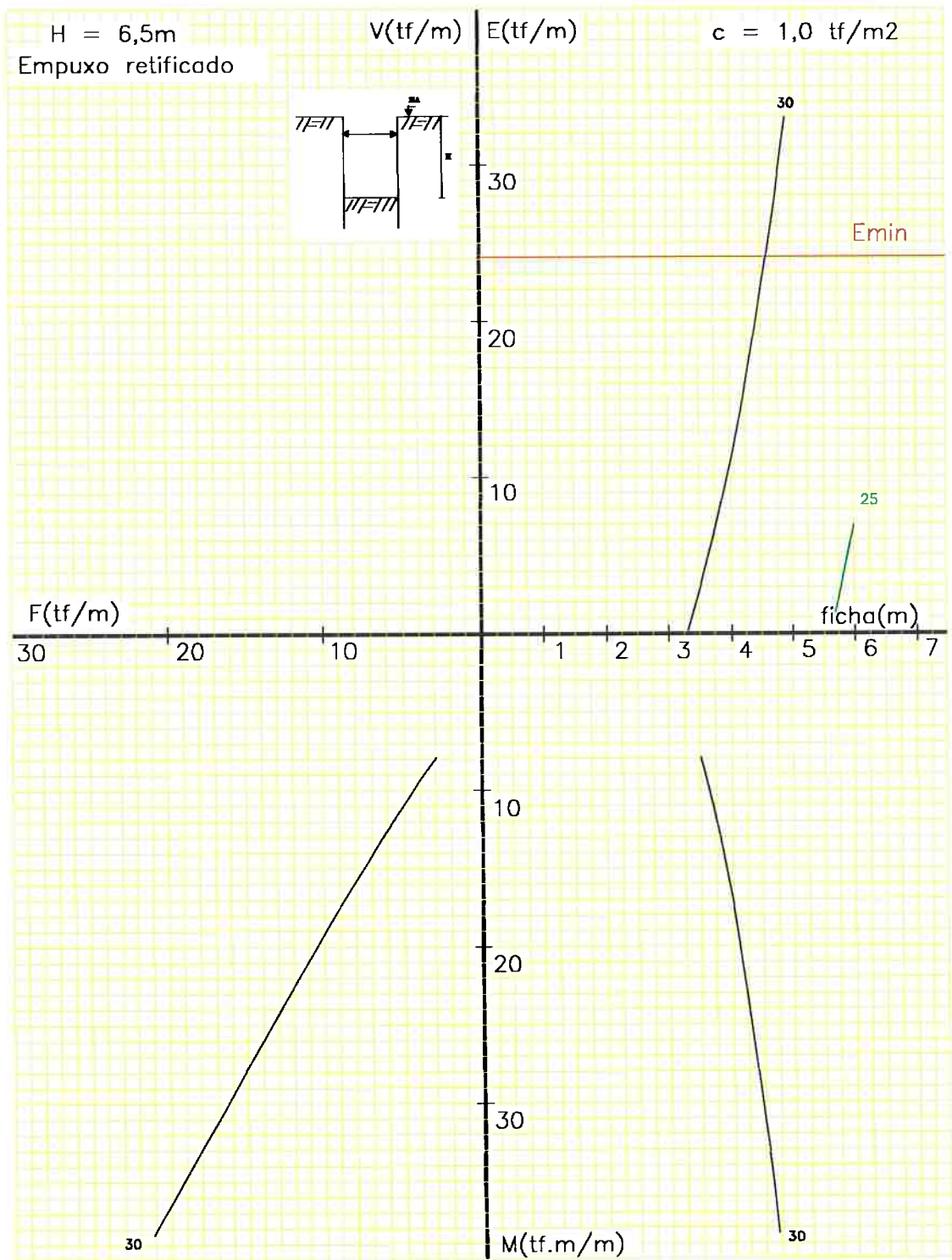


Fig. I.21- Ábaco tipo ES1

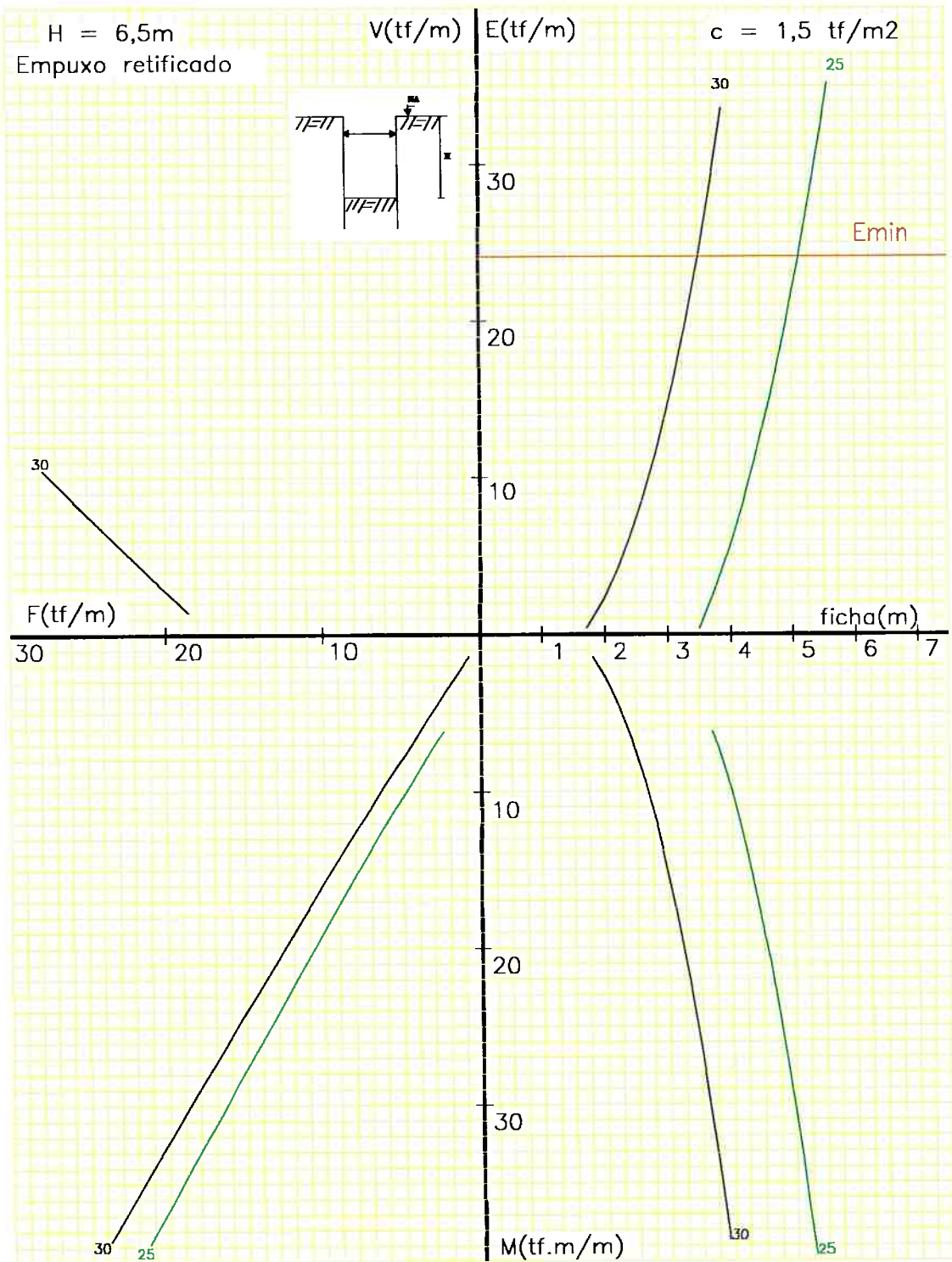


Fig. I.22- Ábaco tipo ES1

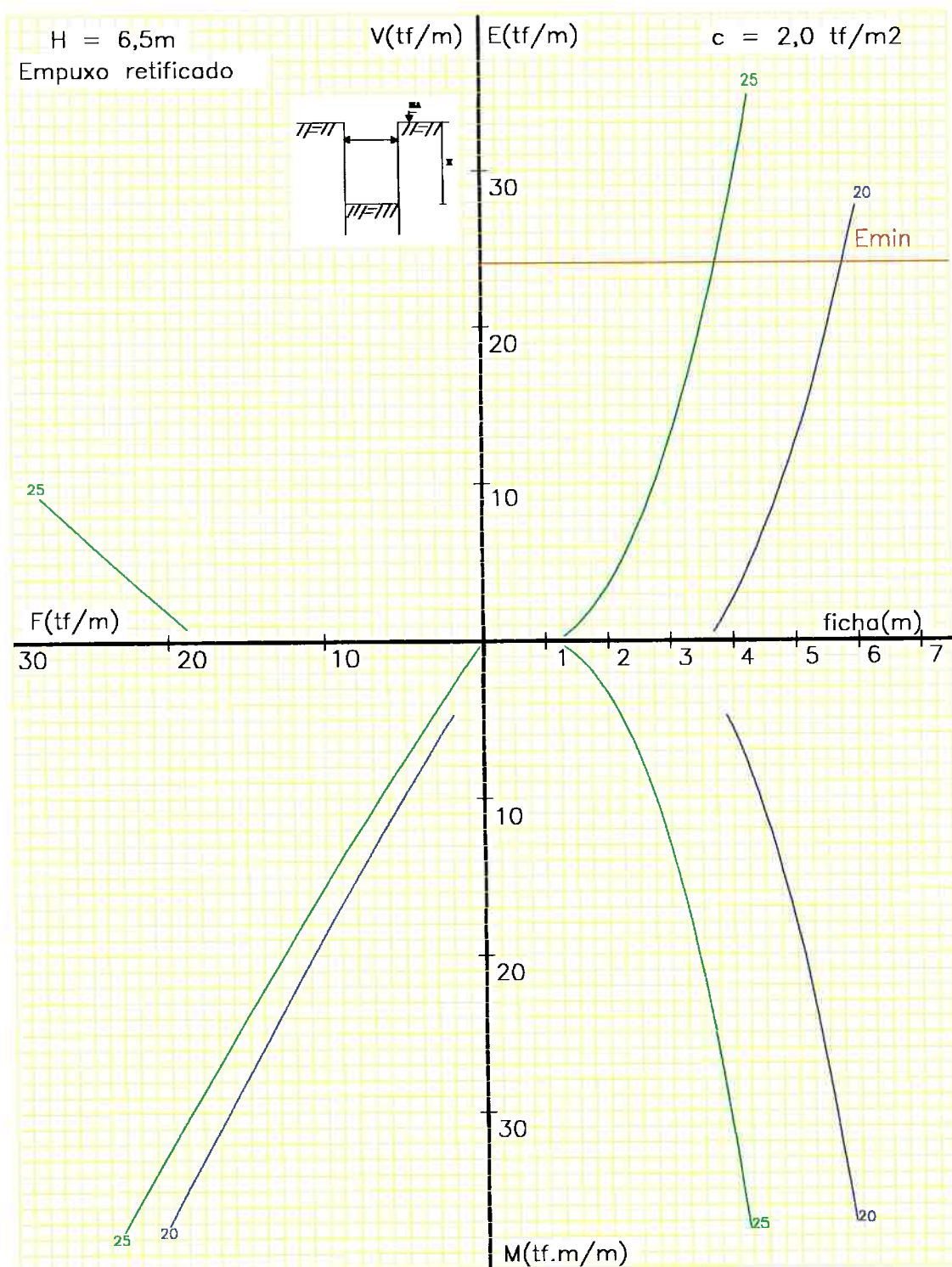


Fig. I.23- Ábaco tipo ES1

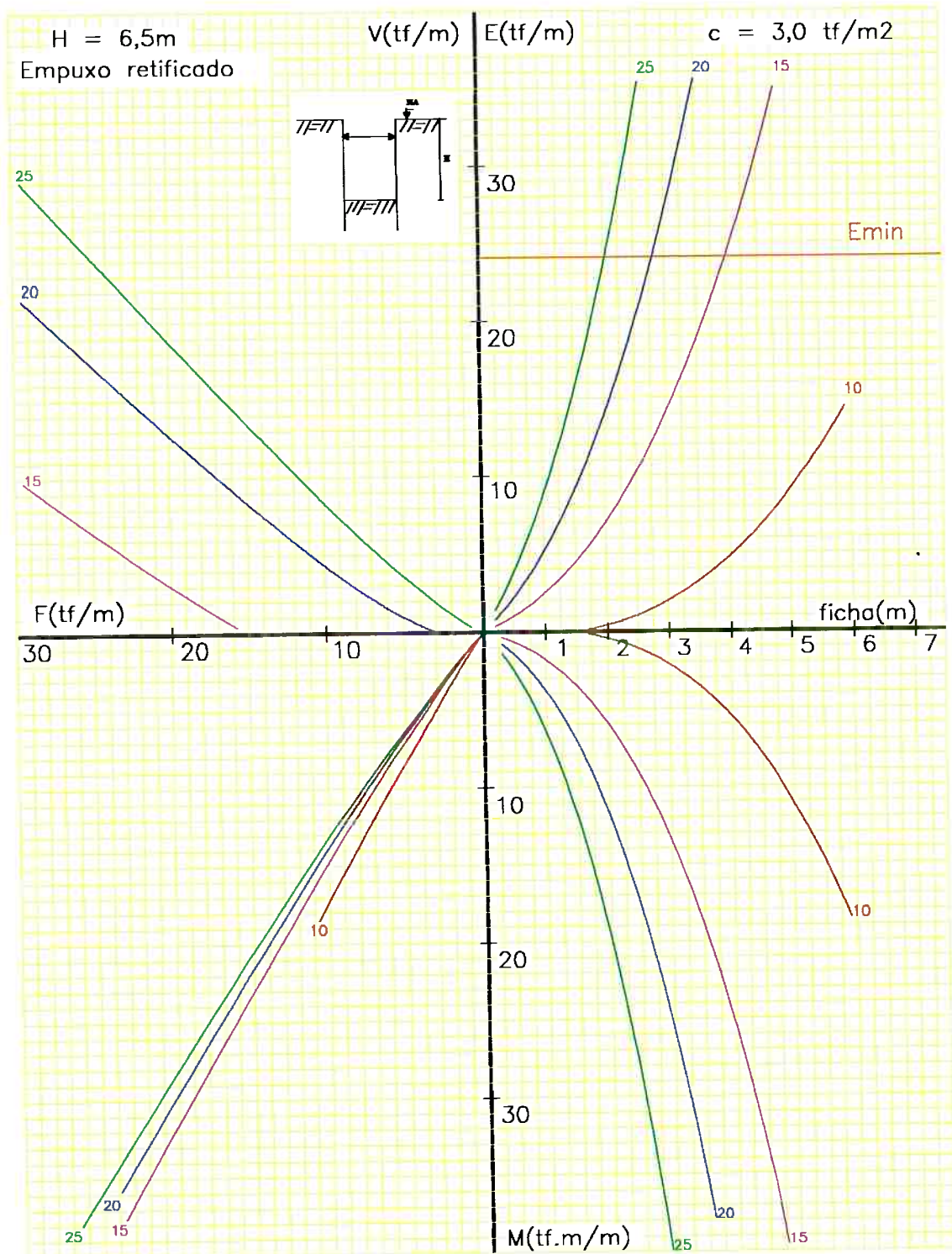


Fig. I.24- Ábaco tipo ES1

**NÍVEL DE ÁGUA
À METADE DA ALTURA
DE ESCAVAÇÃO**

H = 3,5 m

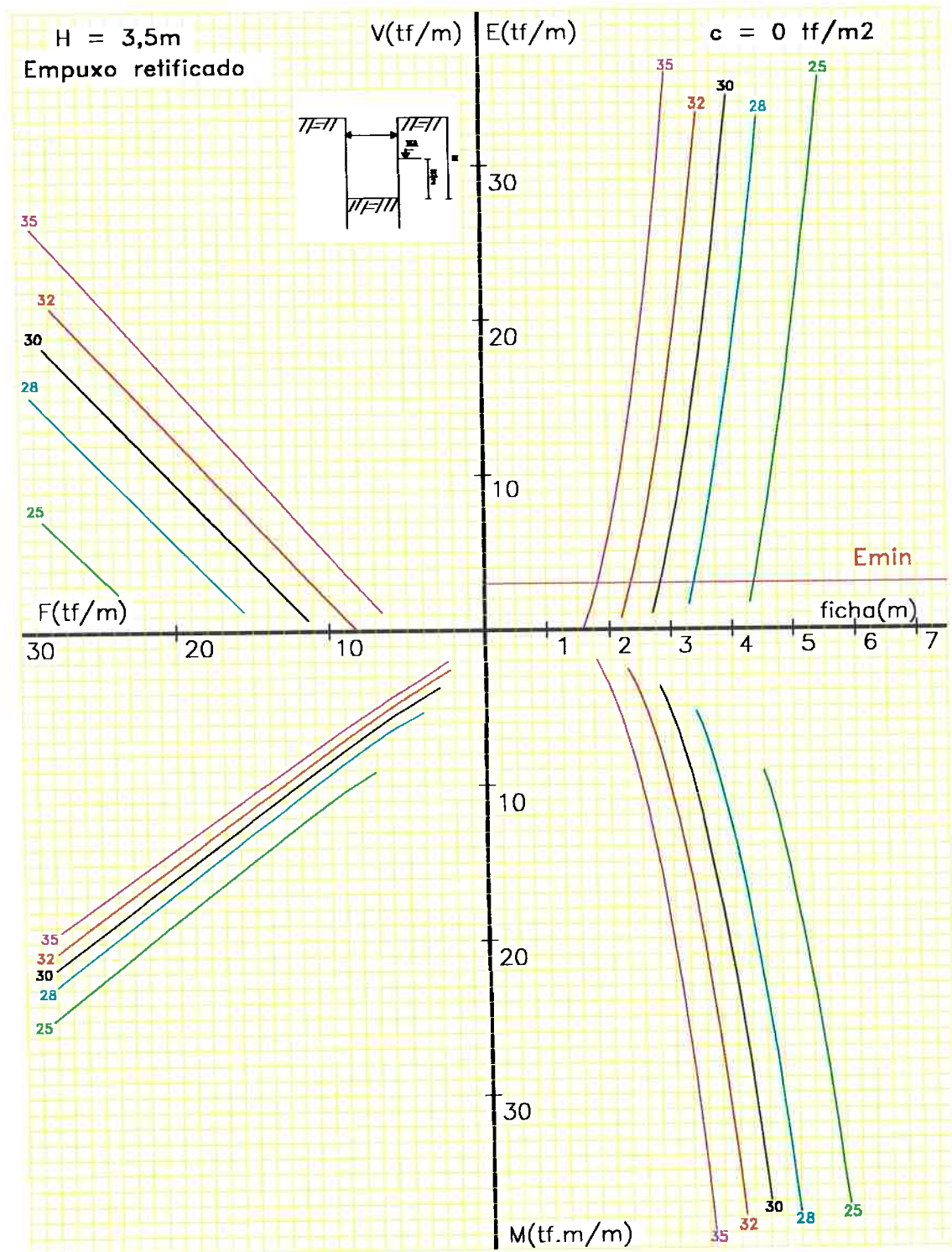


Fig. I.25- Ábaco tipo ES1

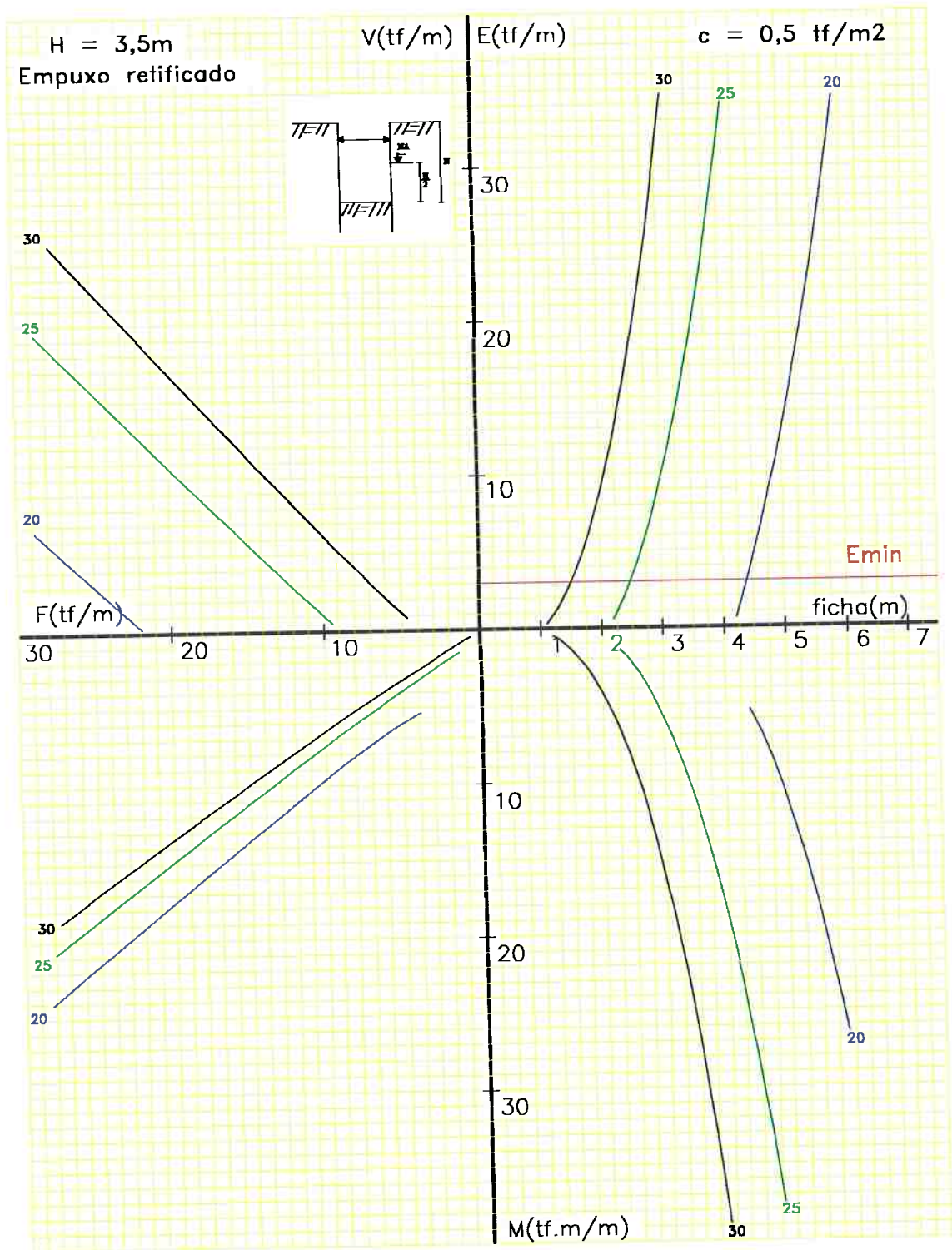


Fig. I.26- Ábaco tipo ES1

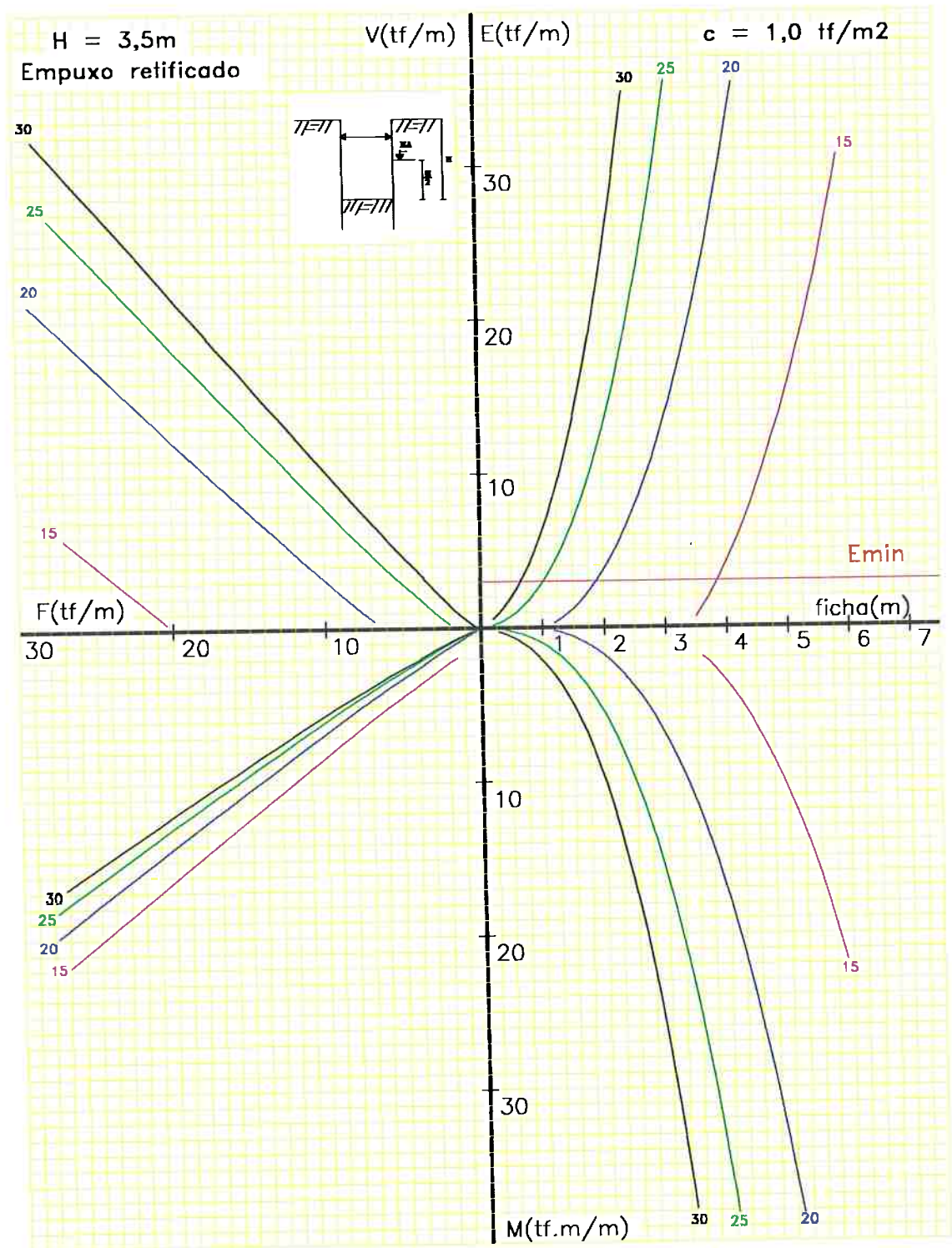


Fig. I.27- Ábaco tipo ES1

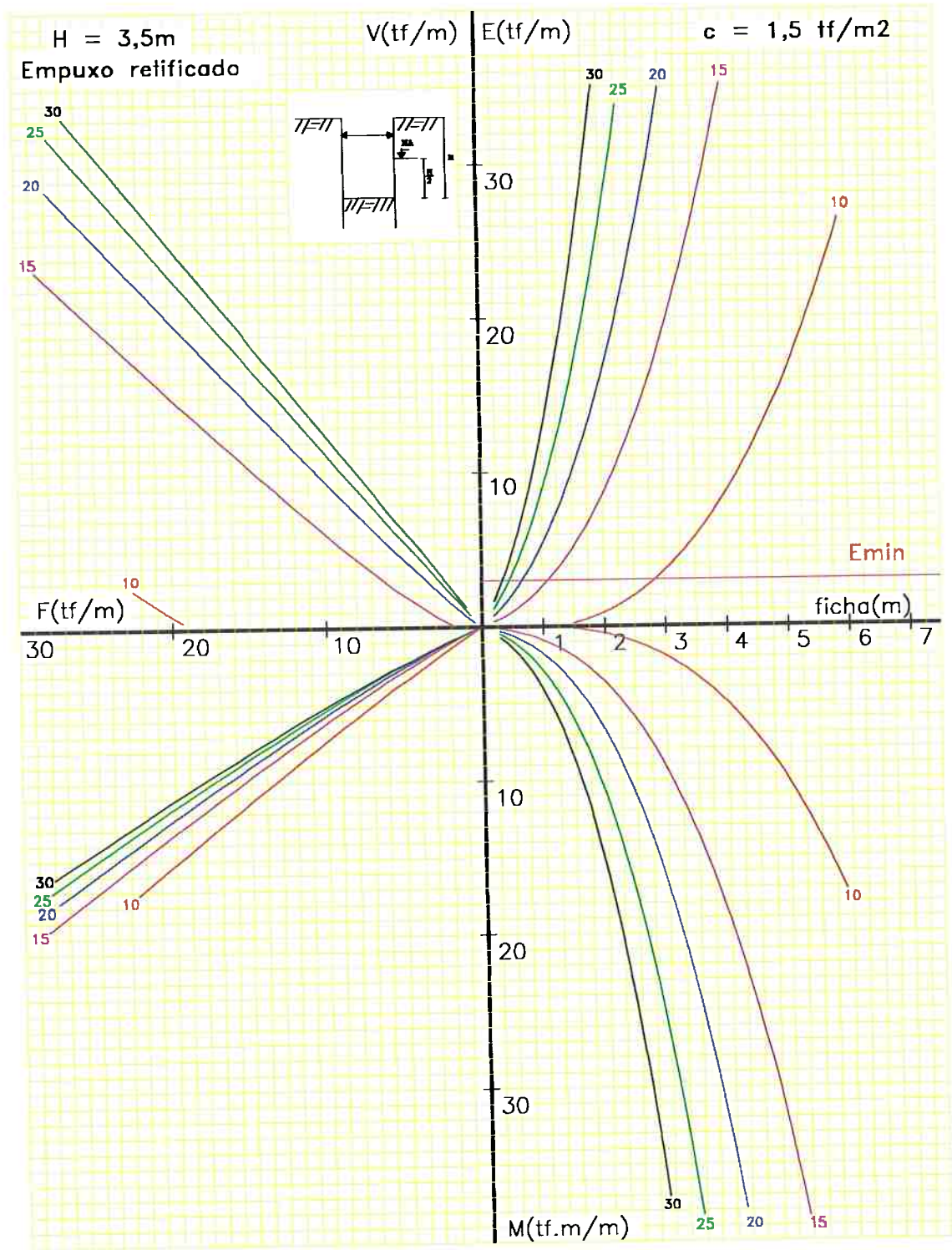


Fig. I.28- Ábaco tipo ES1

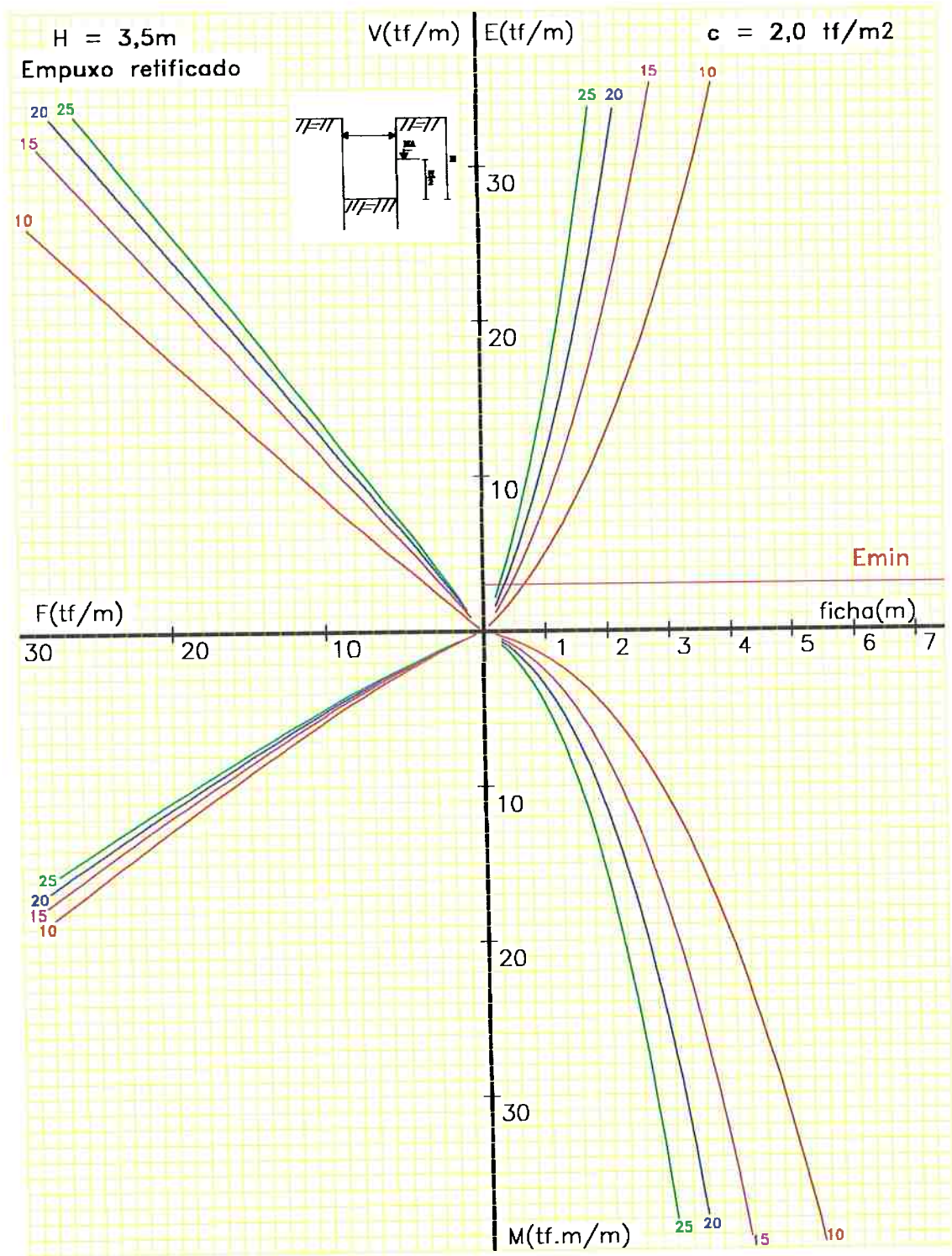


Fig. I.29- Ábaco tipo ES1

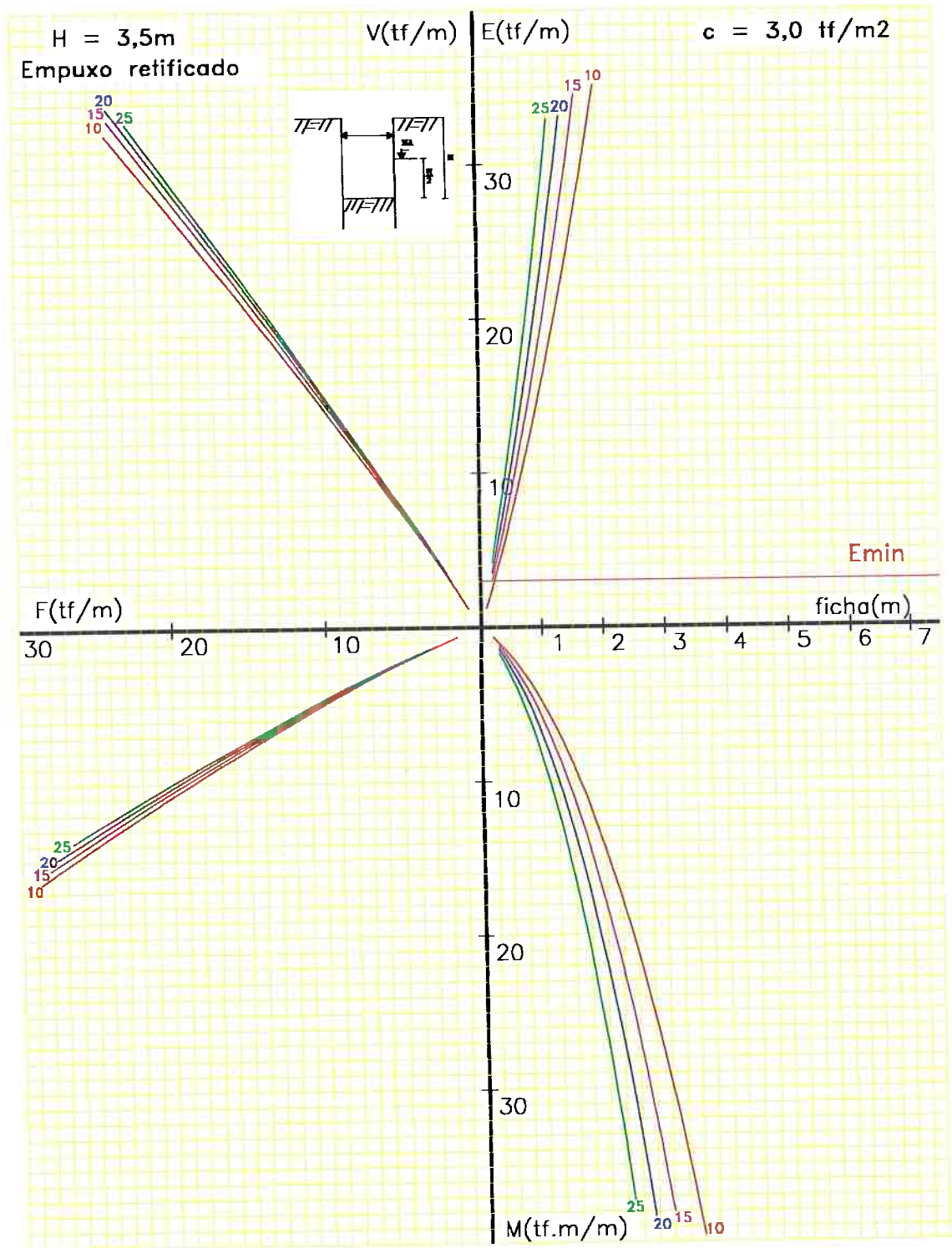


Fig. I.30- Ábaco tipo ES1

H = 4,5 m

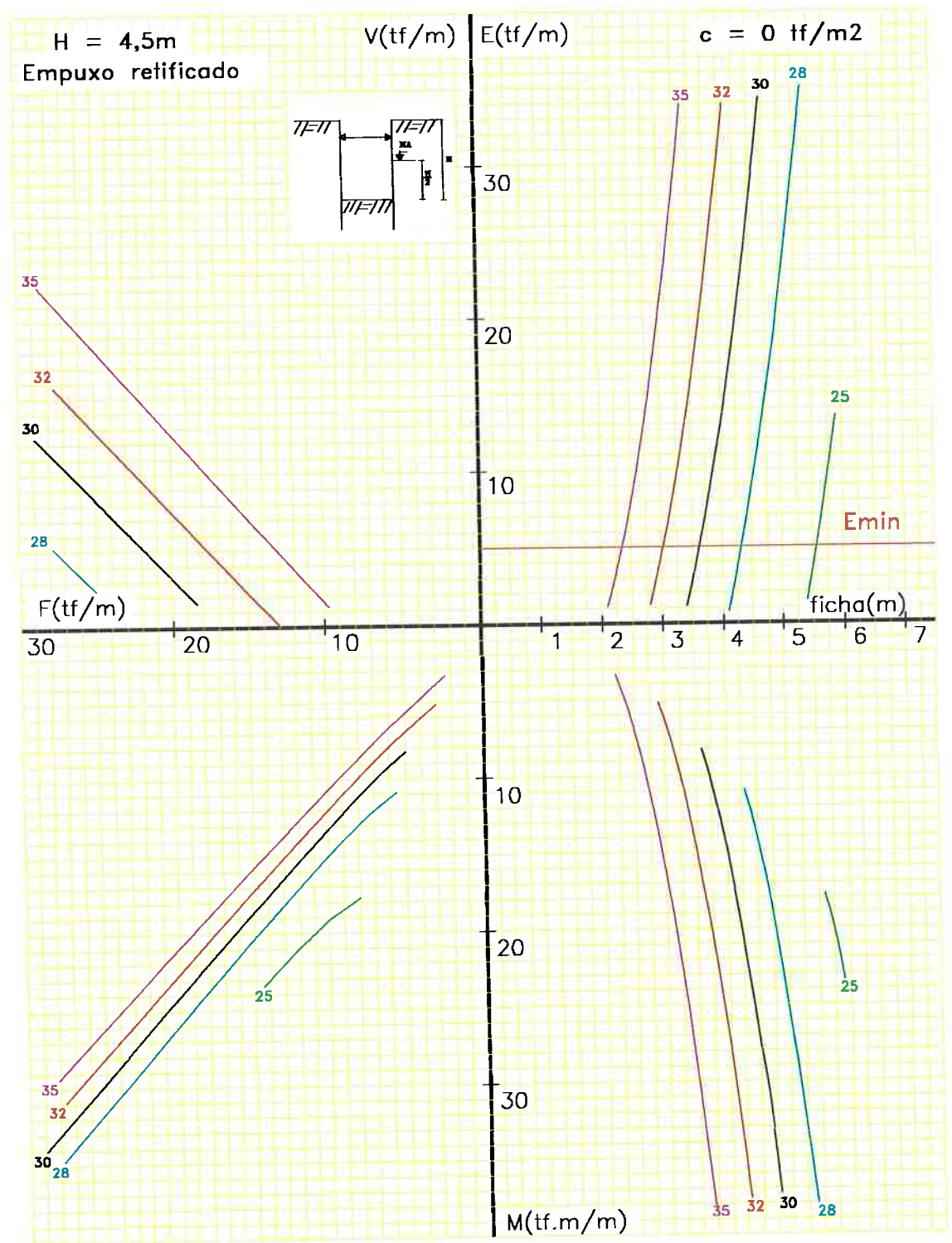


Fig. I.31- Ábaco tipo ES1

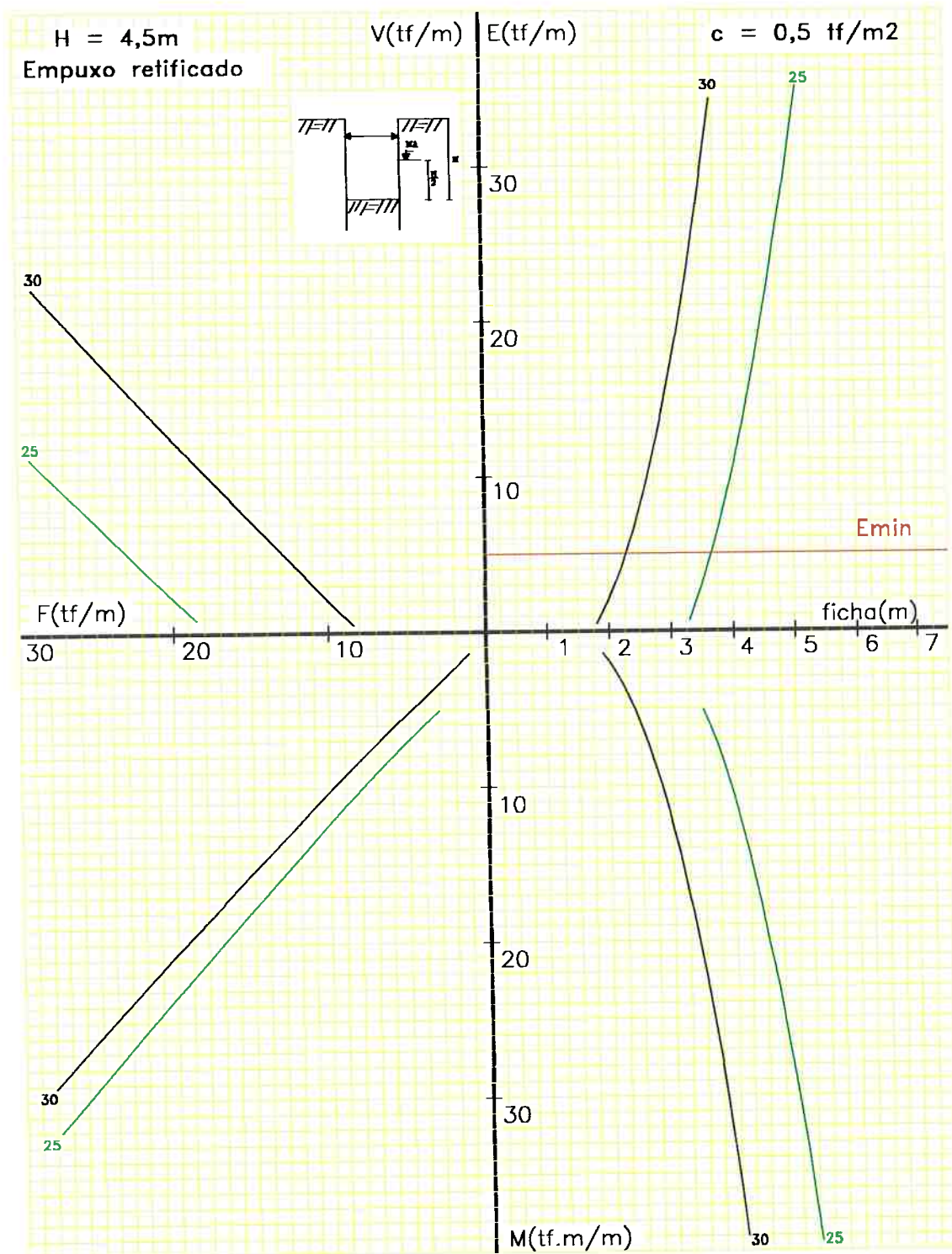


Fig. I.32- Ábaco tipo ES1

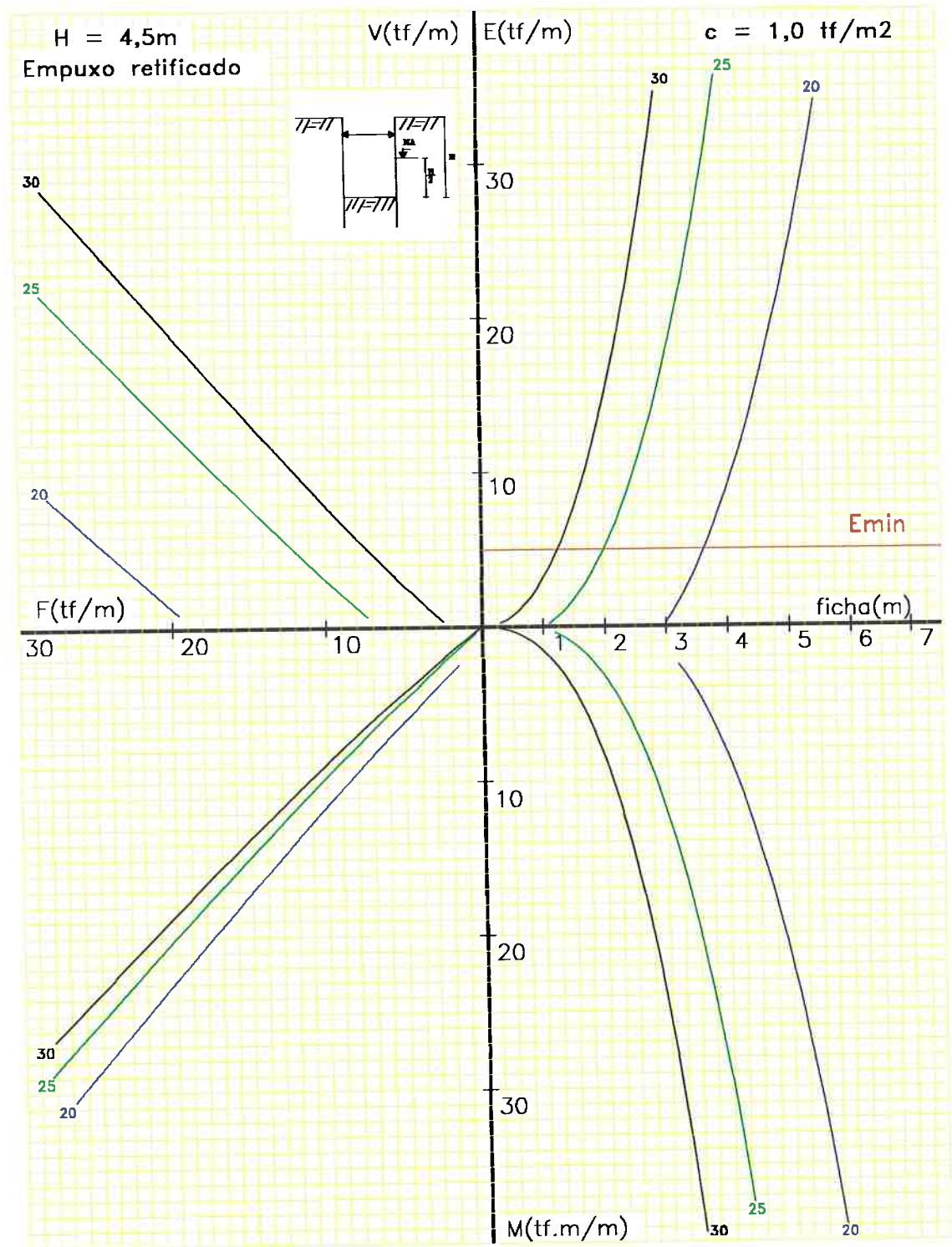


Fig. I.33- Ábaco tipo ES1

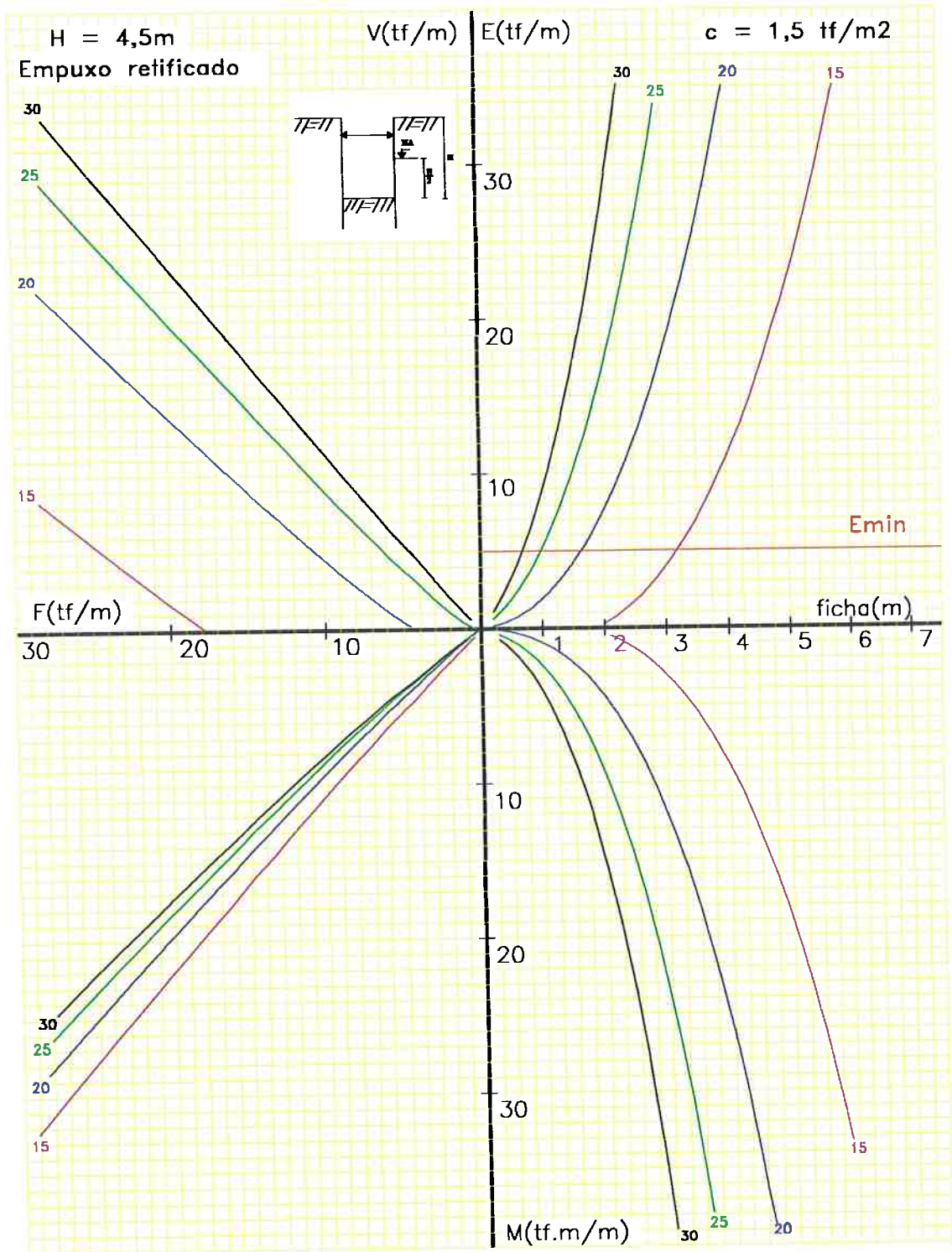


Fig. I.34- Ábaco tipo ES1

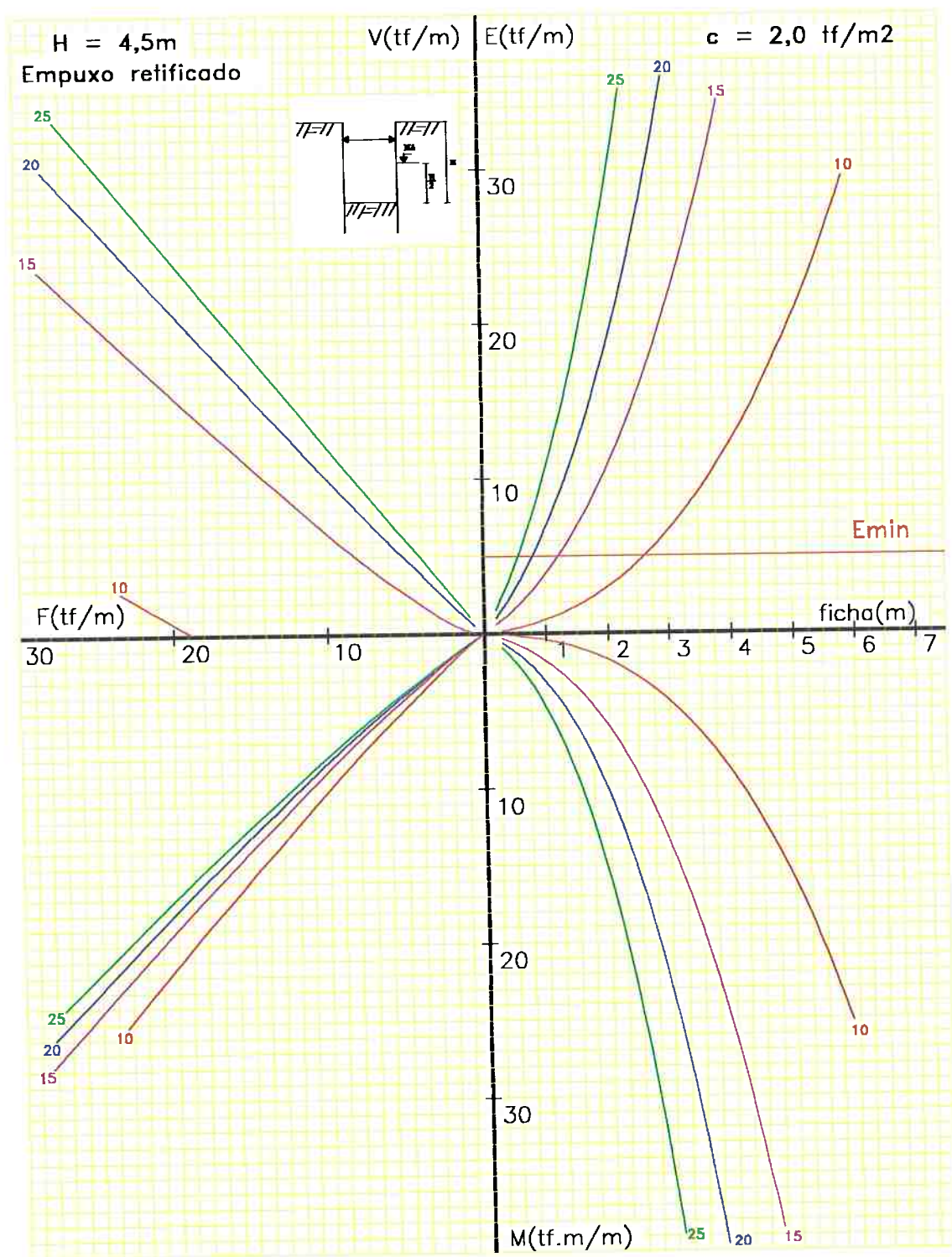


Fig. I.35- Ábaco tipo ES1

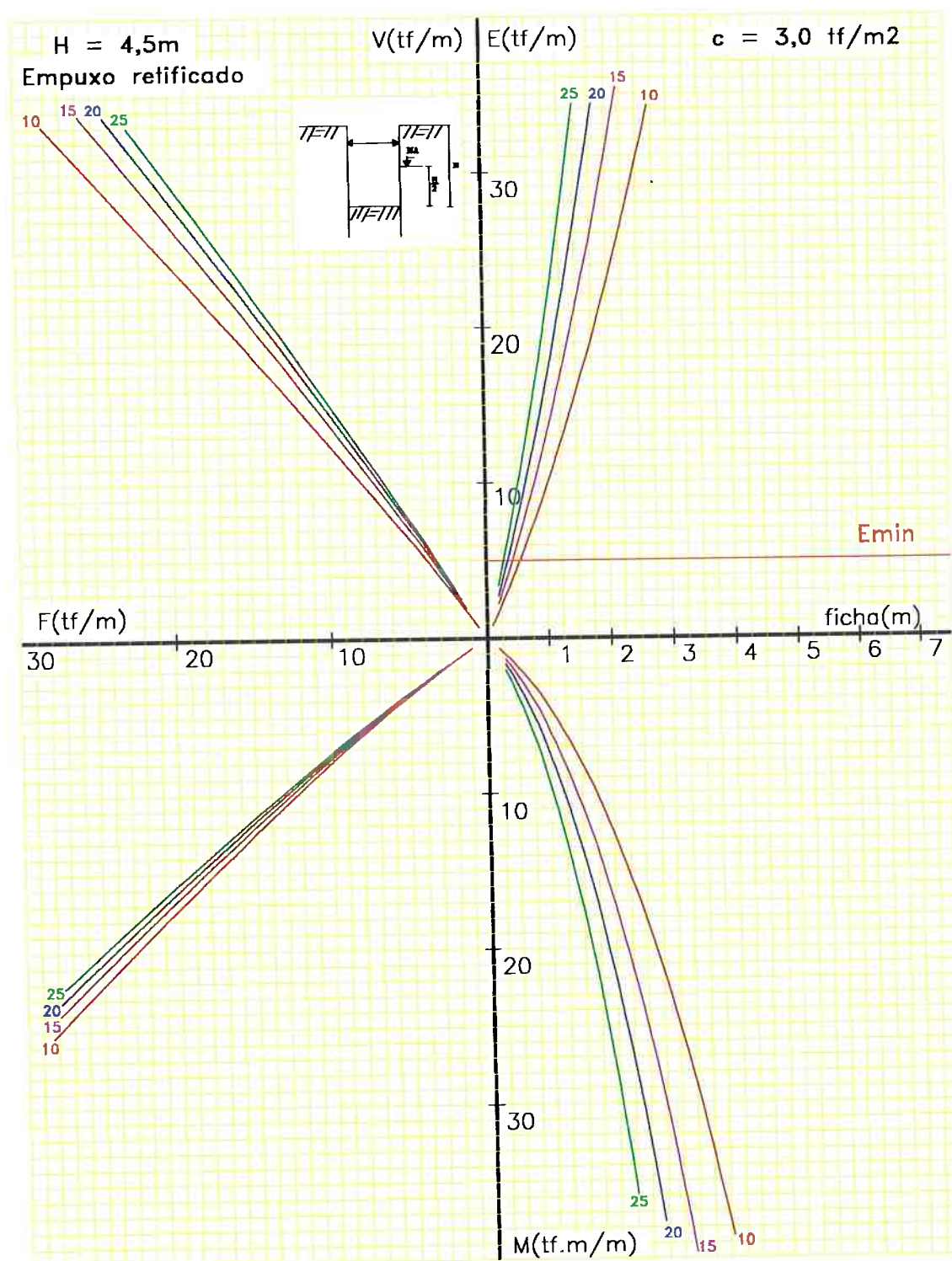


Fig. I.36- Ábaco tipo ES1

H = 5,5 m

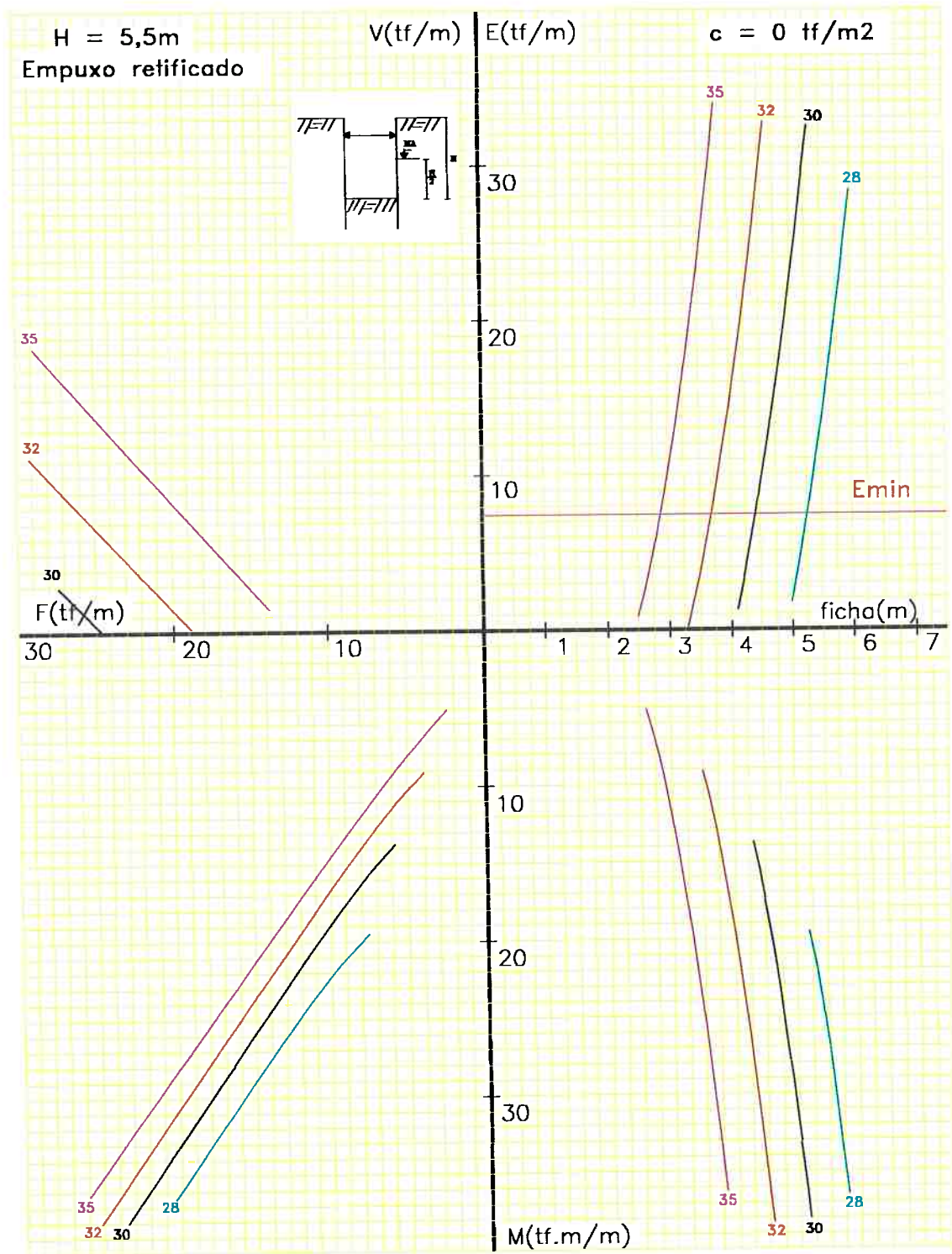


Fig. I.37- Ábaco tipo ES1

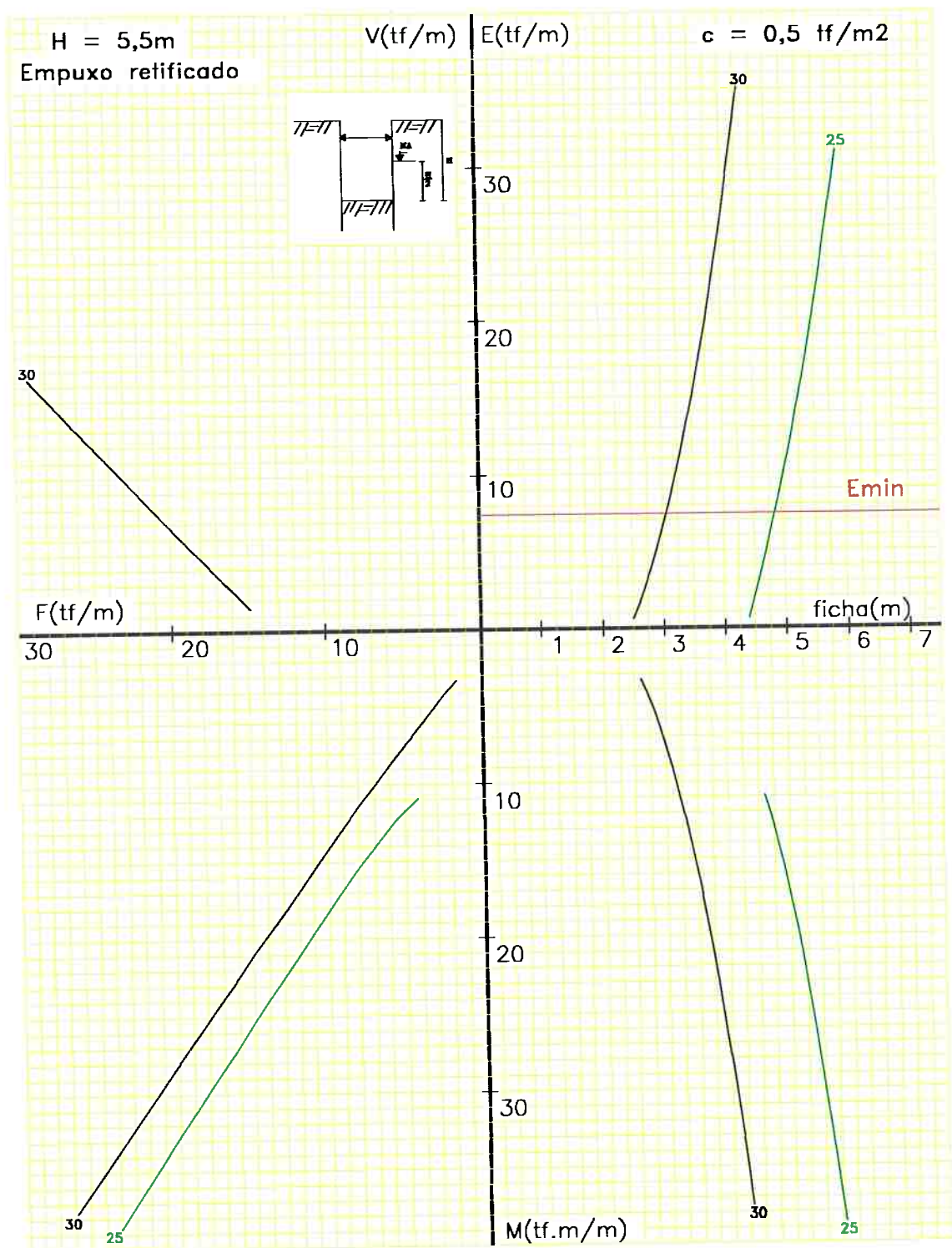


Fig. I.38- Ábaco tipo ES1

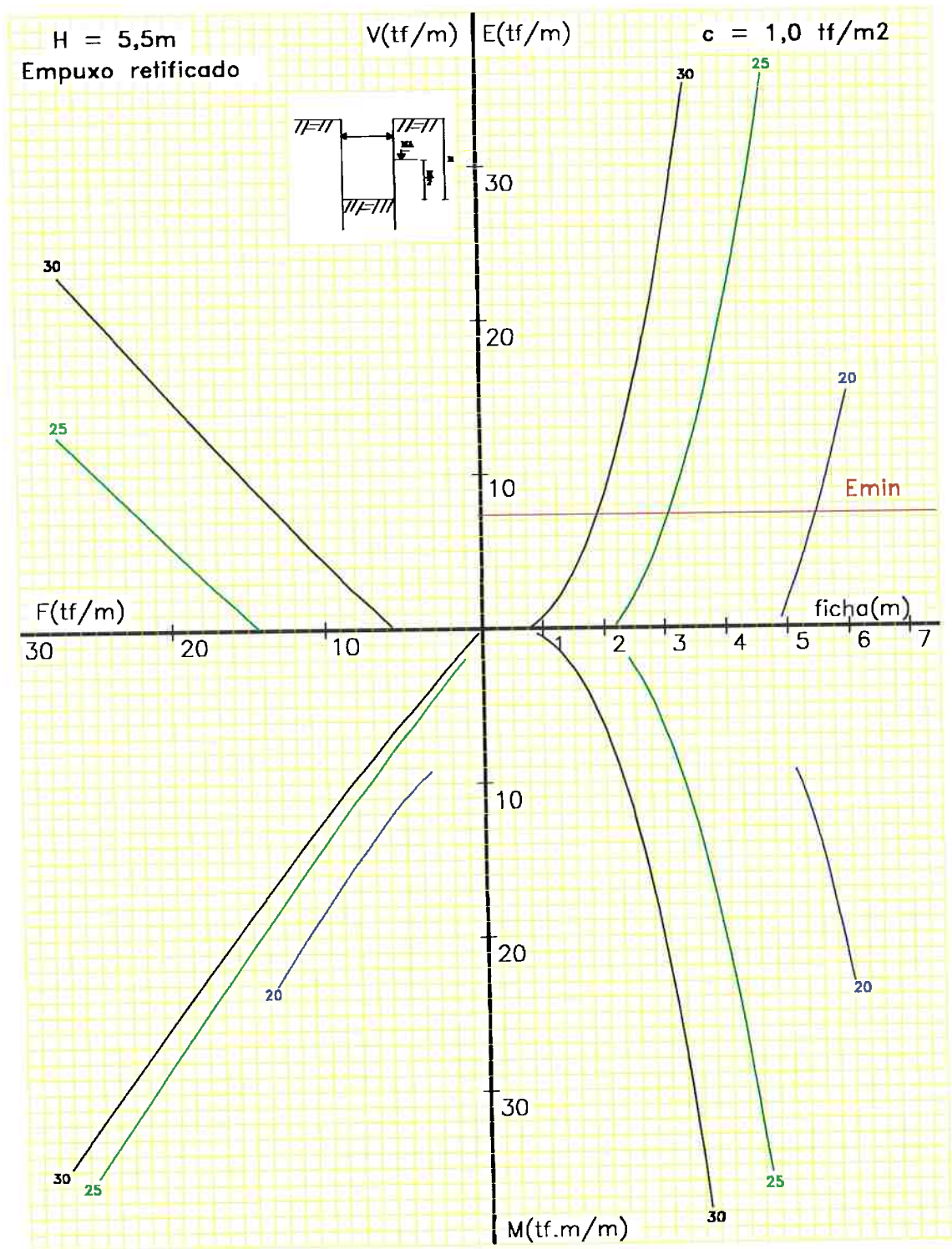


Fig. I.39- Ábaco tipo ES1

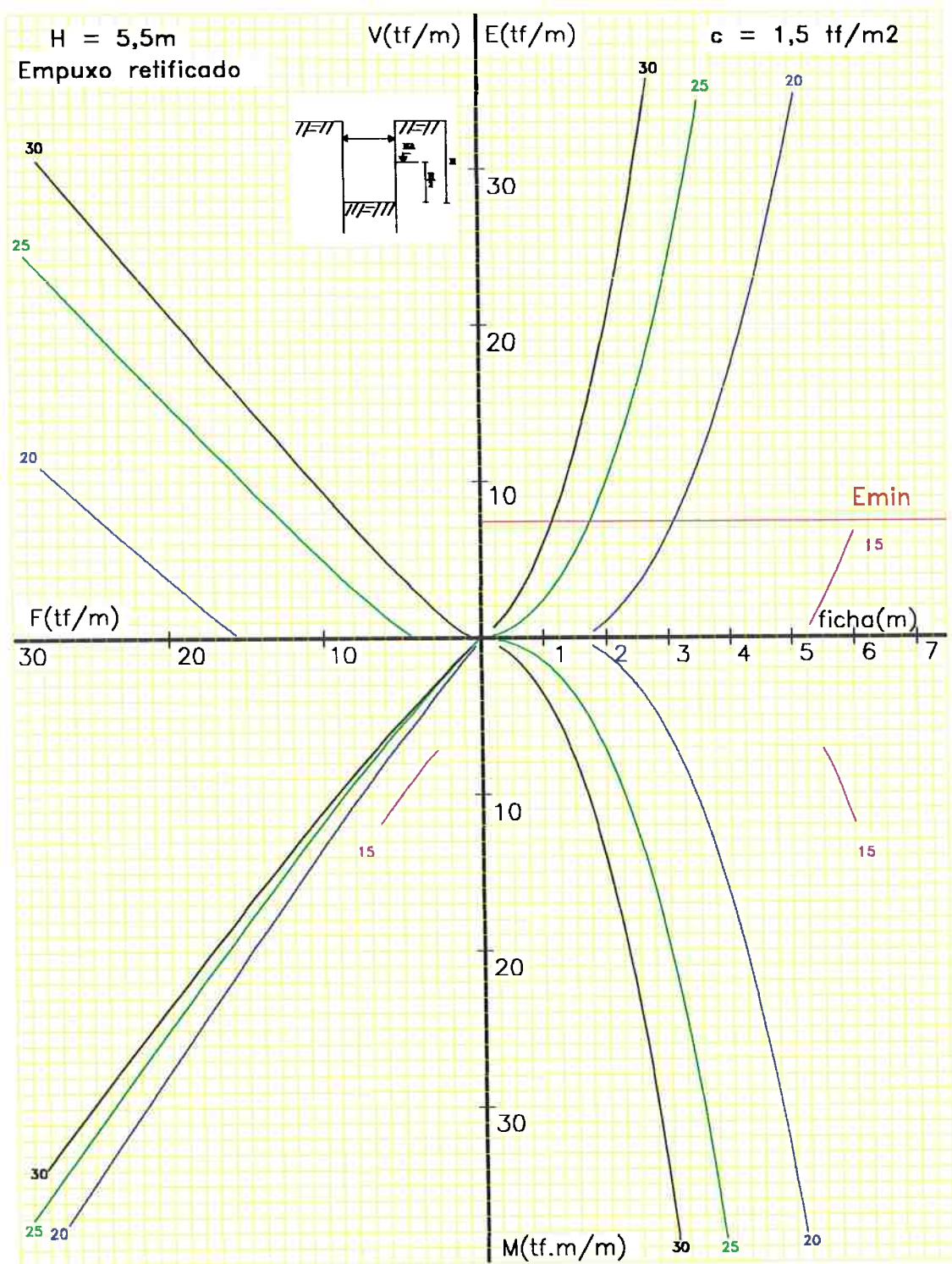


Fig. I.40- Ábaco tipo ES1

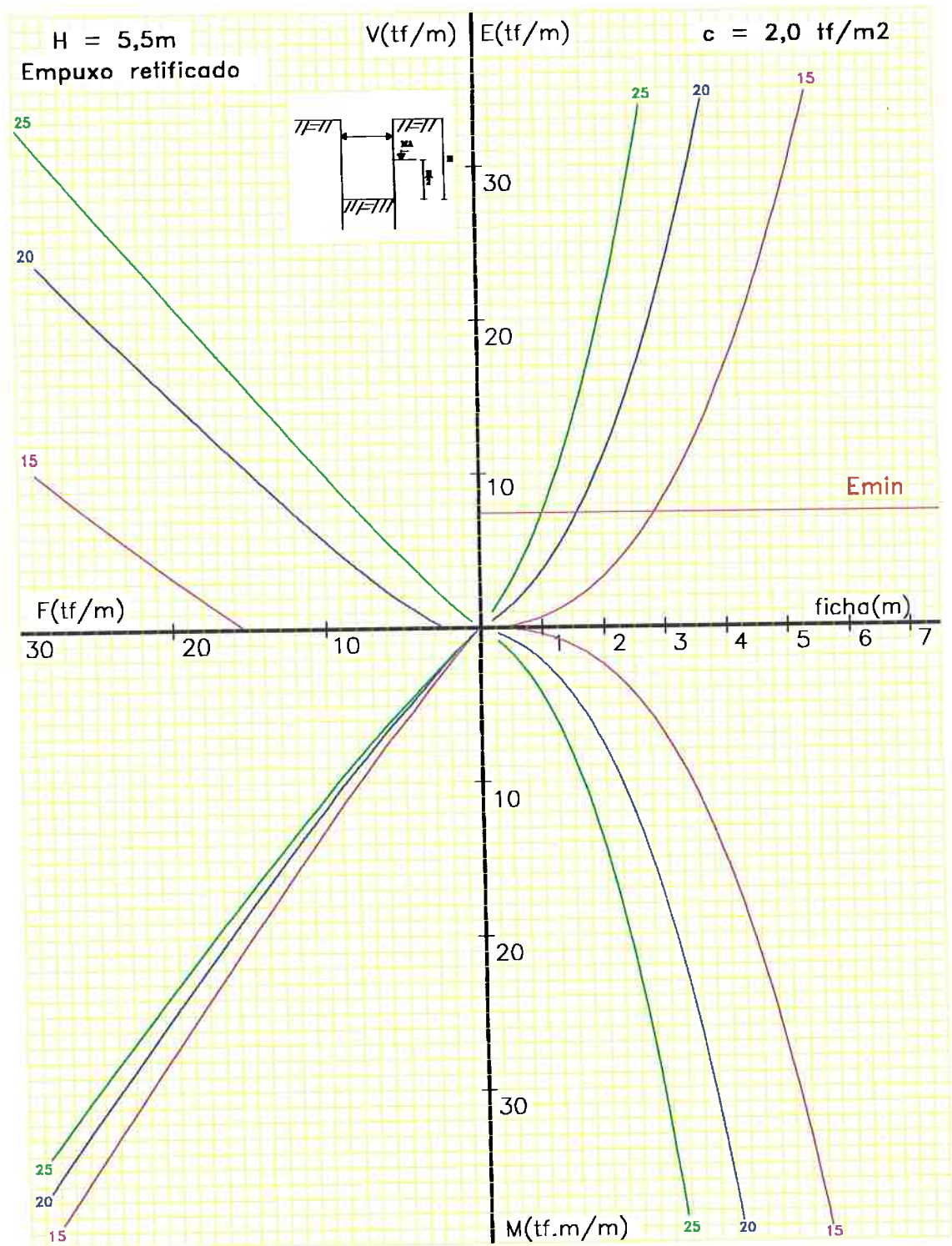


Fig. I.41- Ábaco tipo ES1

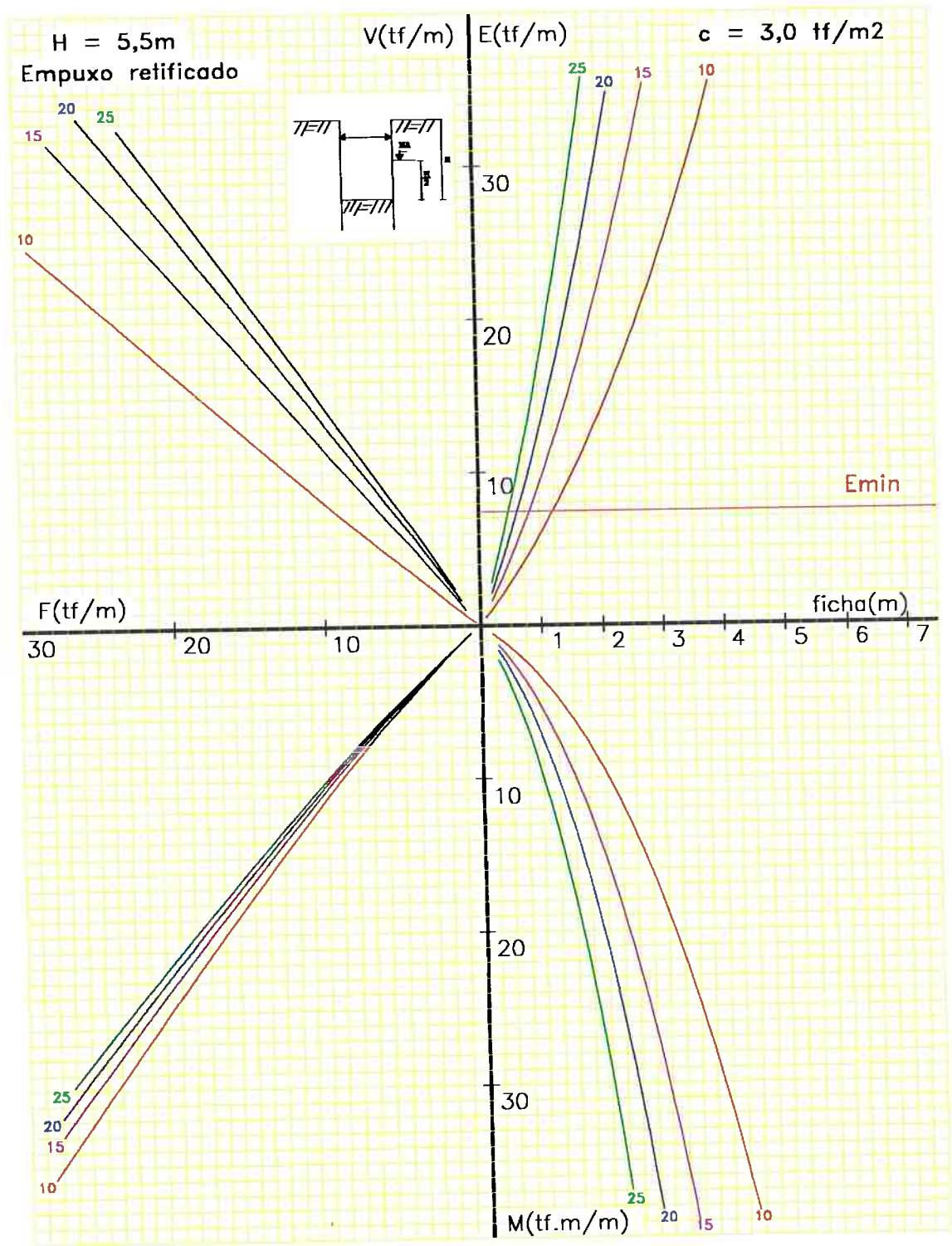


Fig. I.42- Ábaco tipo ES1

H = 6,5 m

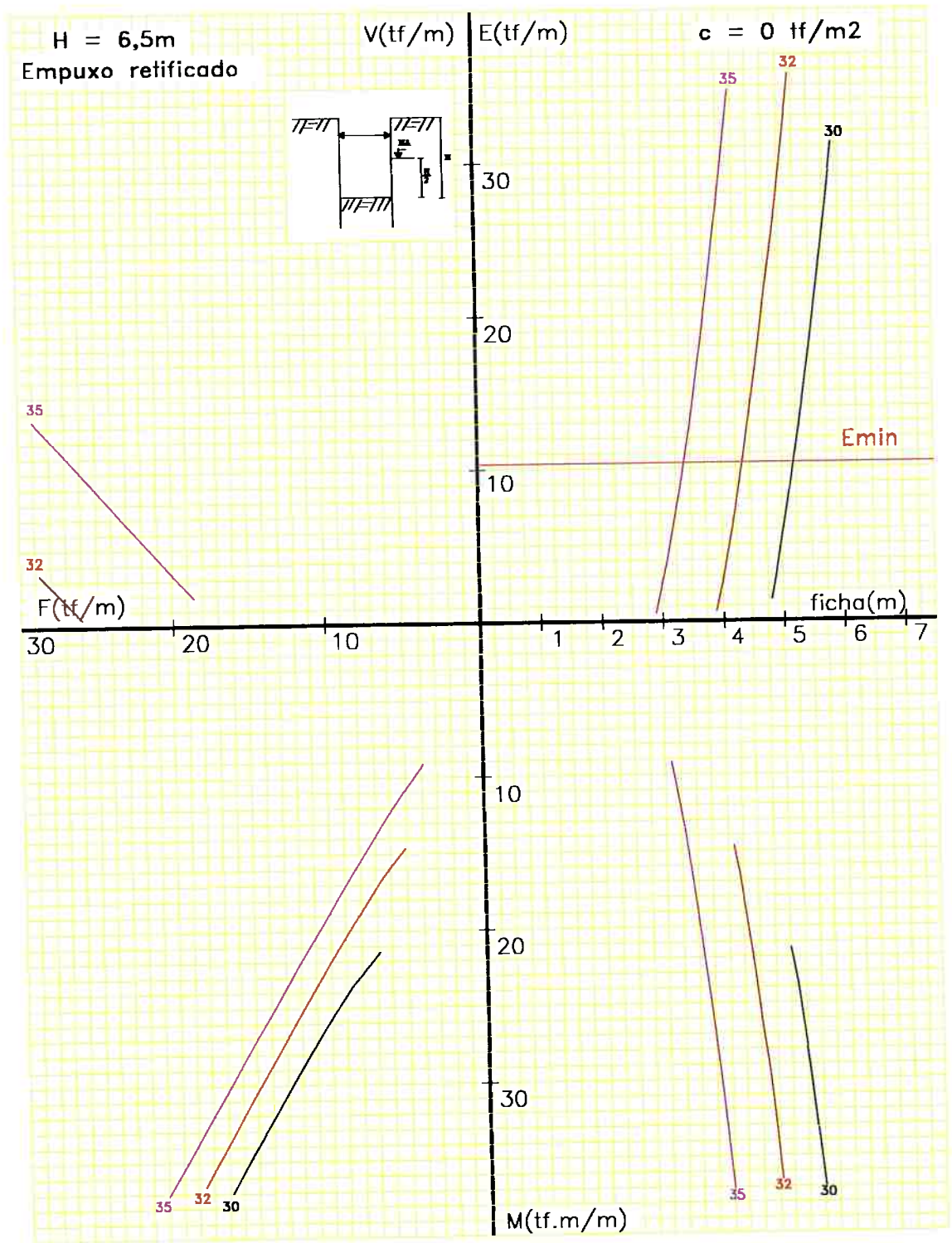


Fig. I.43- Ábaco tipo ES1

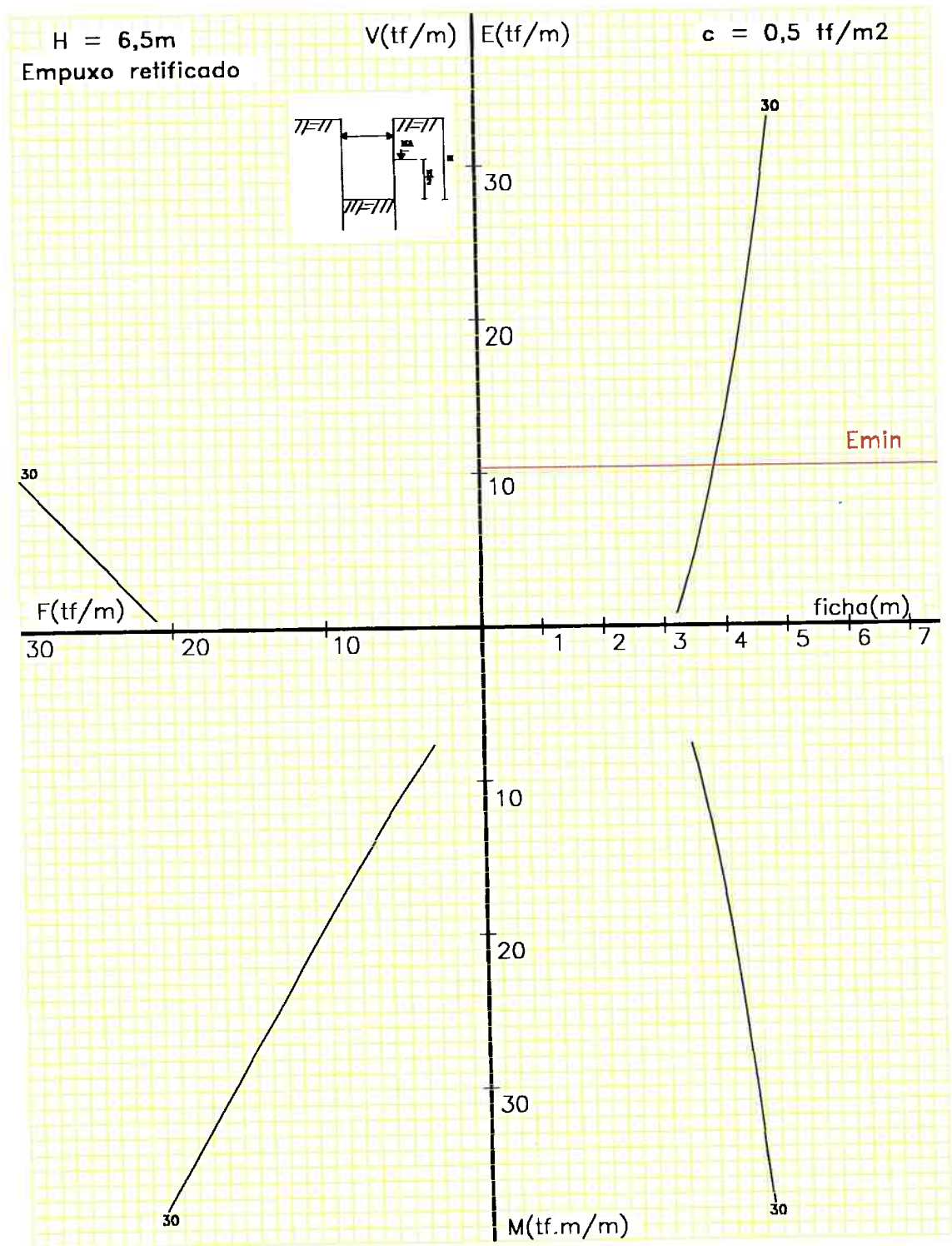


Fig. I.44- Ábaco tipo ES1

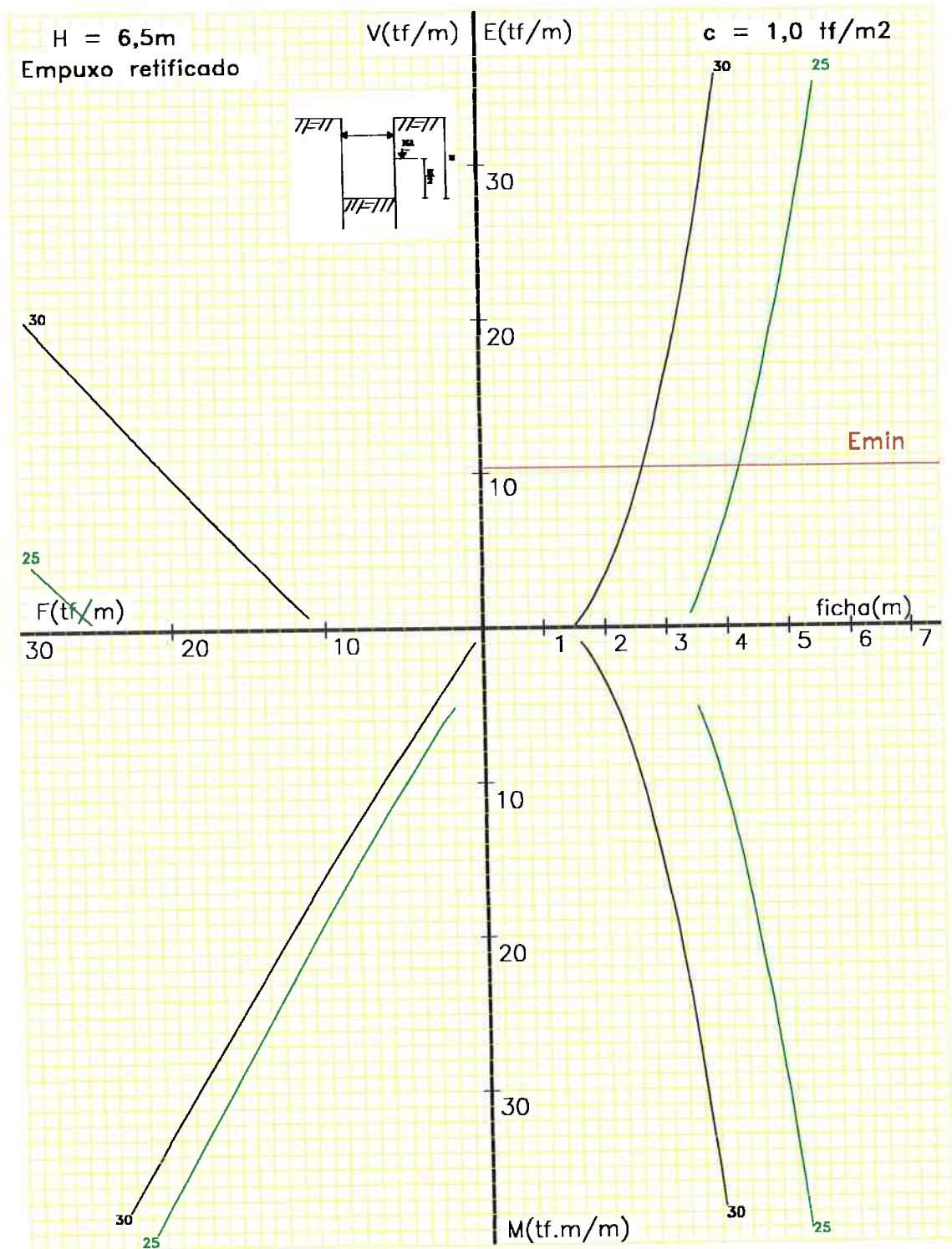


Fig. I.45- Ábaco tipo ES1

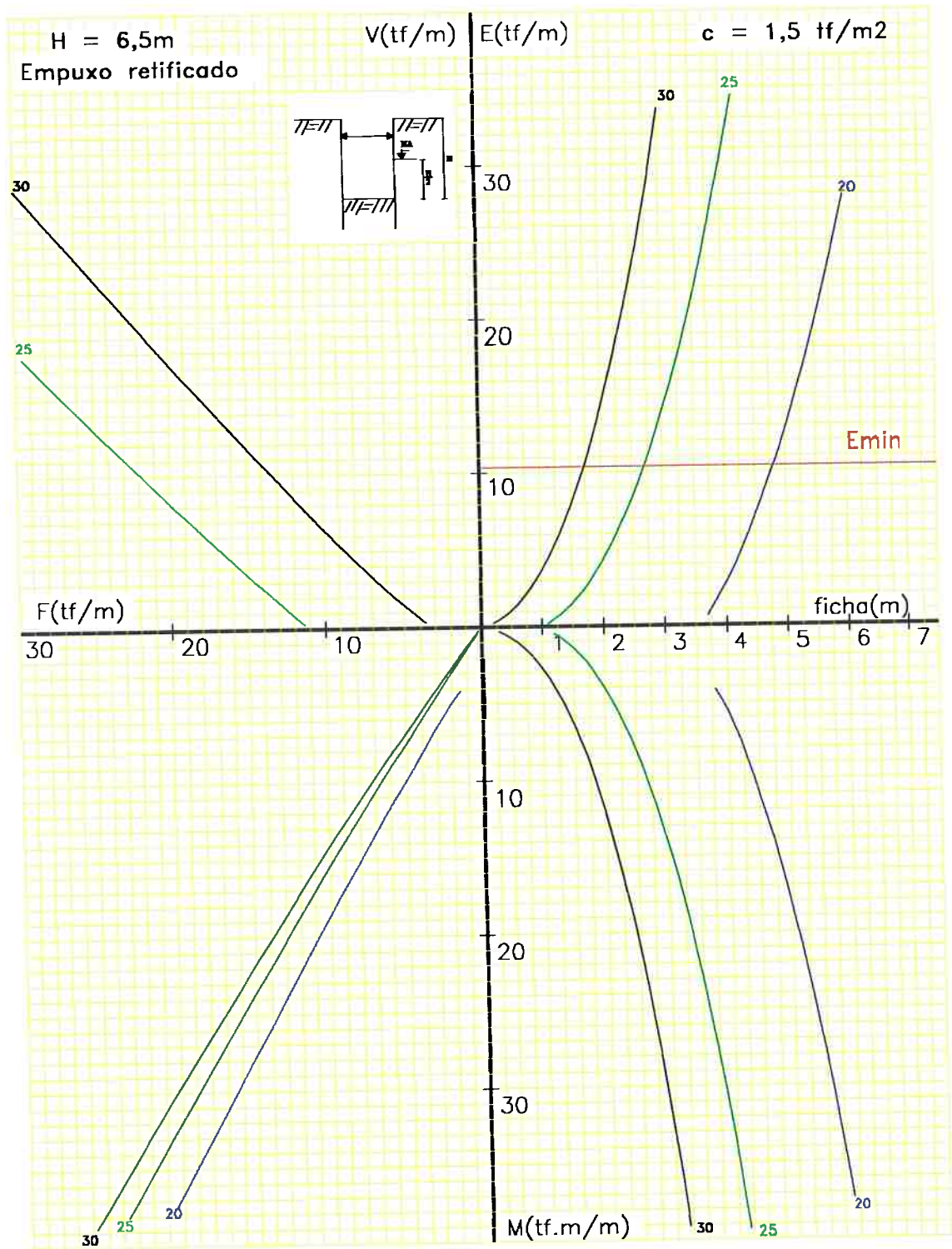


Fig. I.46- Ábaco tipo ES1

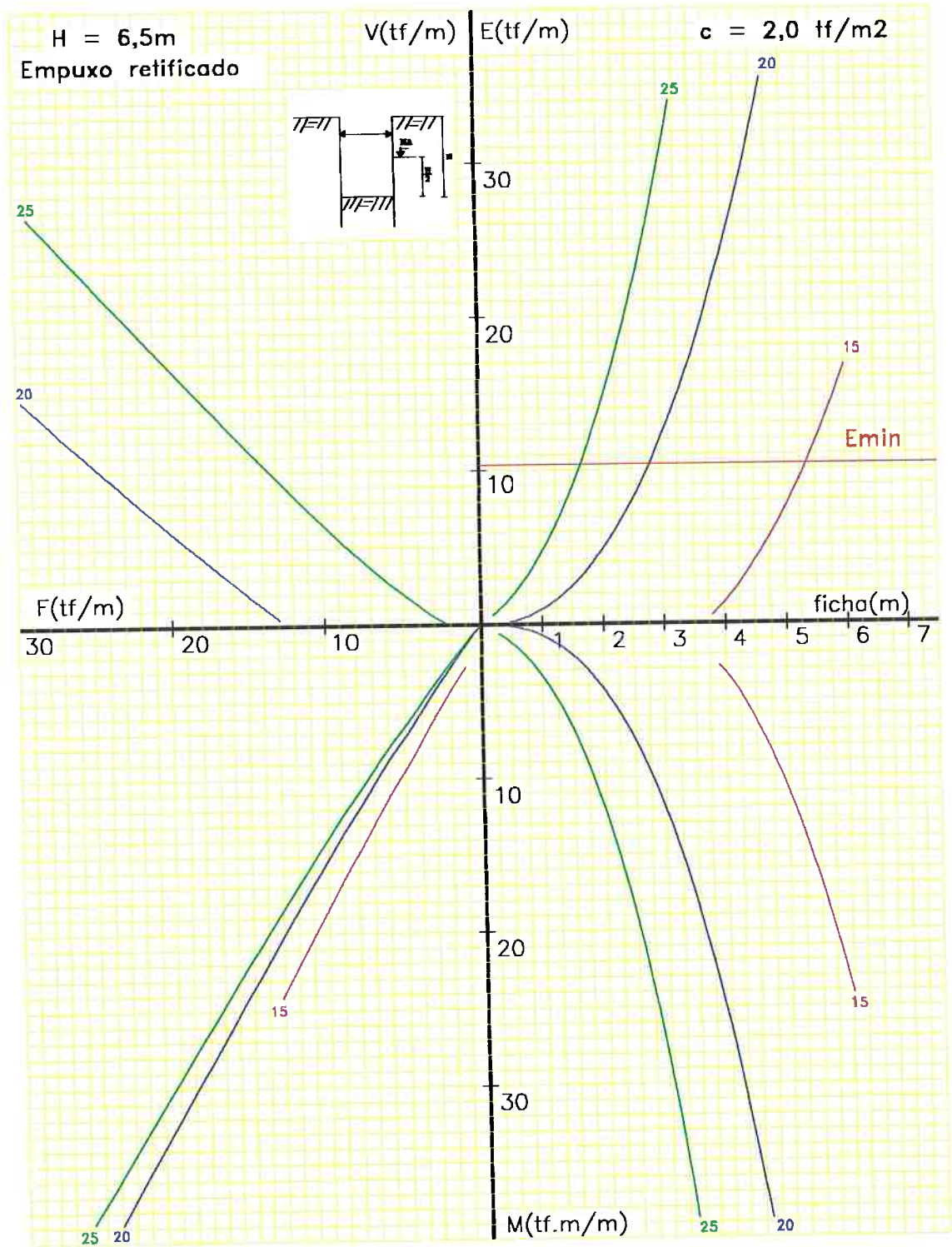


Fig. I.47- Ábaco tipo ES1

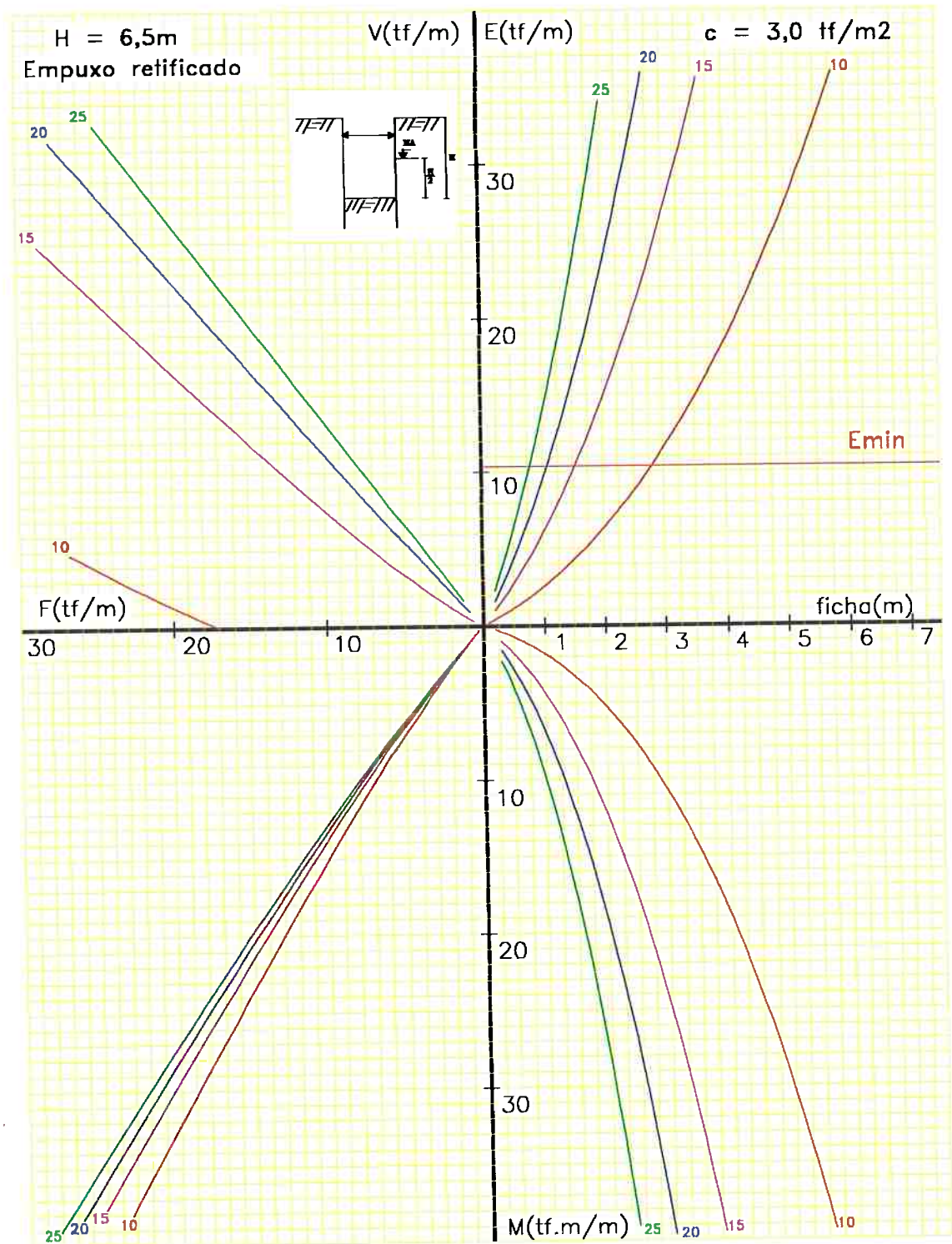


Fig. I.48- Ábaco tipo ES1

**NÍVEL DE ÁGUA
NO FUNDO DA ESCAVAÇÃO**

H = 3,5 m

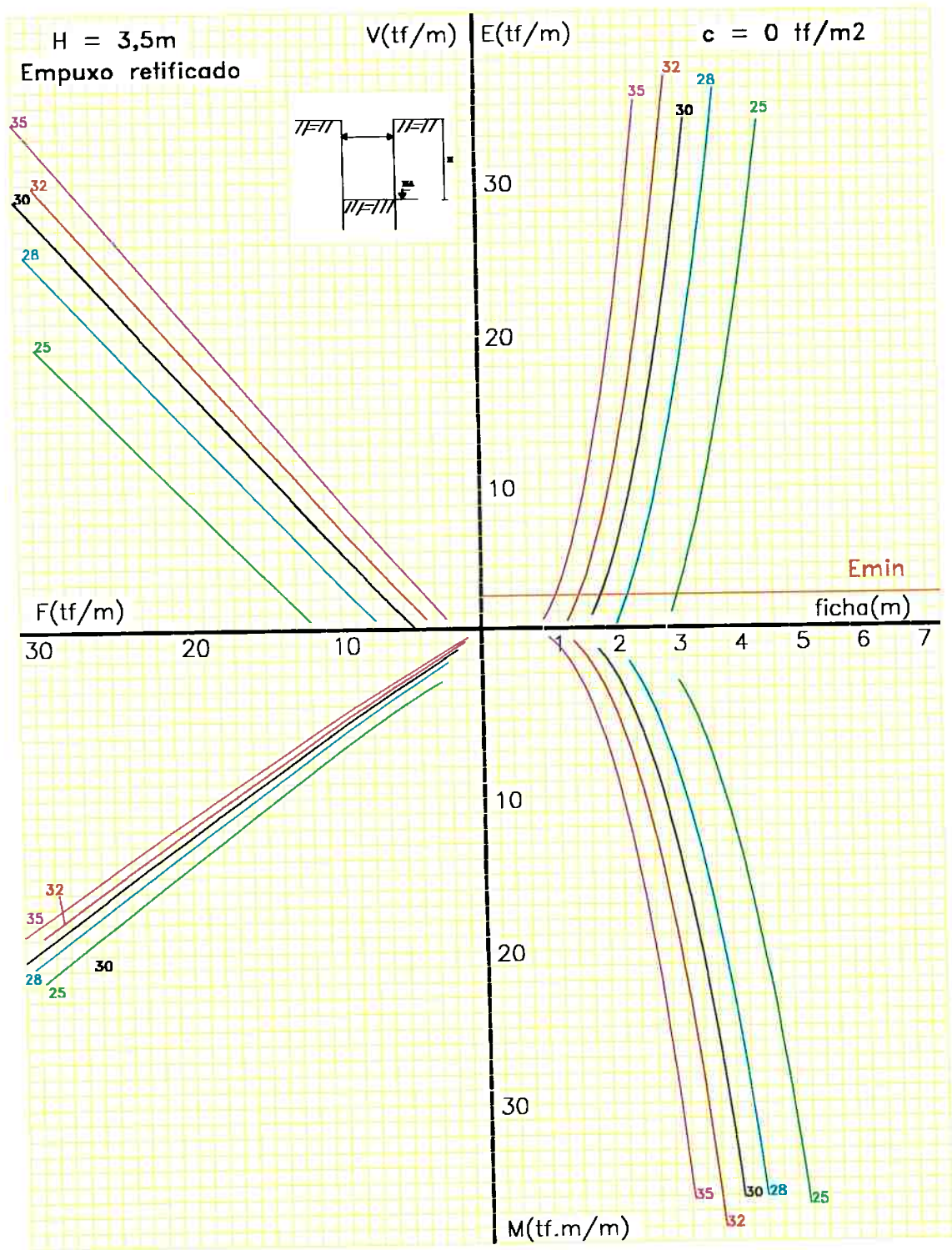


Fig. I.49- Ábaco tipo ES1

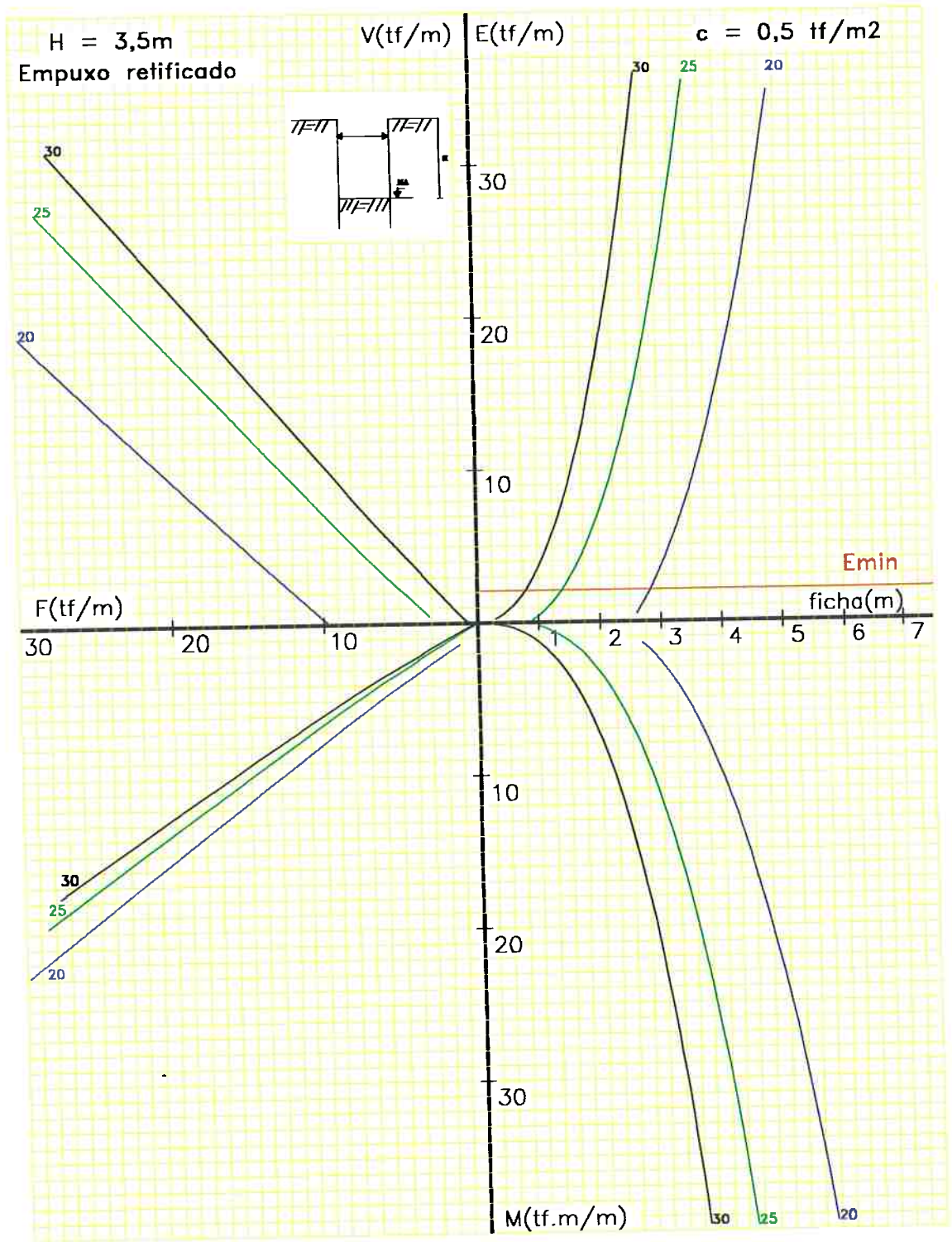


Fig. I.50- Ábaco tipo ES1

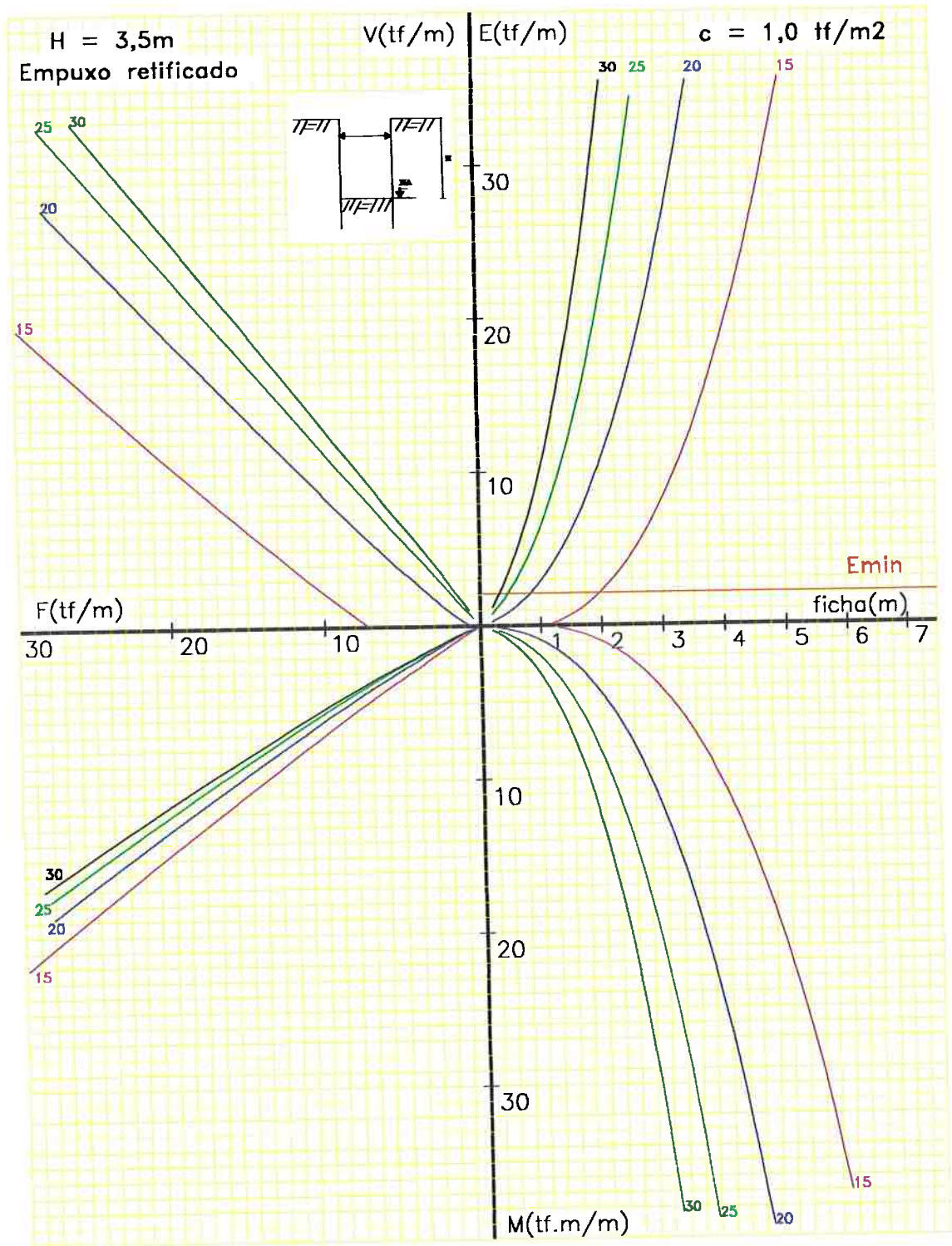


Fig. I.51- Ábaco tipo ES1

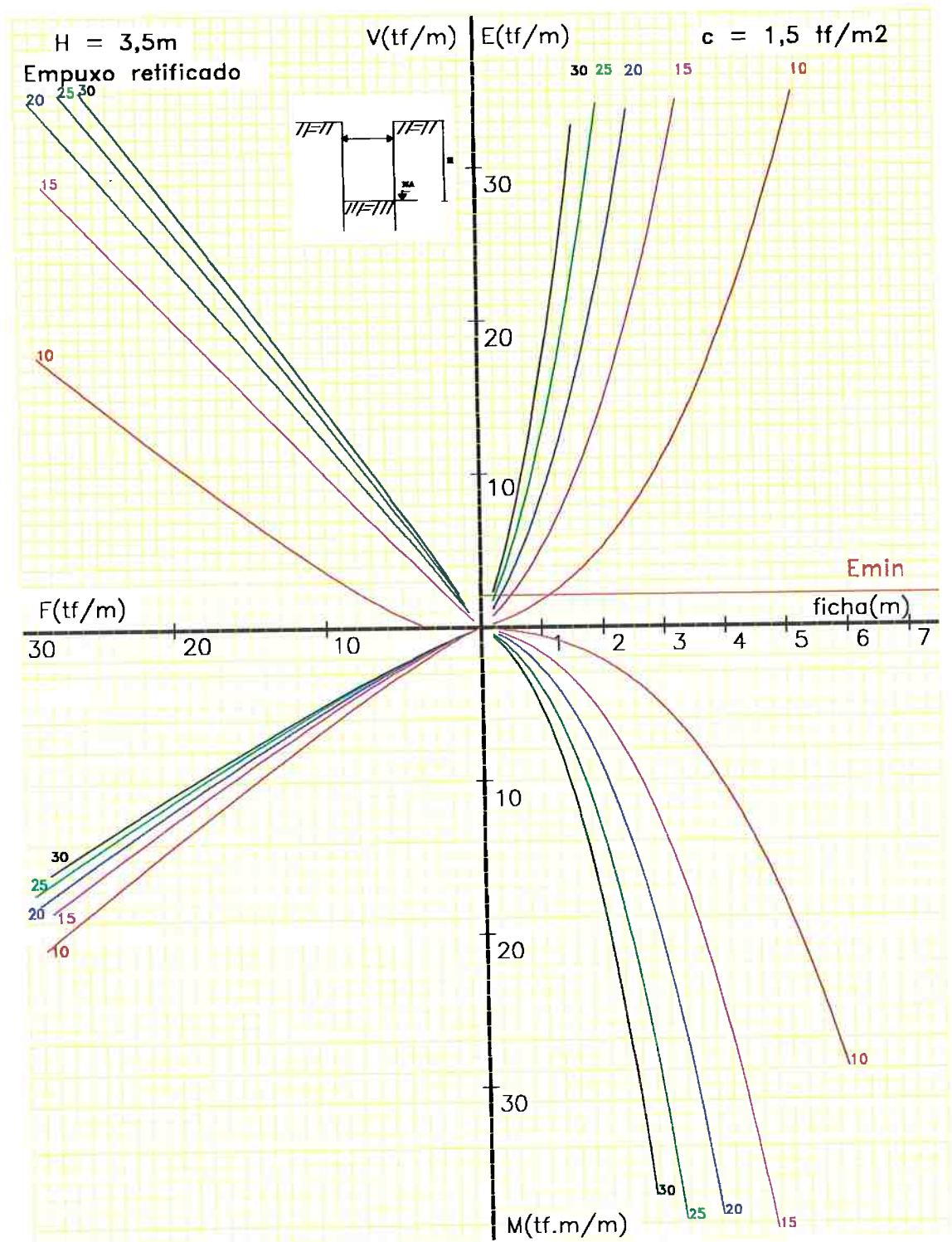


Fig. I.52- Ábaco tipo ES1

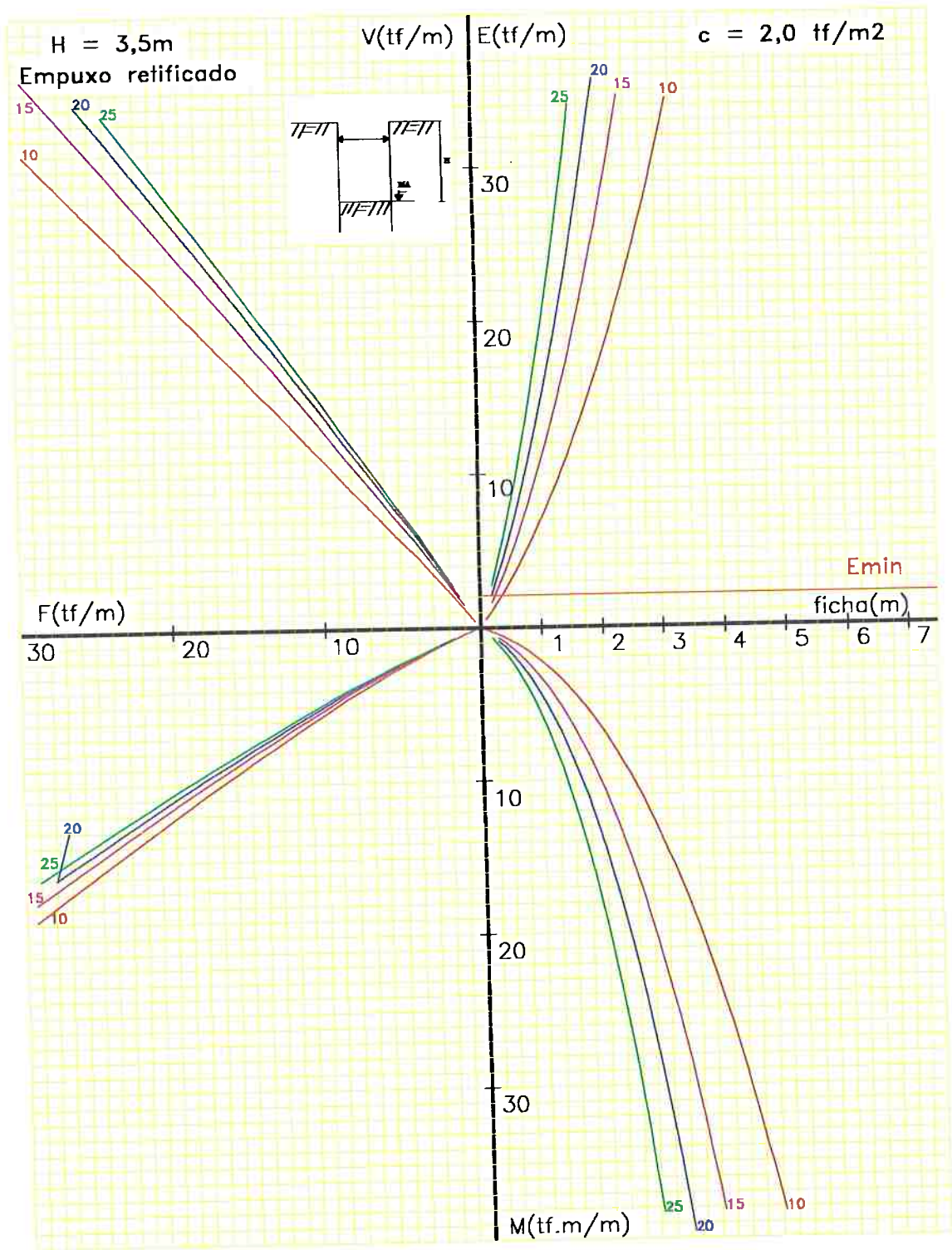


Fig. I.53- Ábaco tipo ES1

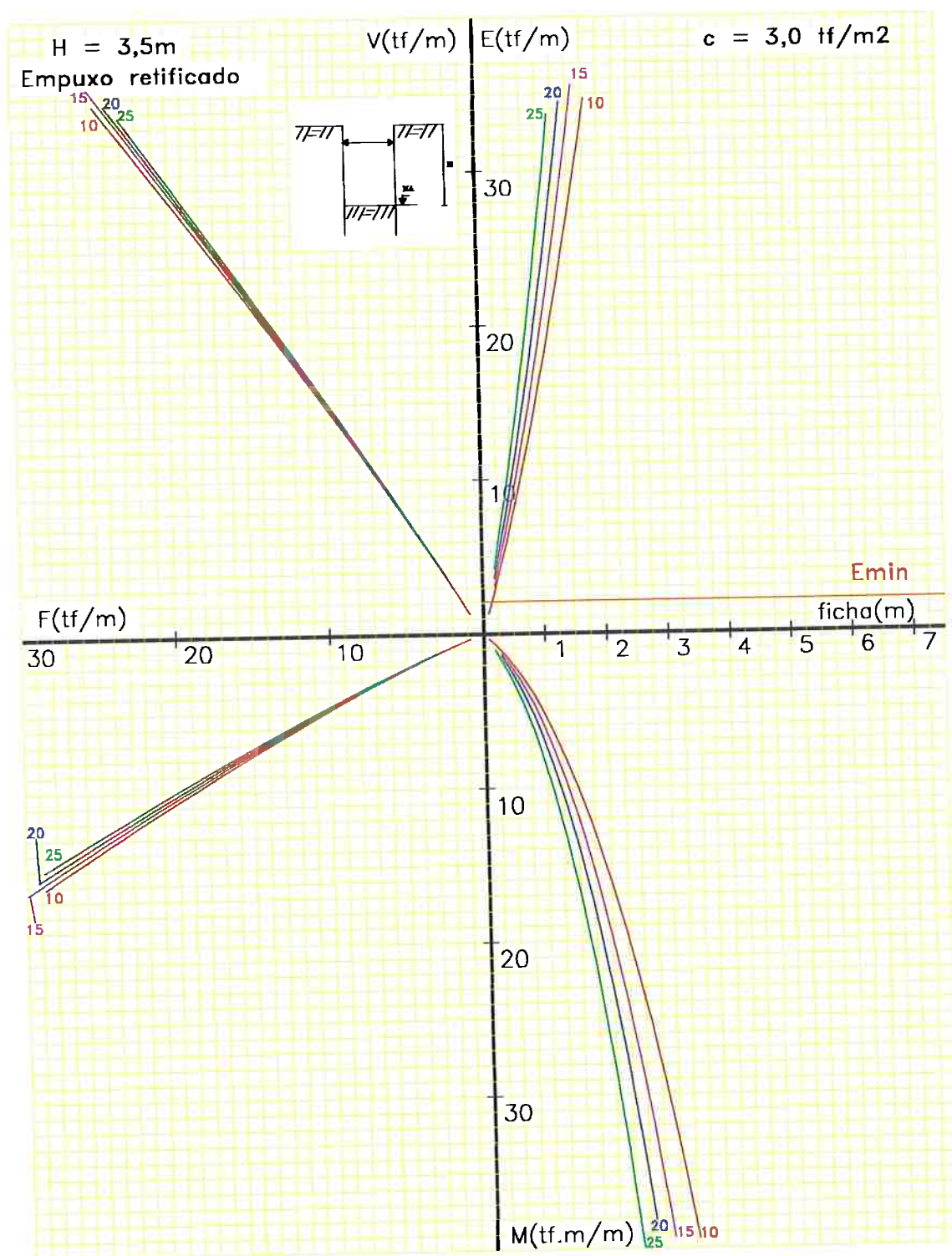


Fig. I.54- Ábaco tipo ES1

H = 4,5 m

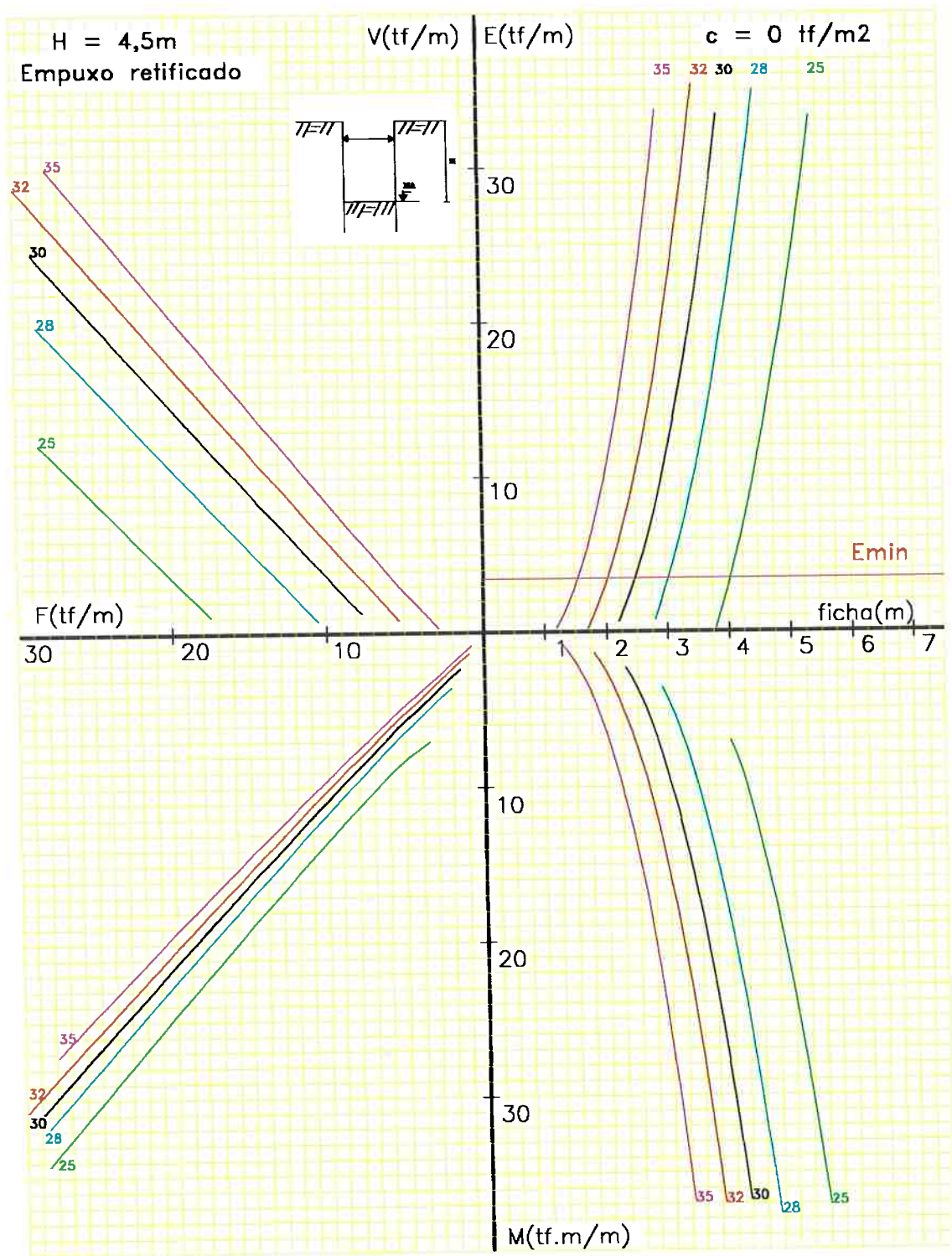


Fig. I.55- Ábaco tipo ES1

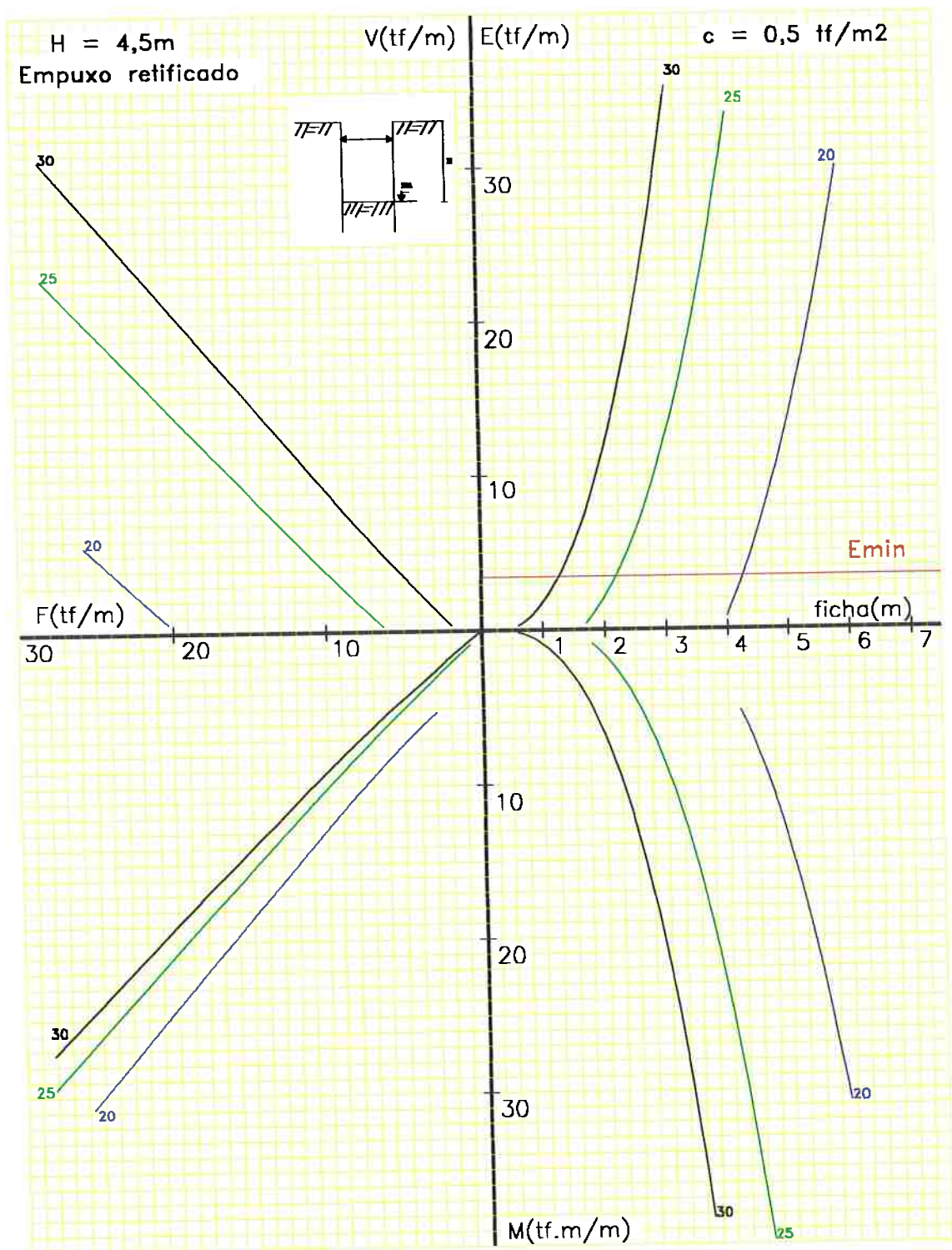


Fig. I.56- Ábaco tipo ES1

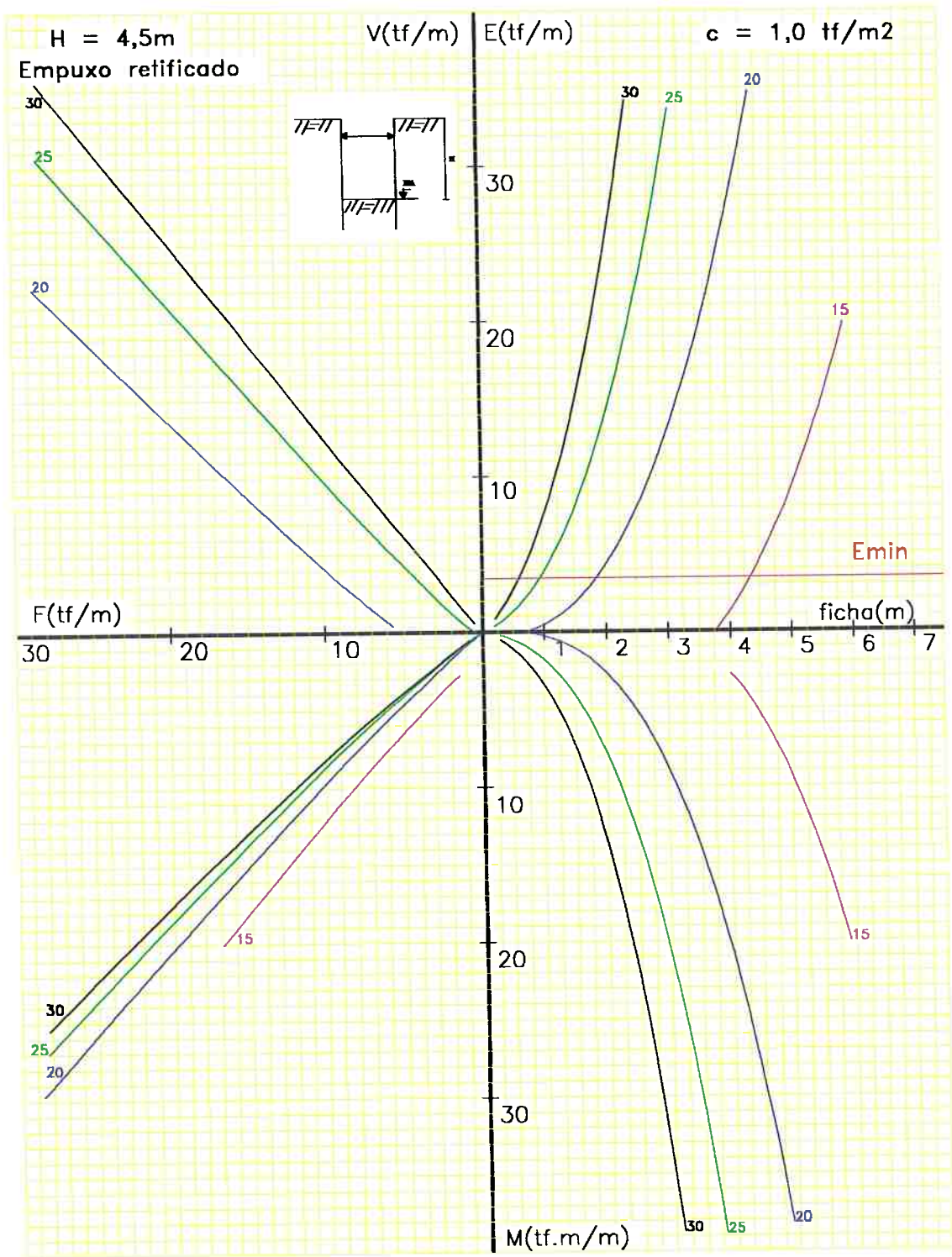


Fig. I.57- Ábaco tipo ES1

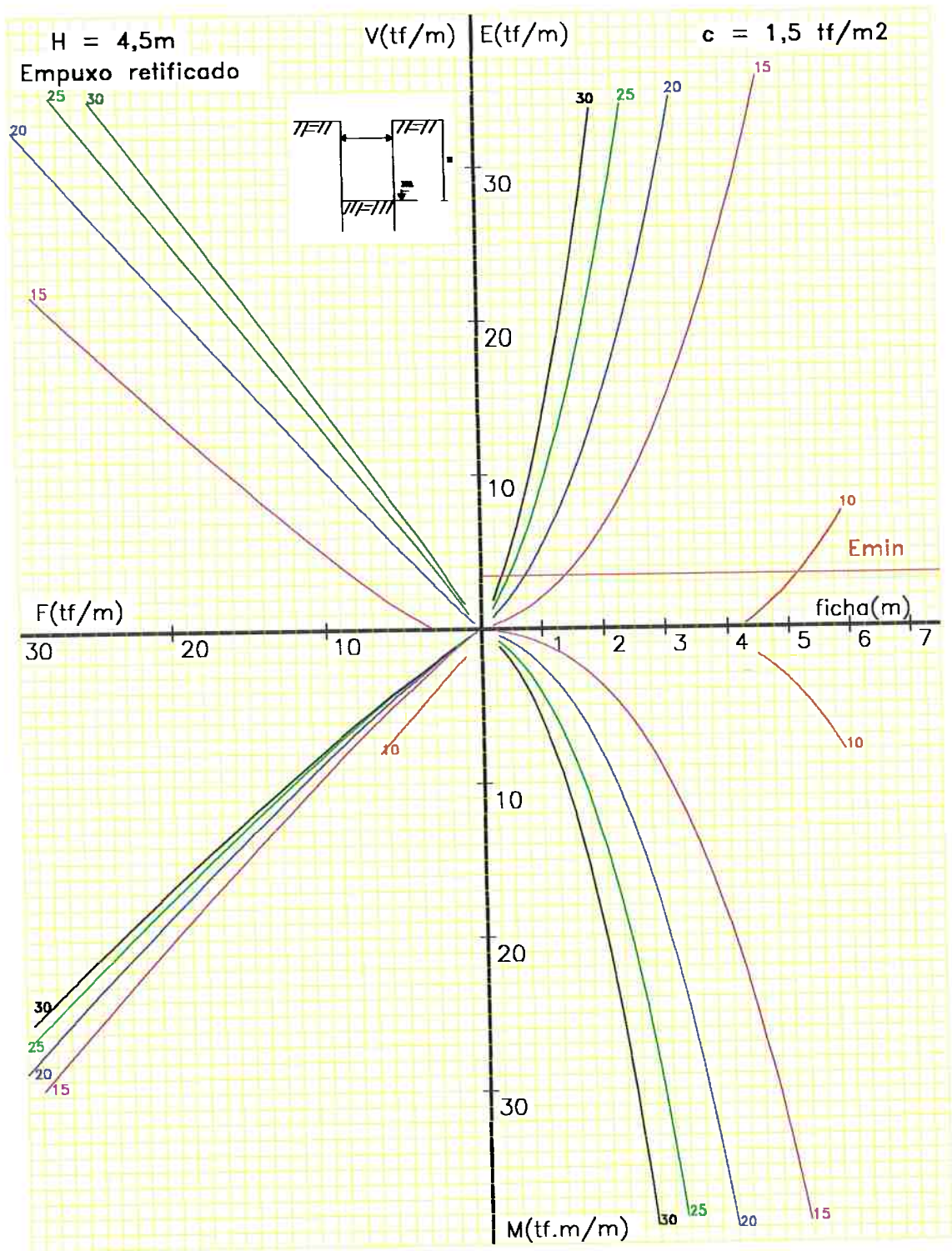


Fig. 1.58- Ábaco tipo ES1

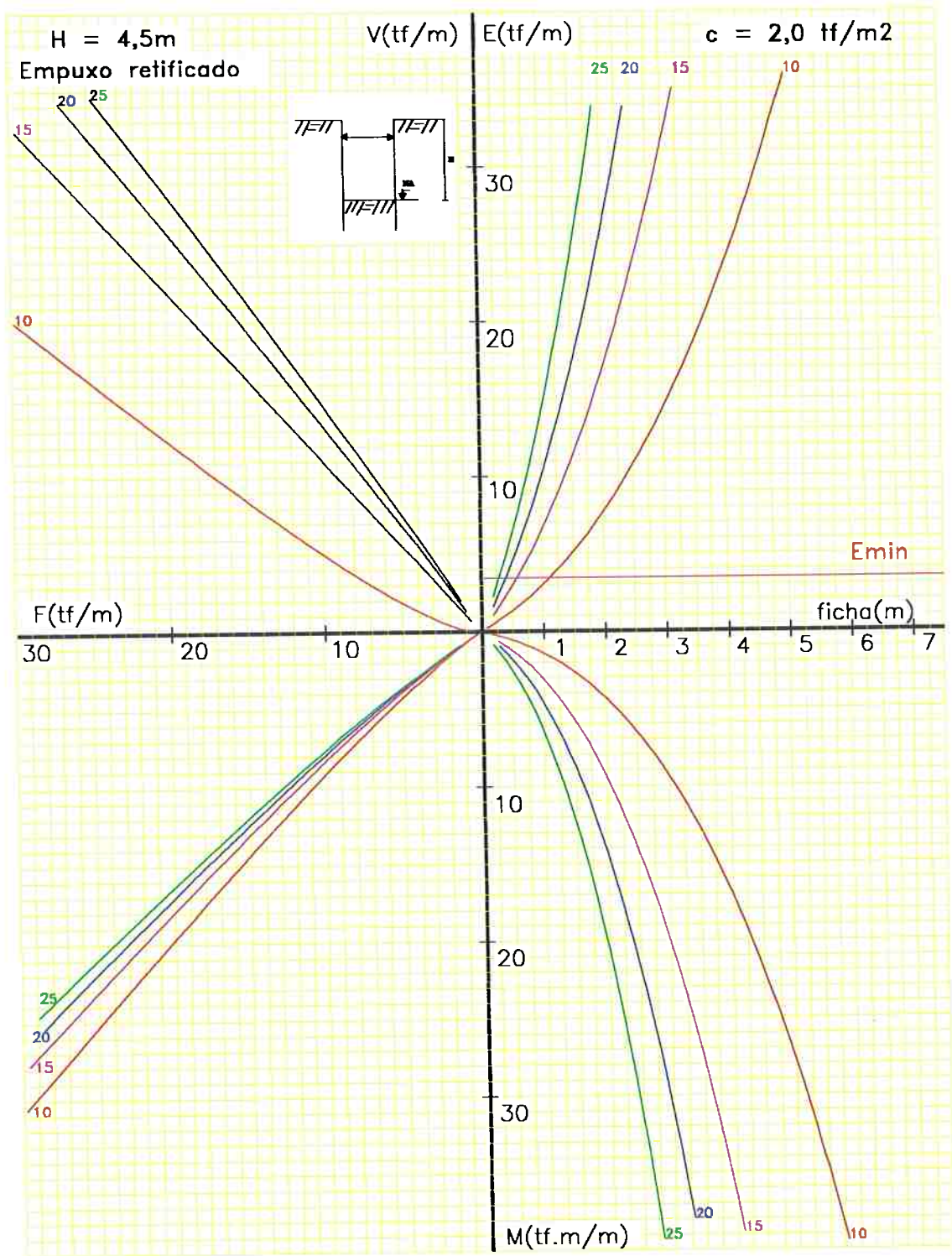


Fig. I.59- Ábaco tipo ES1

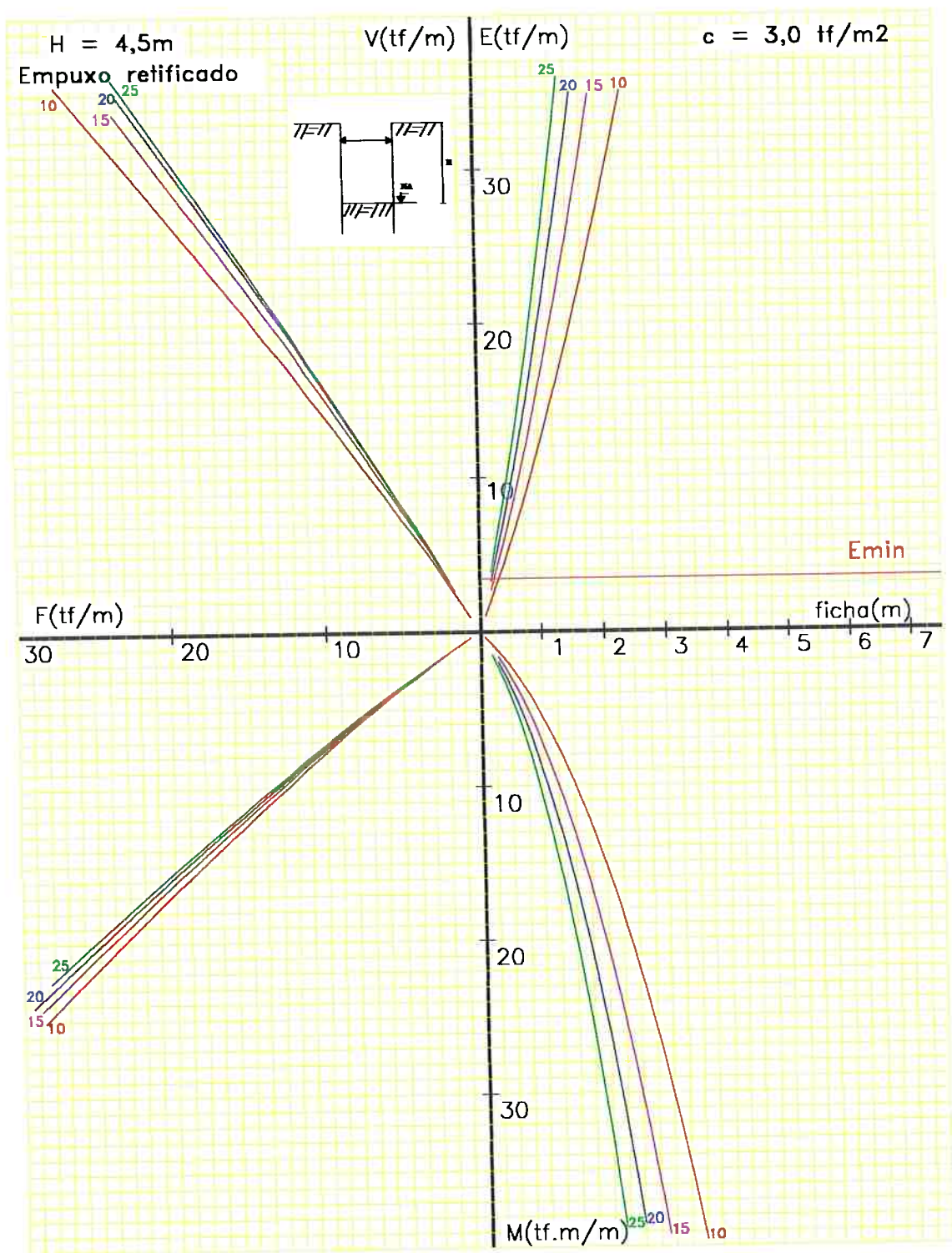


Fig. I.60- Ábaco tipo ES1

H = 5,5 m

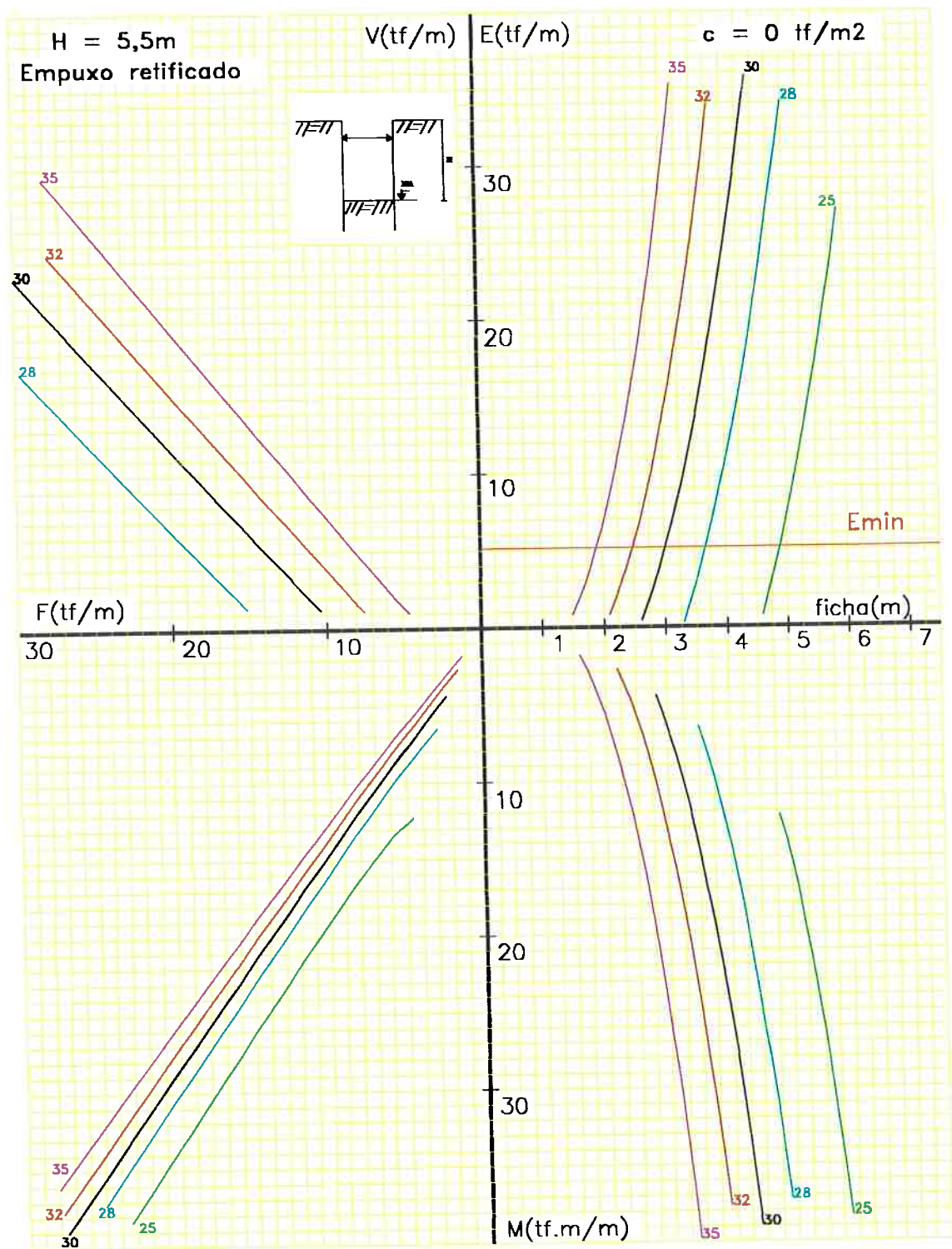


Fig. I.61- Ábaco tipo ES1

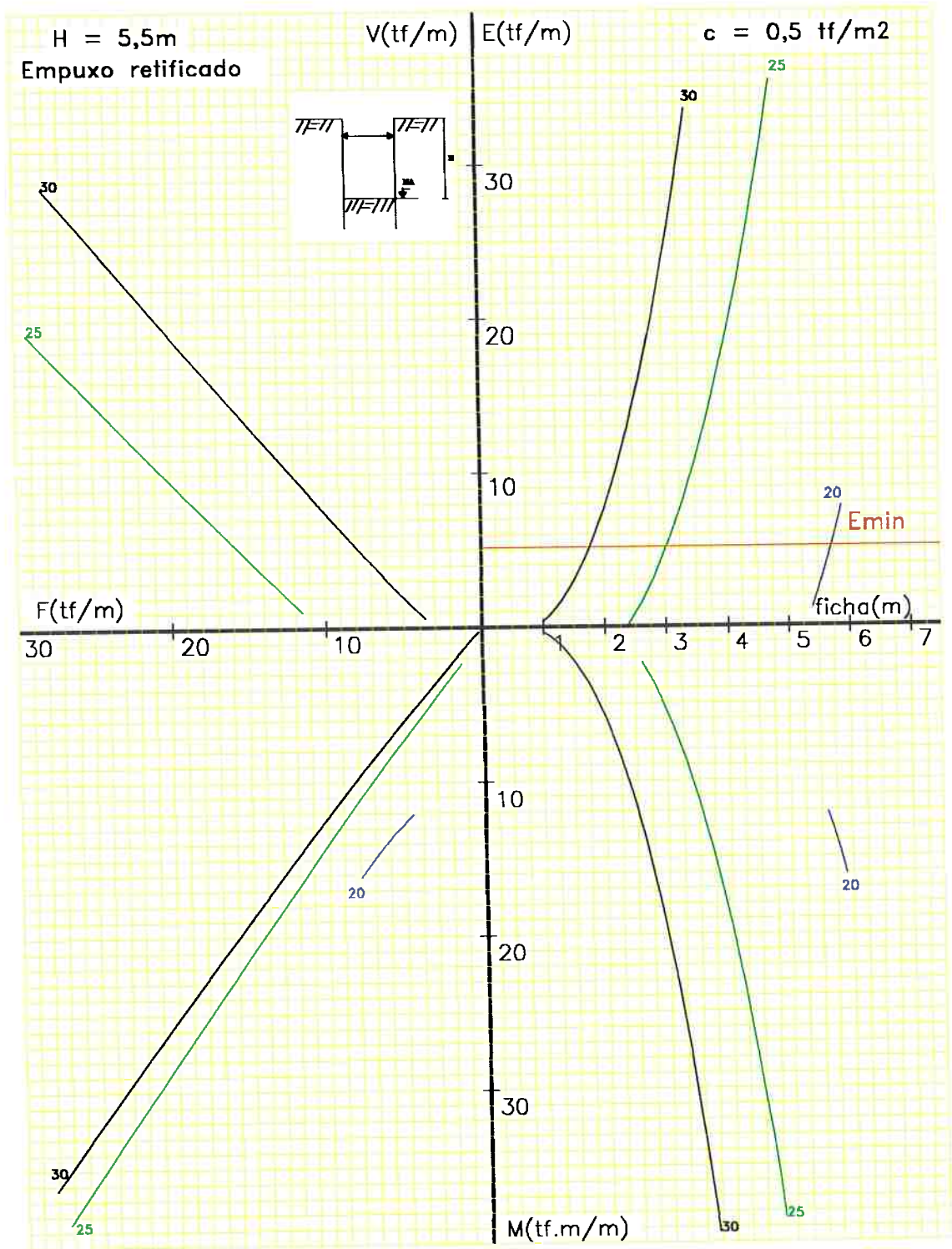


Fig. I.62- Ábaco tipo ES1

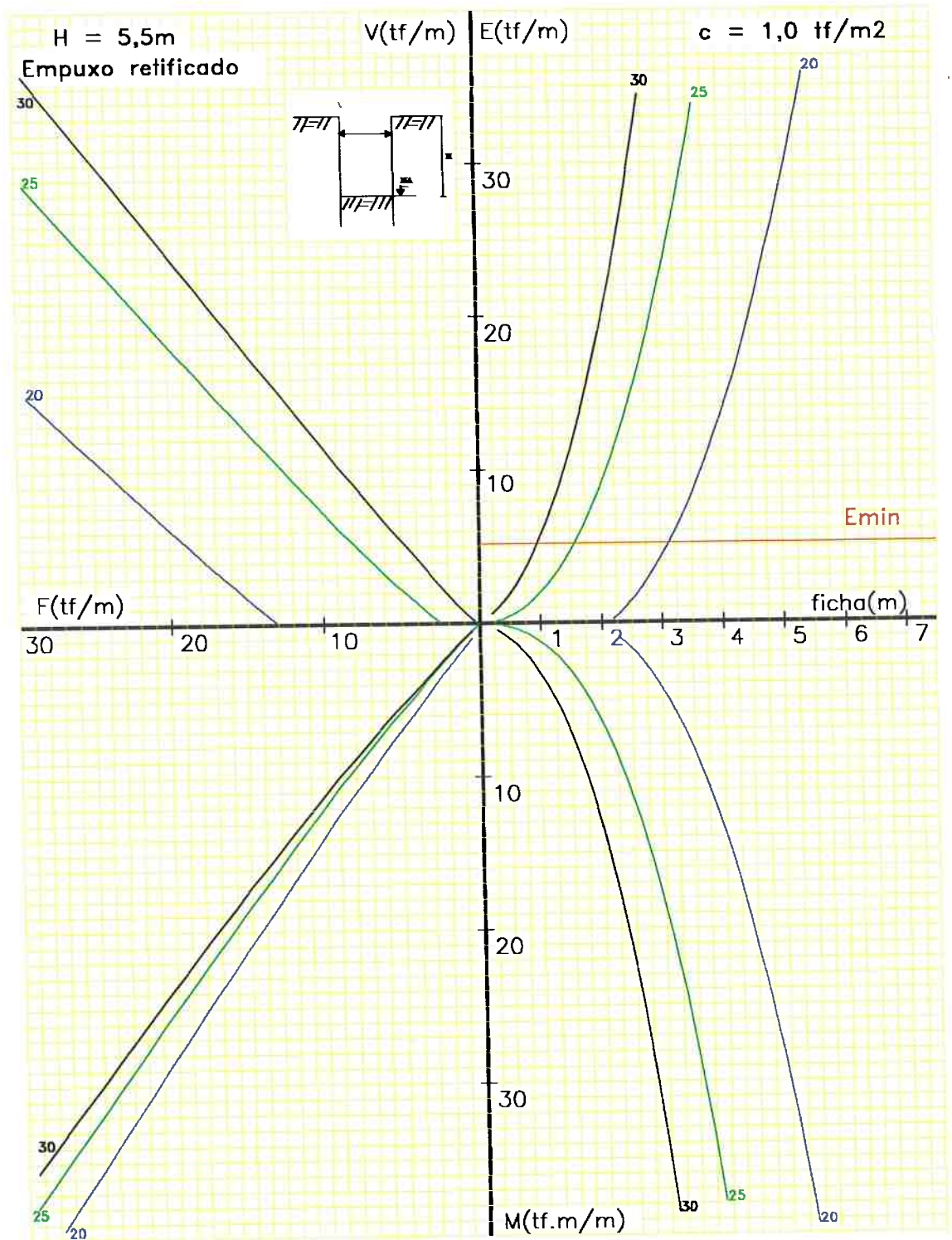


Fig. I.63- Ábaco tipo ES1

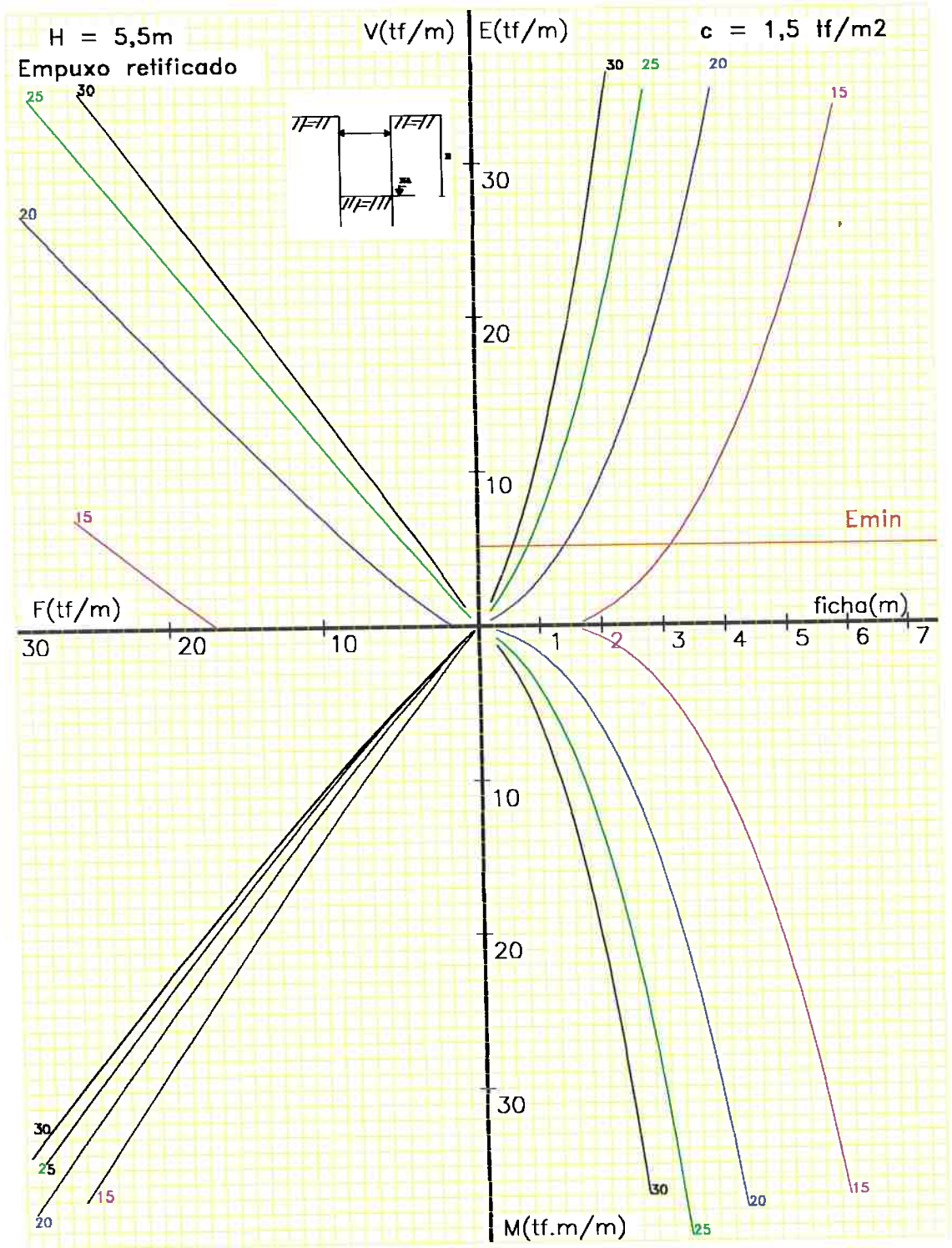


Fig. I.64- Ábaco tipo ES1

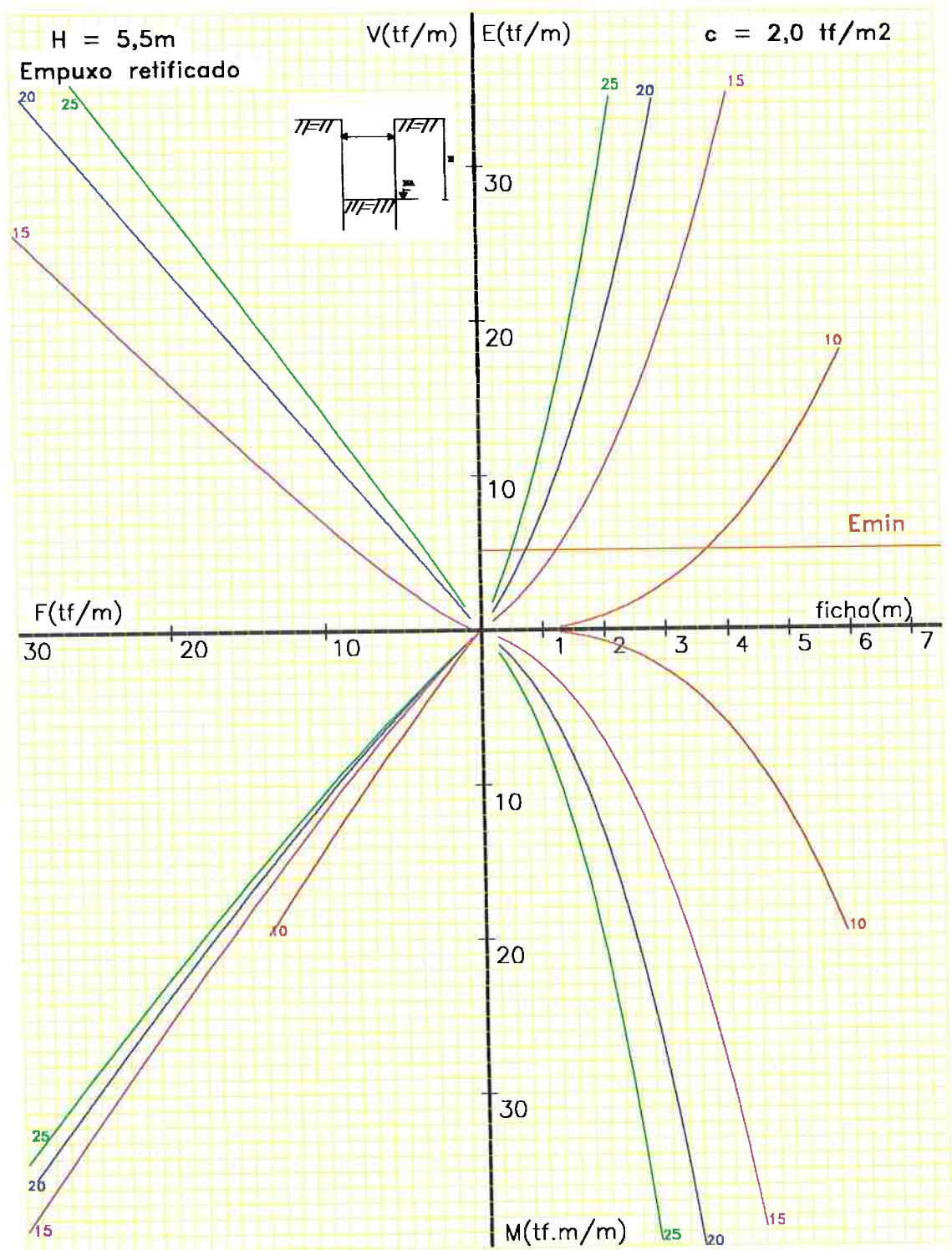


Fig. I.65- Ábaco tipo ES1

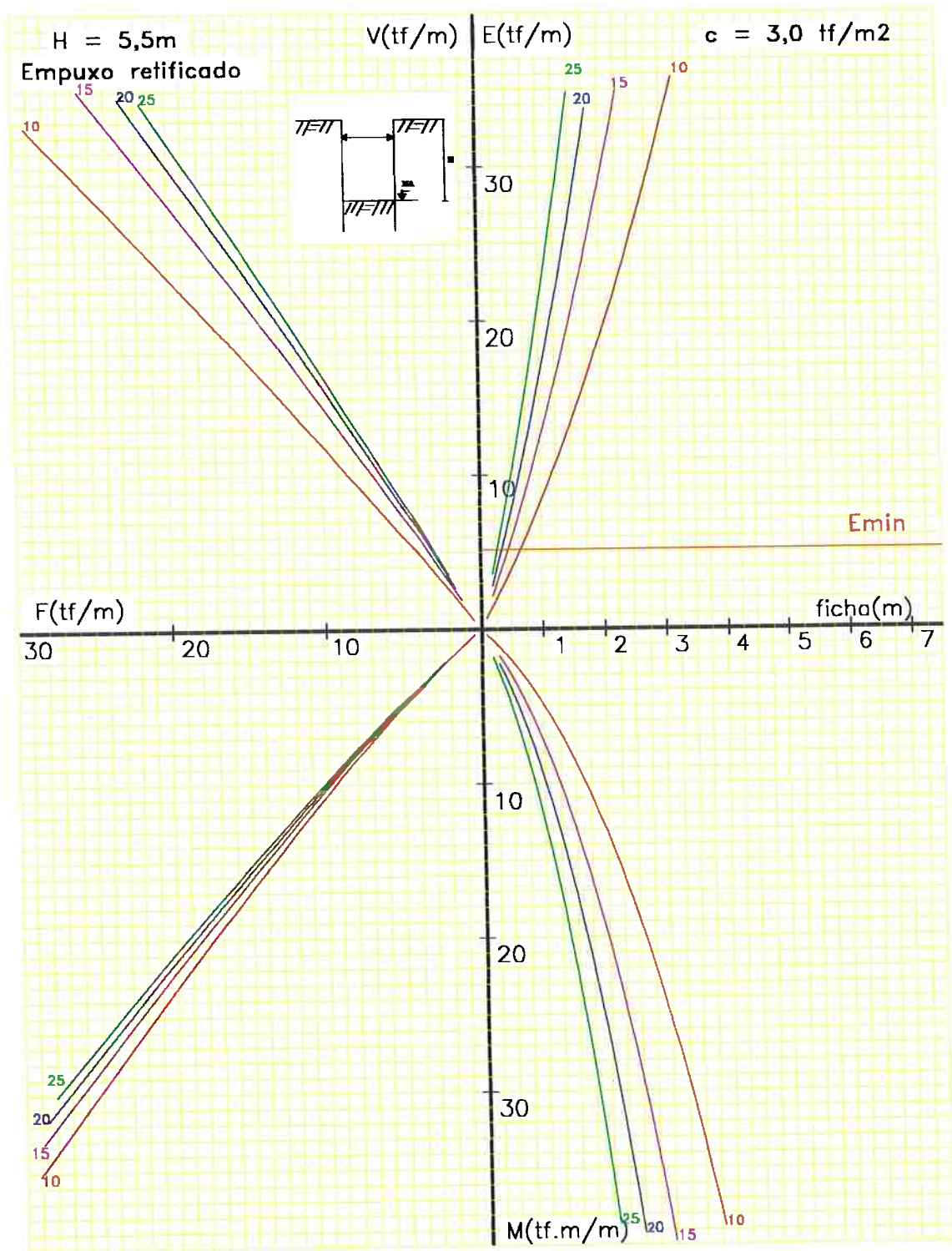


Fig. I.66- Ábaco tipo ES1

H = 6,5 m

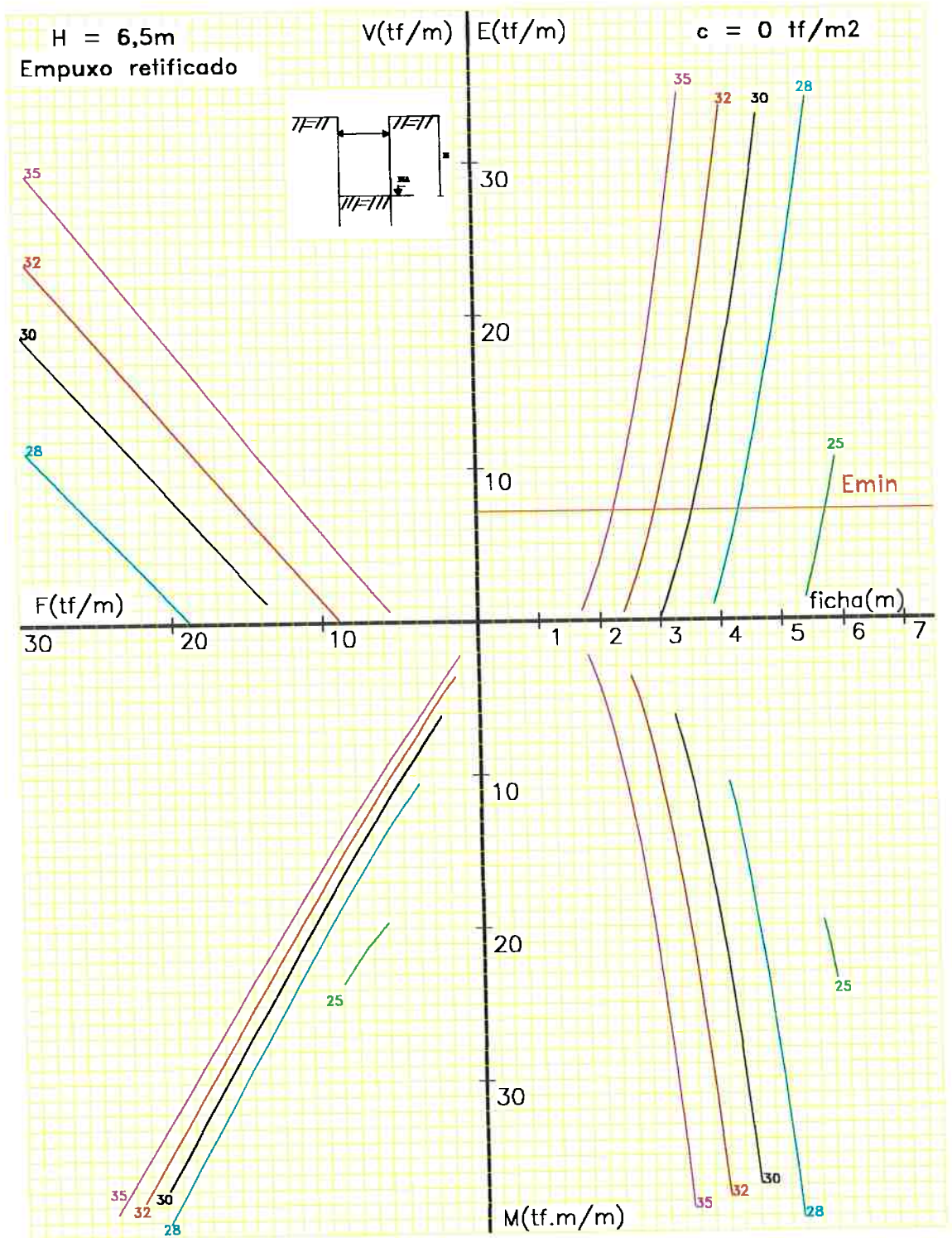


Fig. I.67- Ábaco tipo ES1

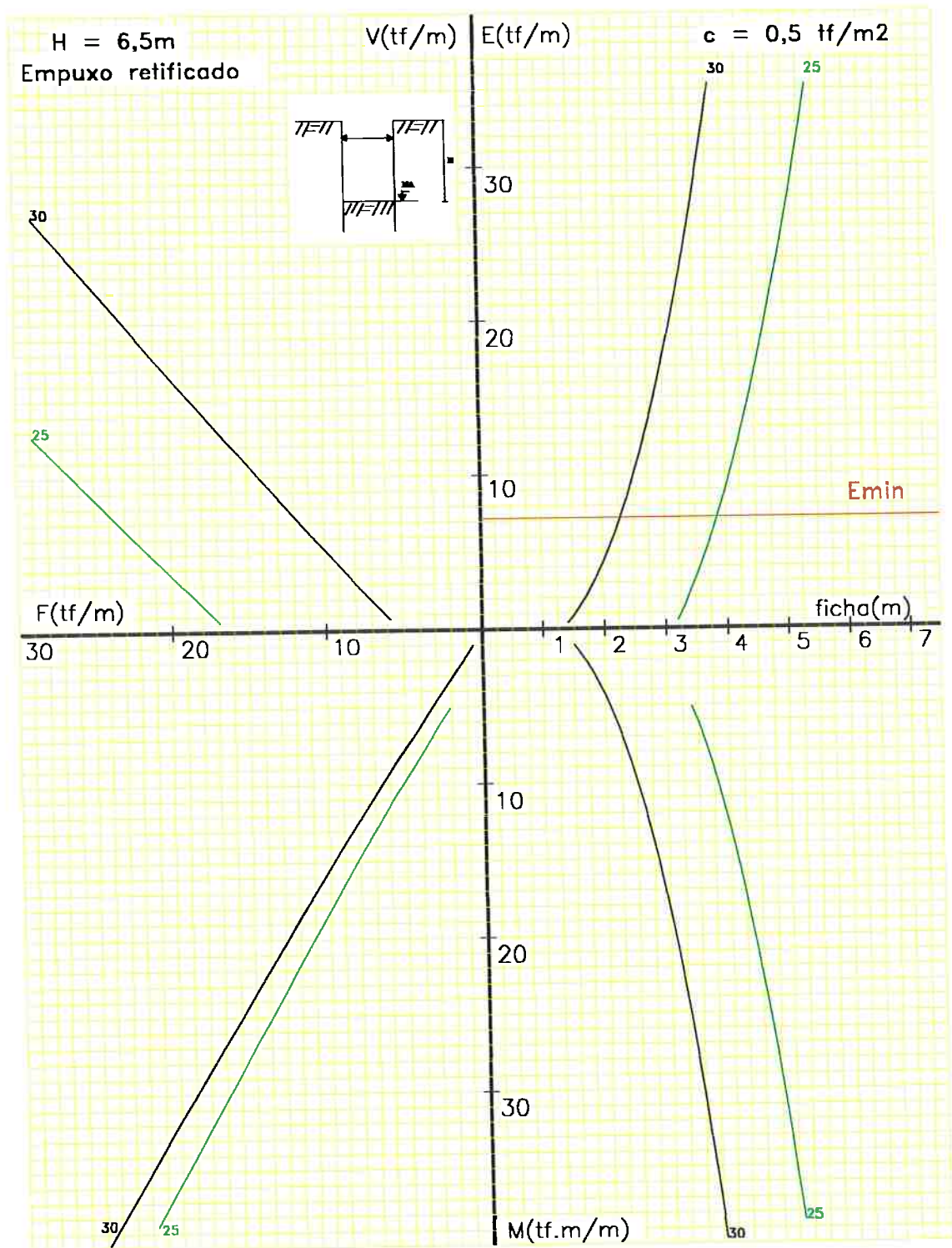


Fig. I.68- Ábaco tipo ES1

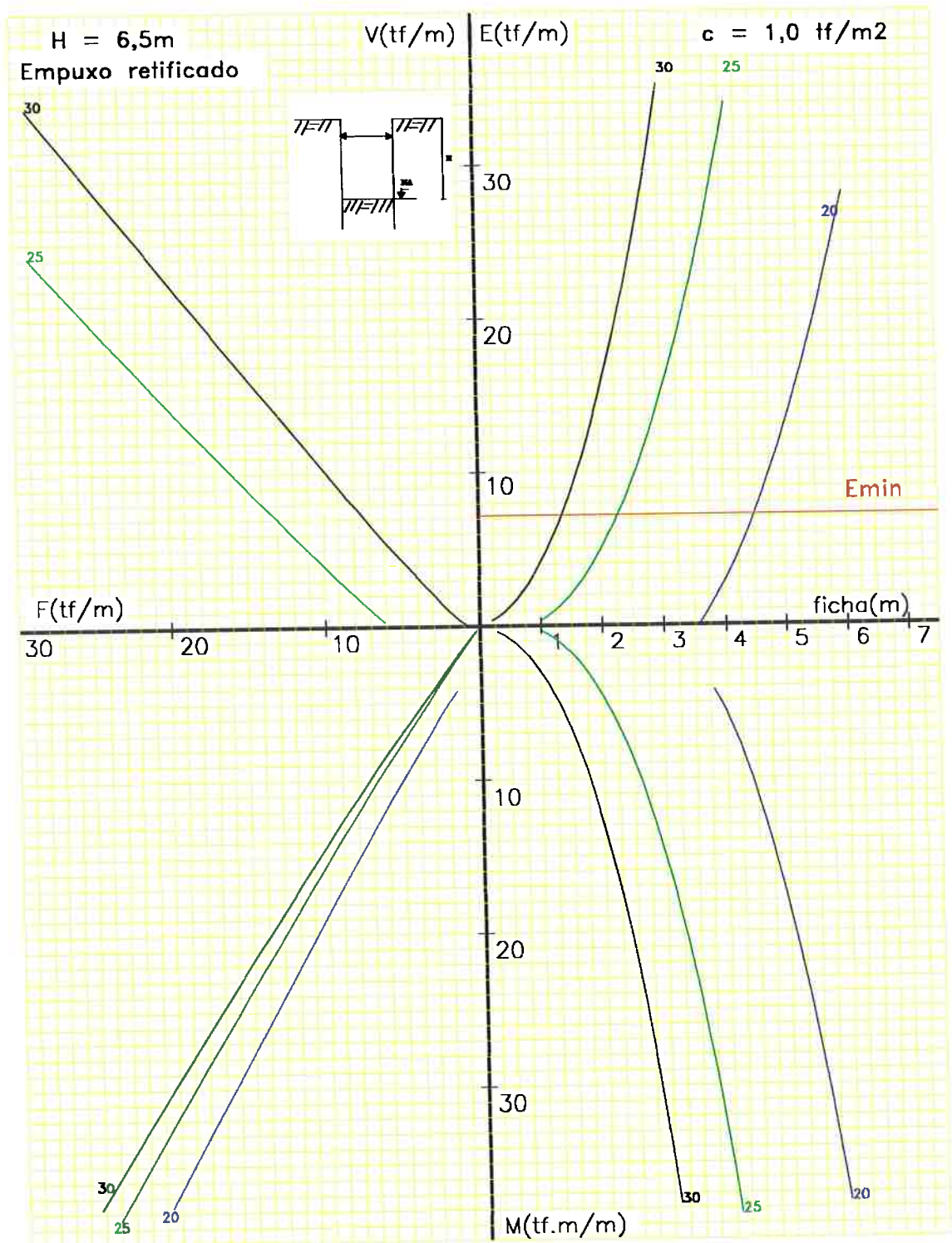


Fig. I.69- Ábaco tipo ES1

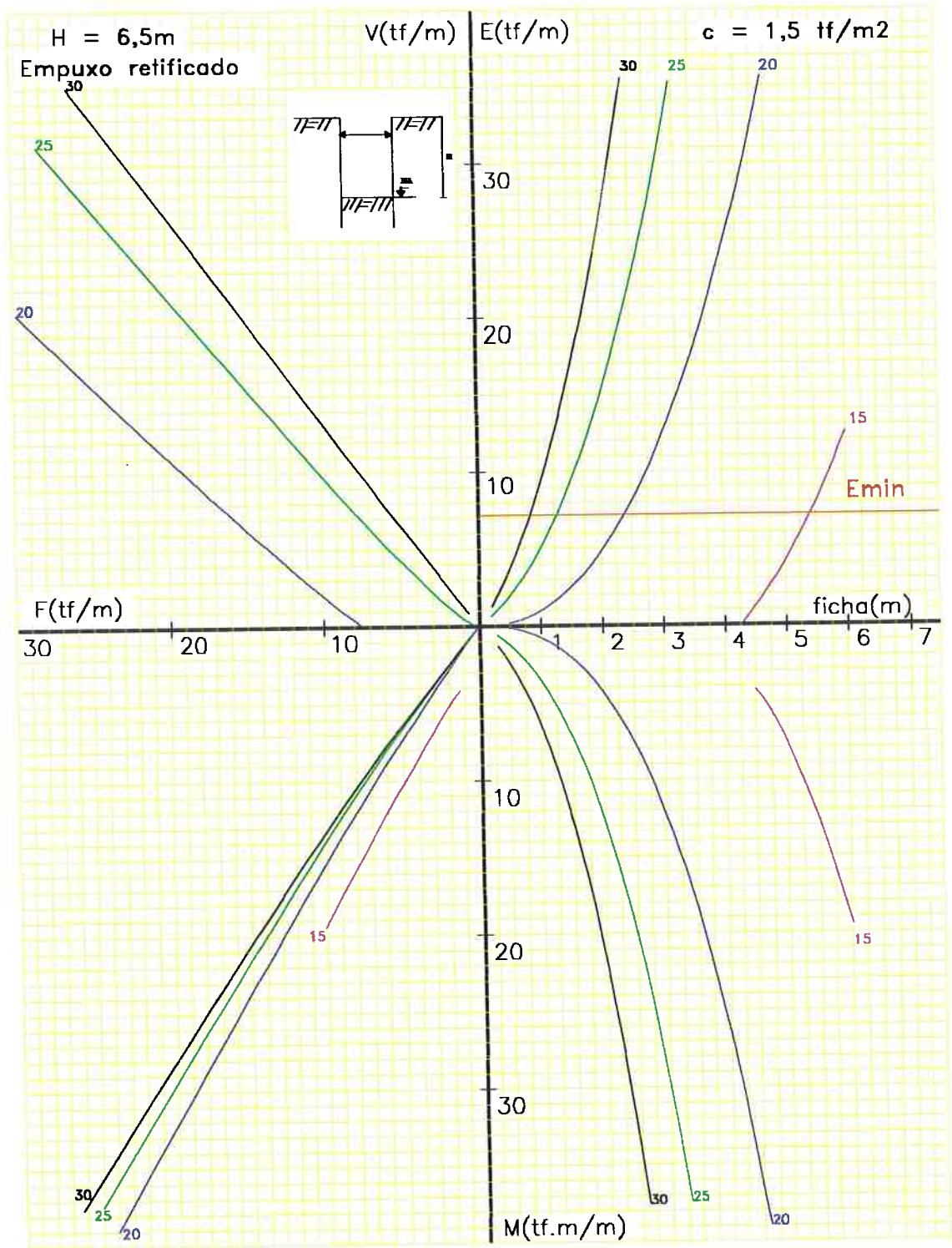


Fig. I.70- Ábaco tipo ES1

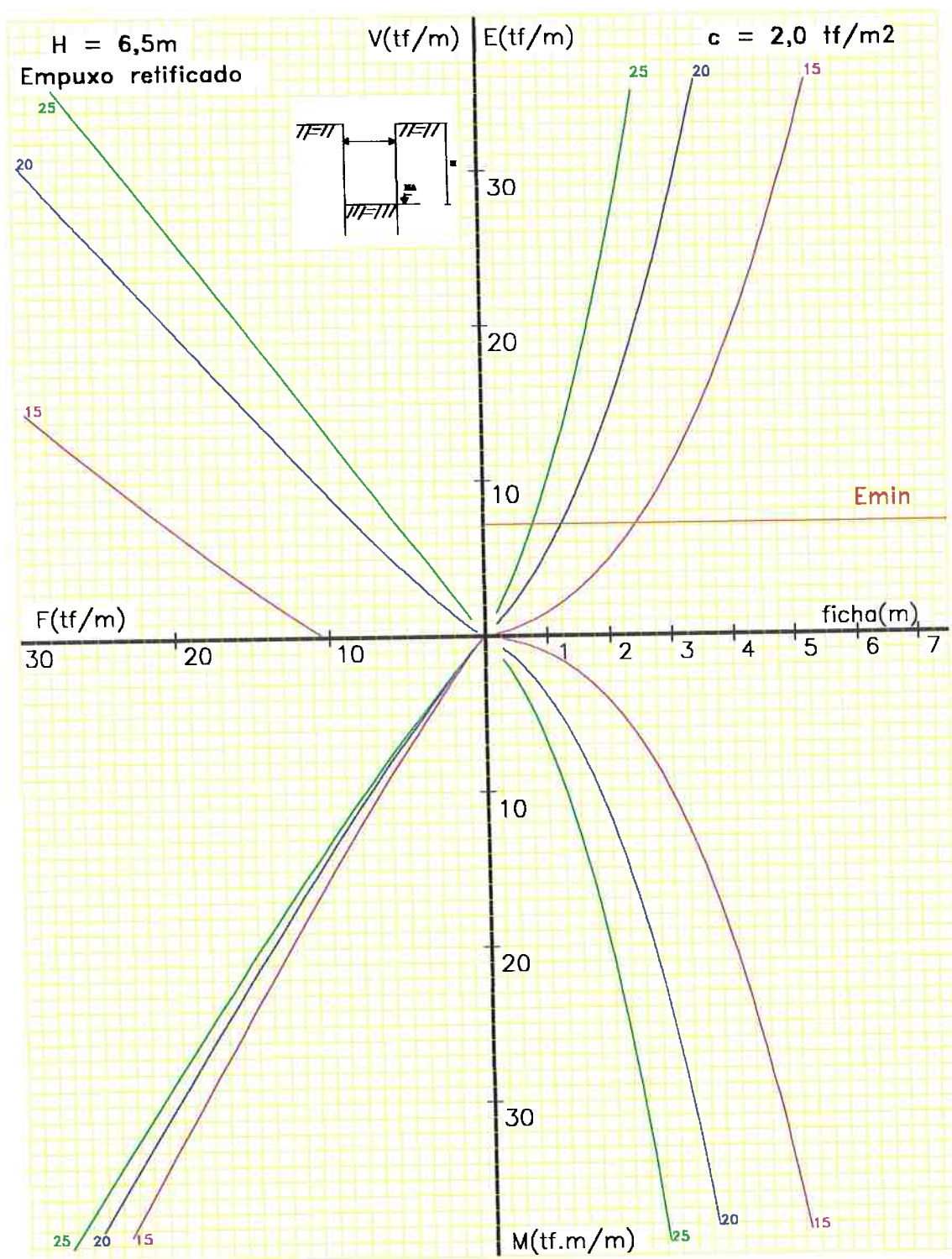


Fig. I.71- Ábaco tipo ES1

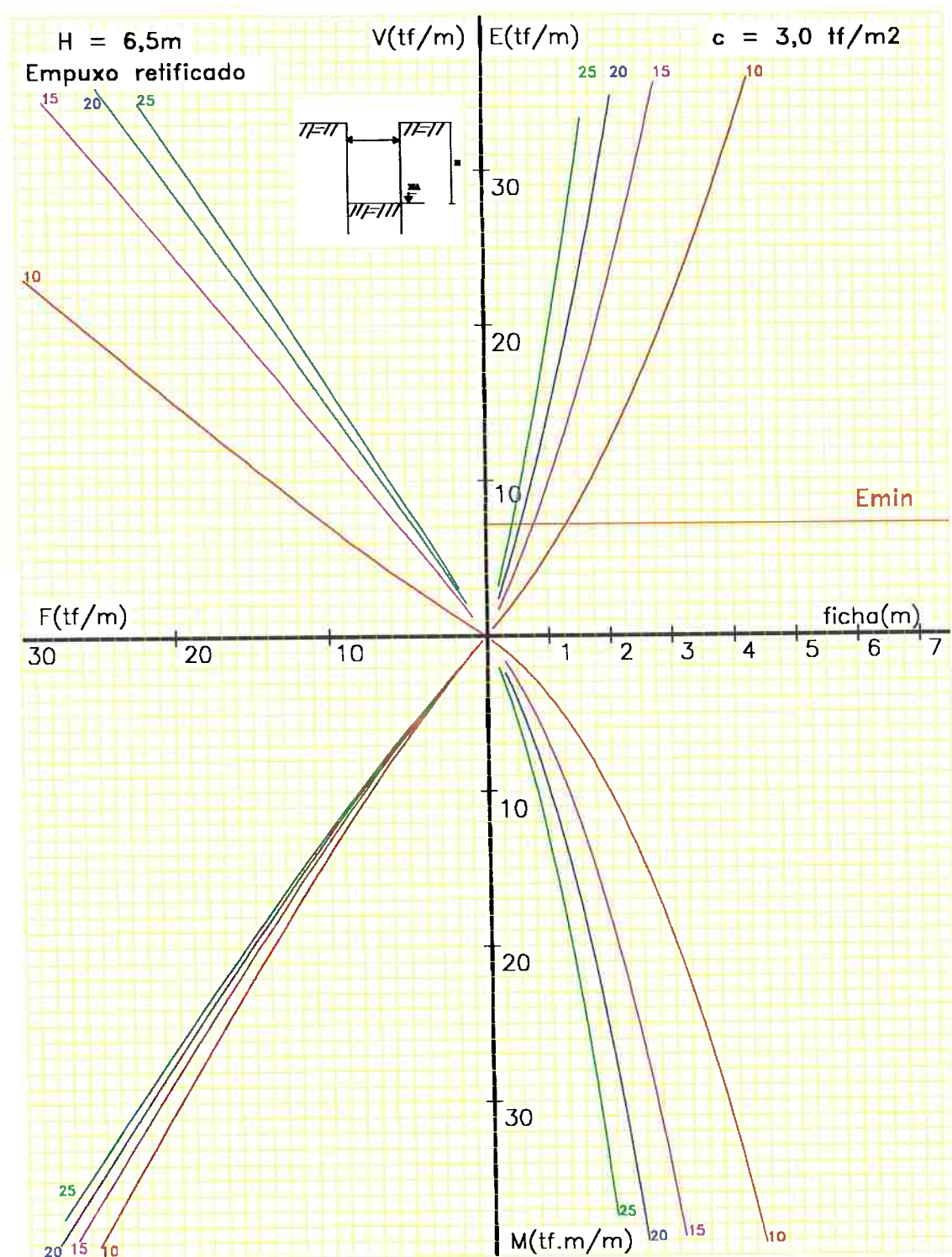


Fig. I.72- Ábaco tipo ES1

**NÍVEL DE ÁGUA
ABAIXO DA FICHA**

H = 3,5 m

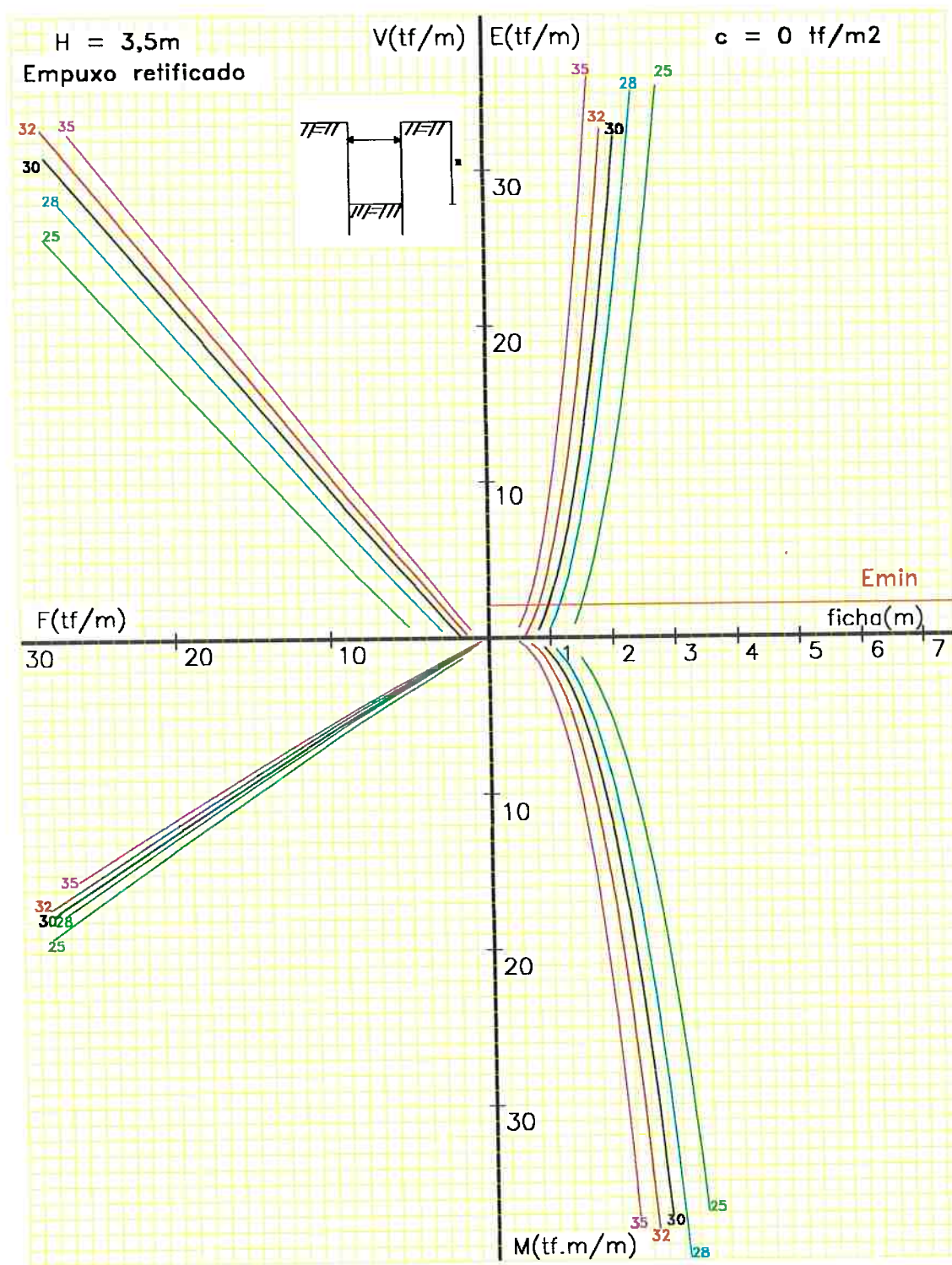


Fig. I.73- Ábaco tipo ES1

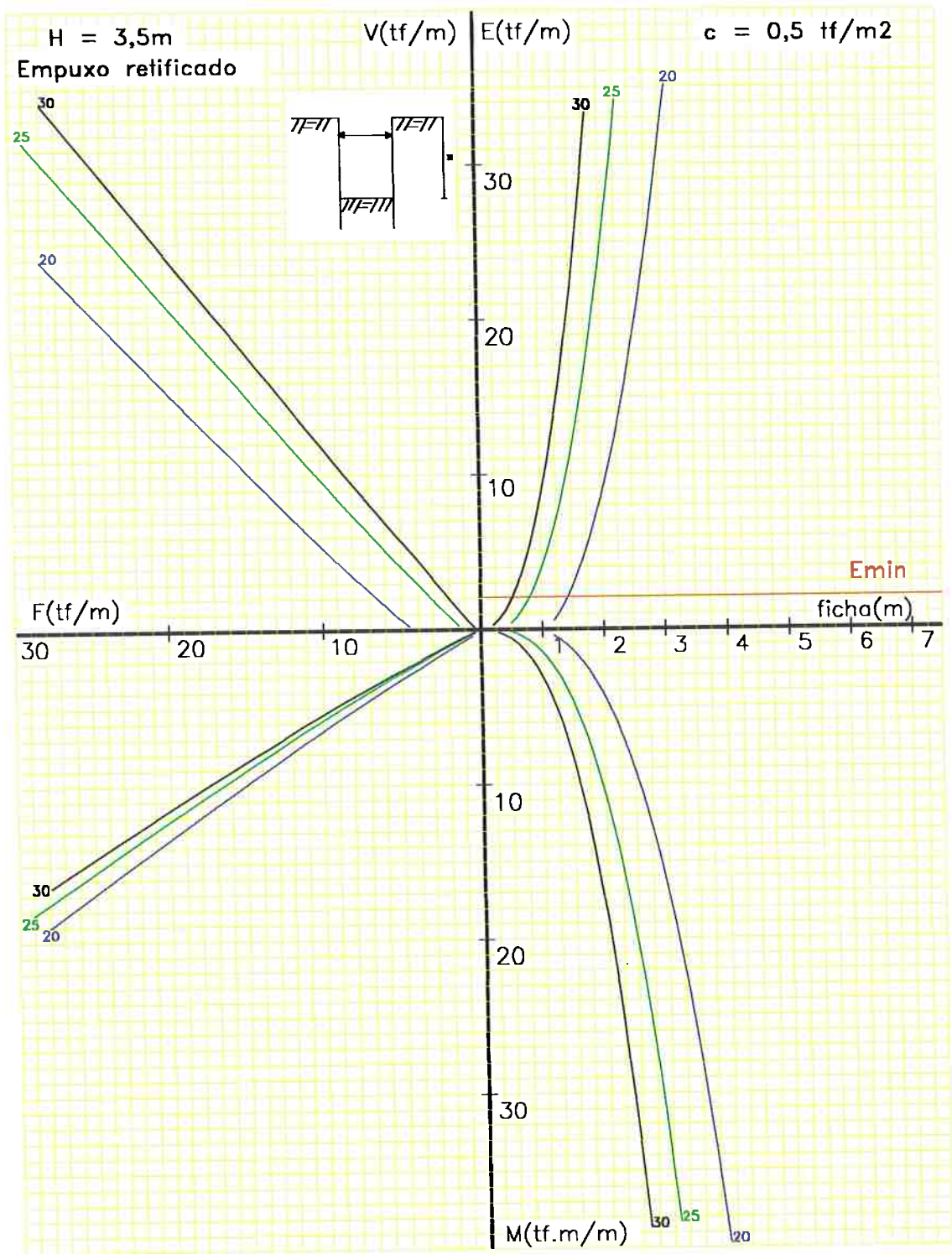


Fig. I.74- Ábaco tipo ES1

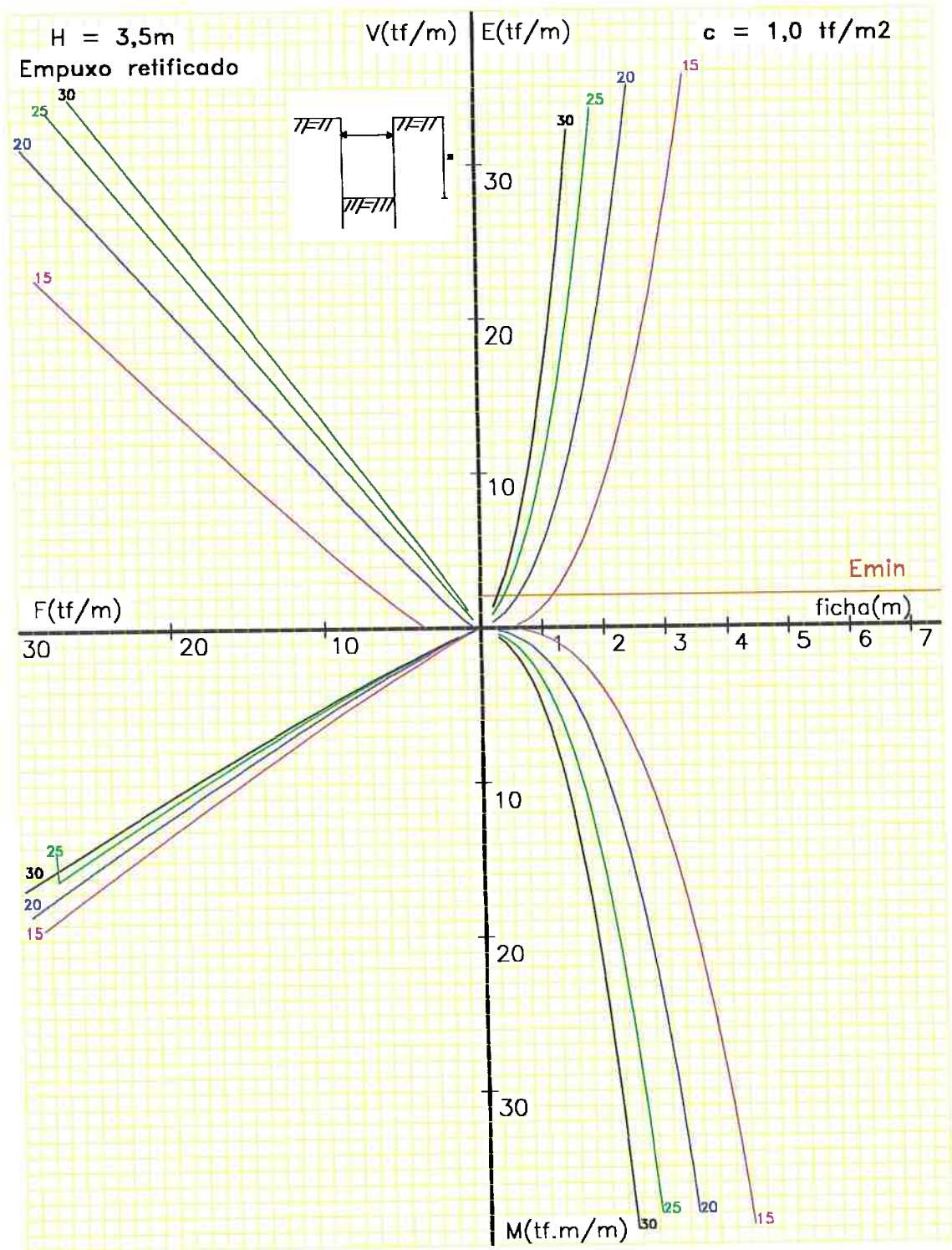


Fig. I.75- Ábaco tipo ES1

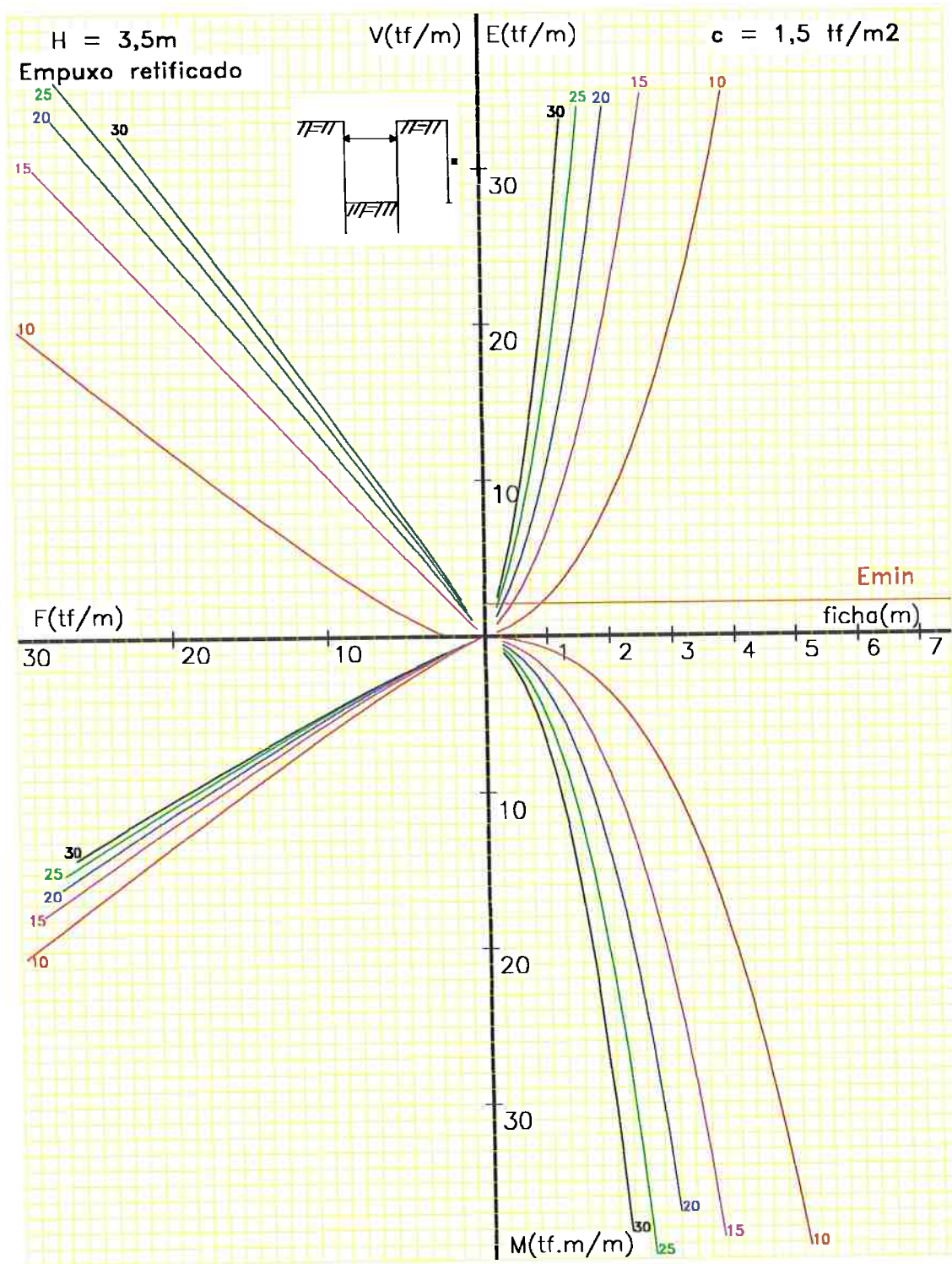


Fig. I.76- Ábaco tipo ES1

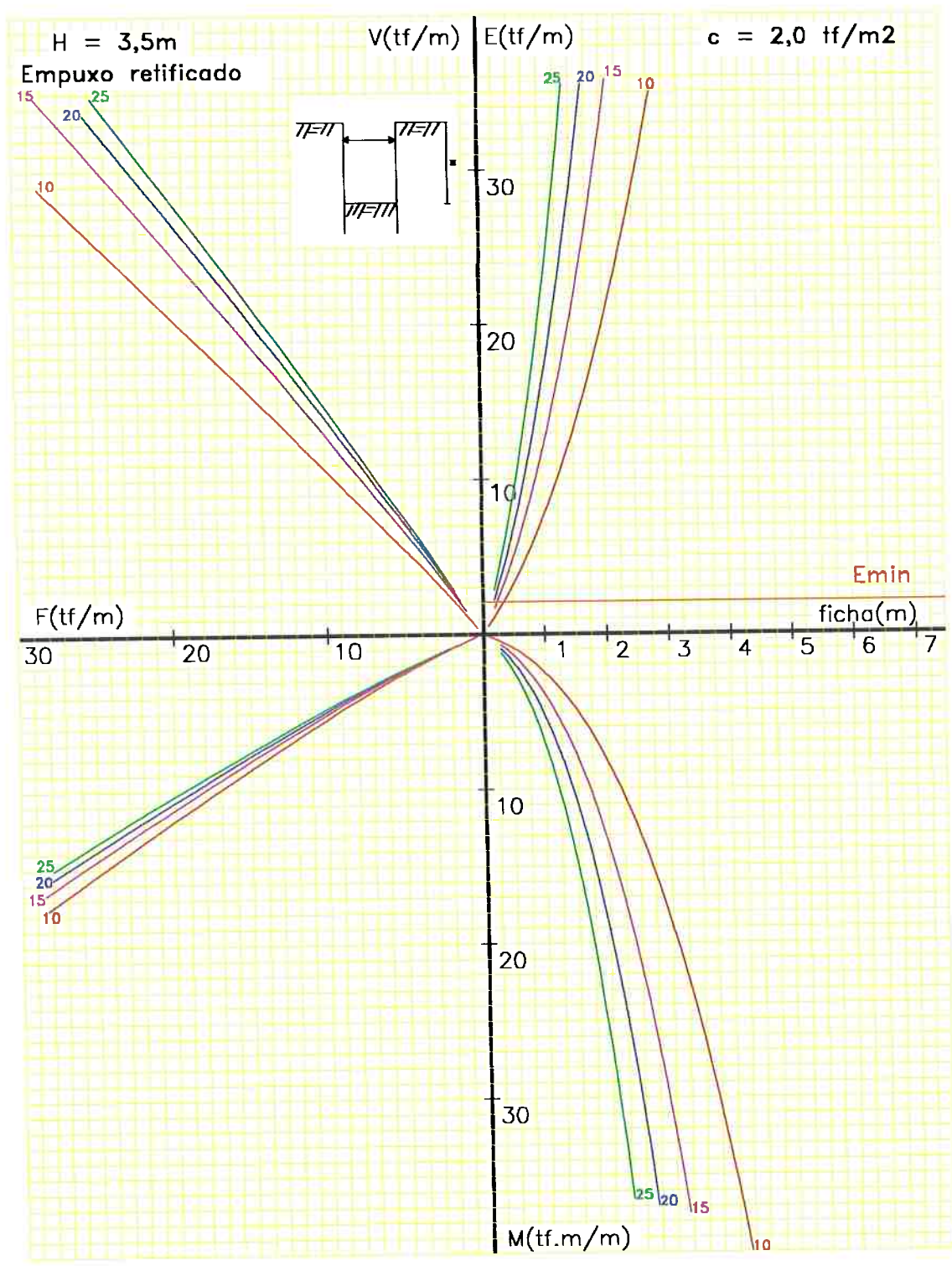


Fig. I.77- Ábaco tipo ES1

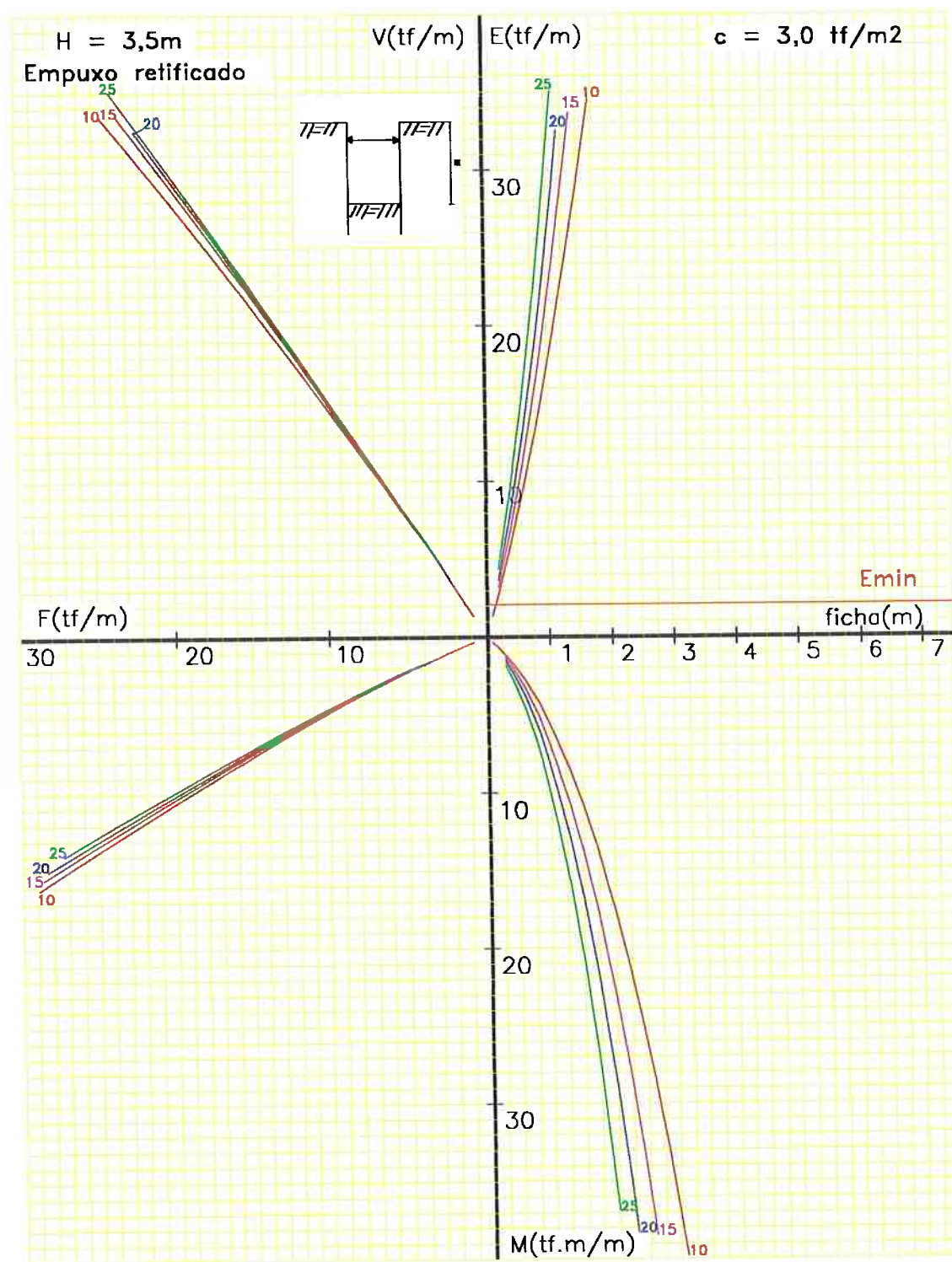


Fig. I.78- Ábaco tipo ES1

H = 4,5 m

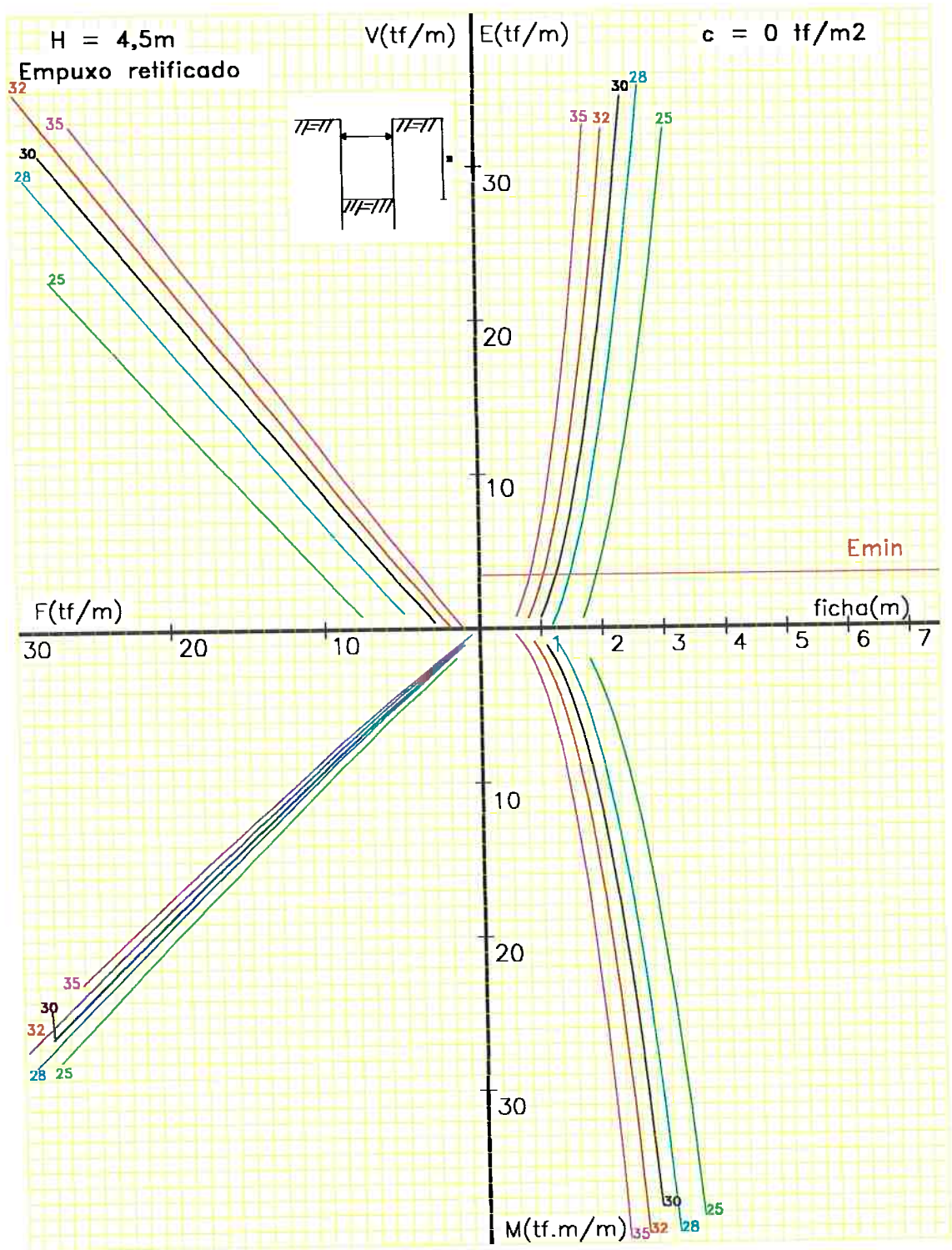


Fig. I.79- Ábaco tipo ES1

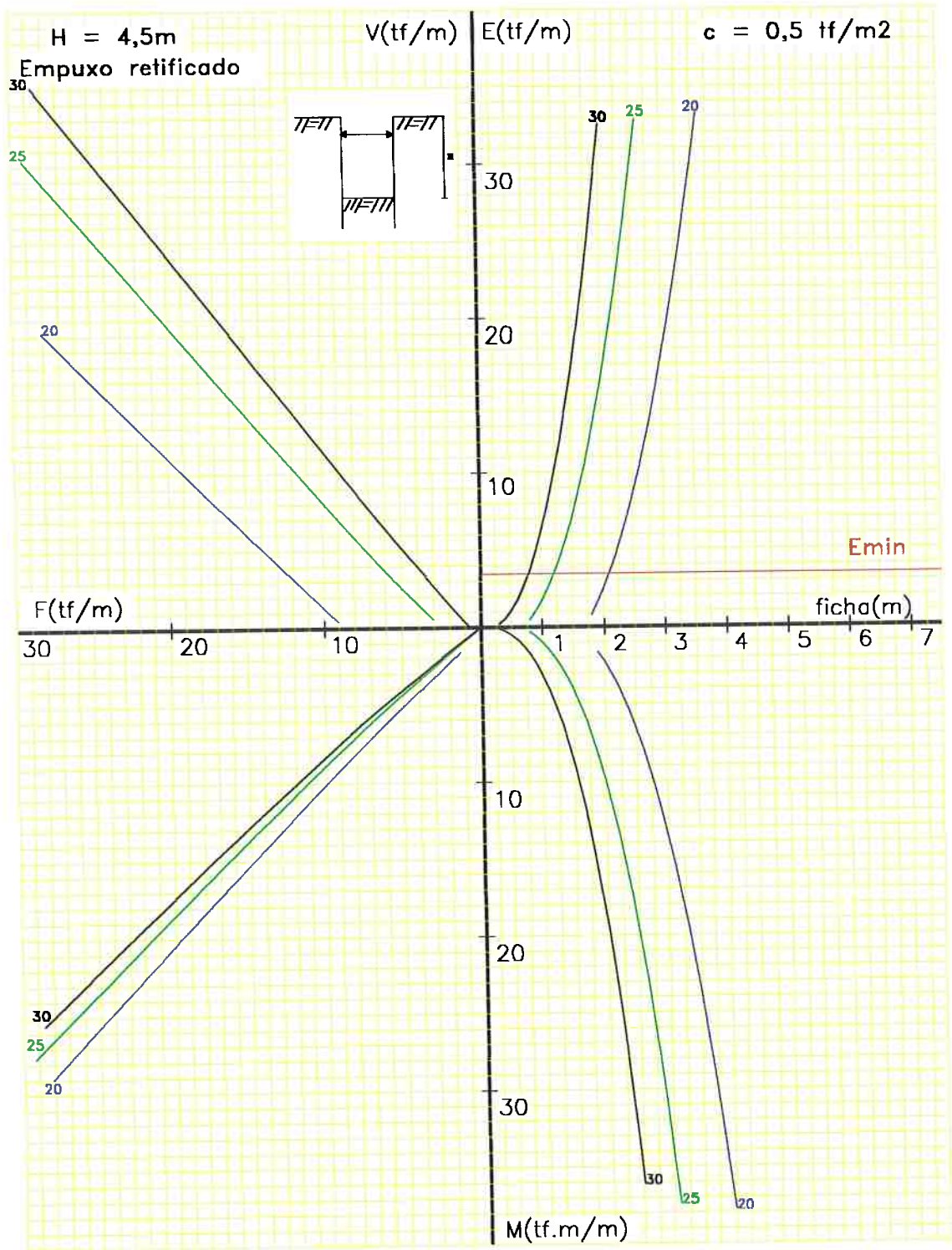


Fig. I.80- Ábaco tipo ES1

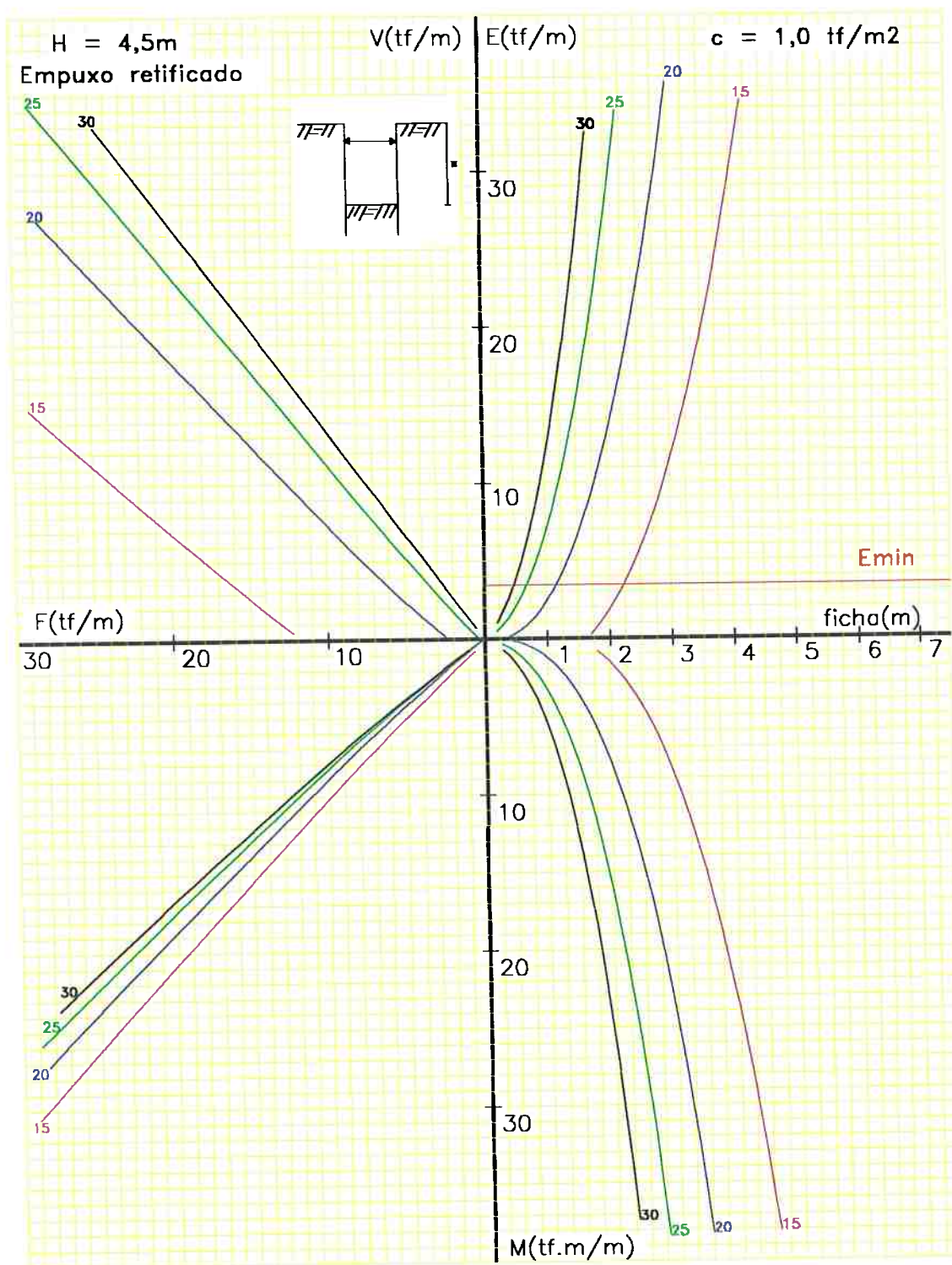


Fig. I.81- Ábaco tipo ES1

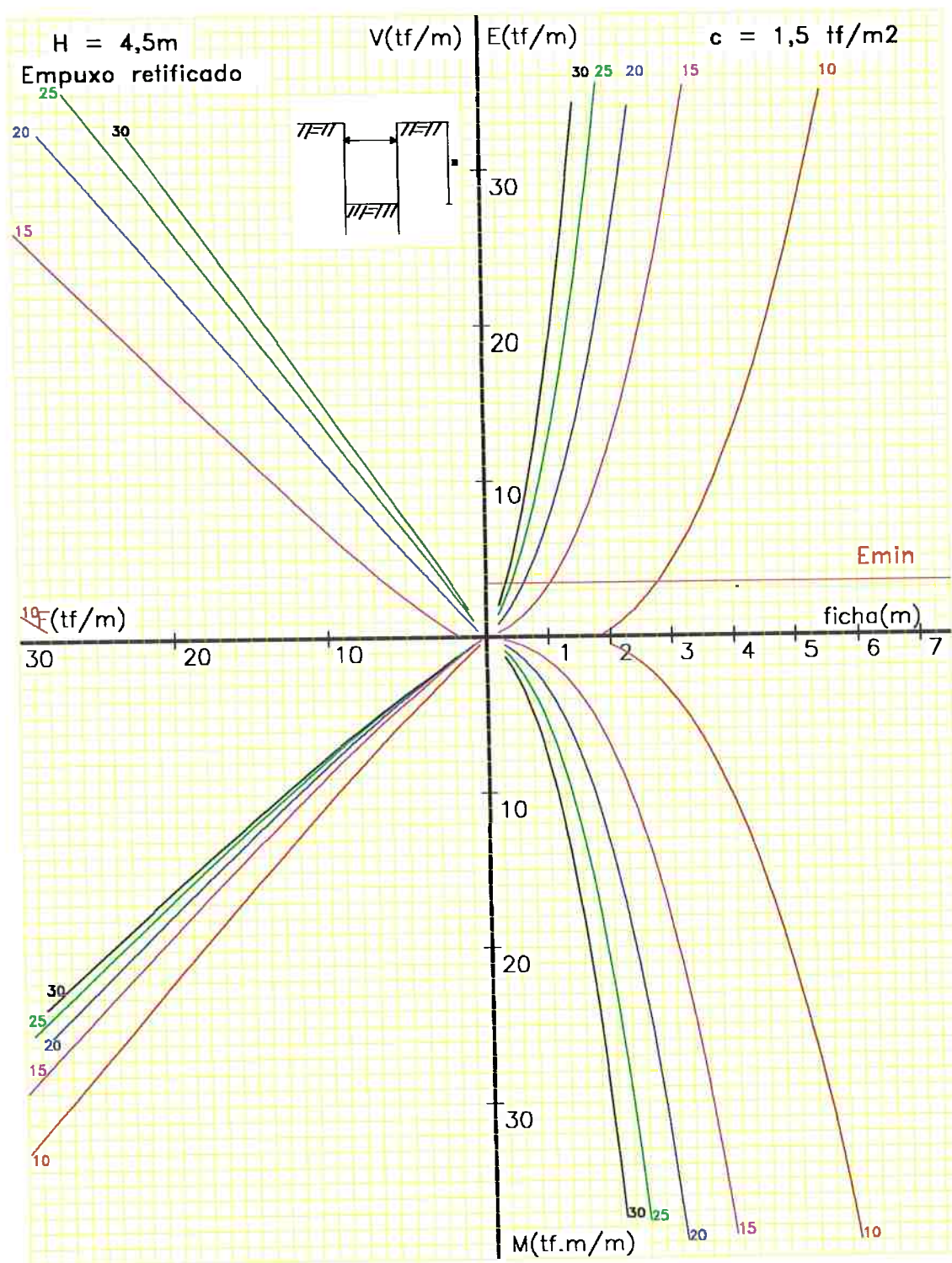


Fig. I.82- Ábaco tipo ES1

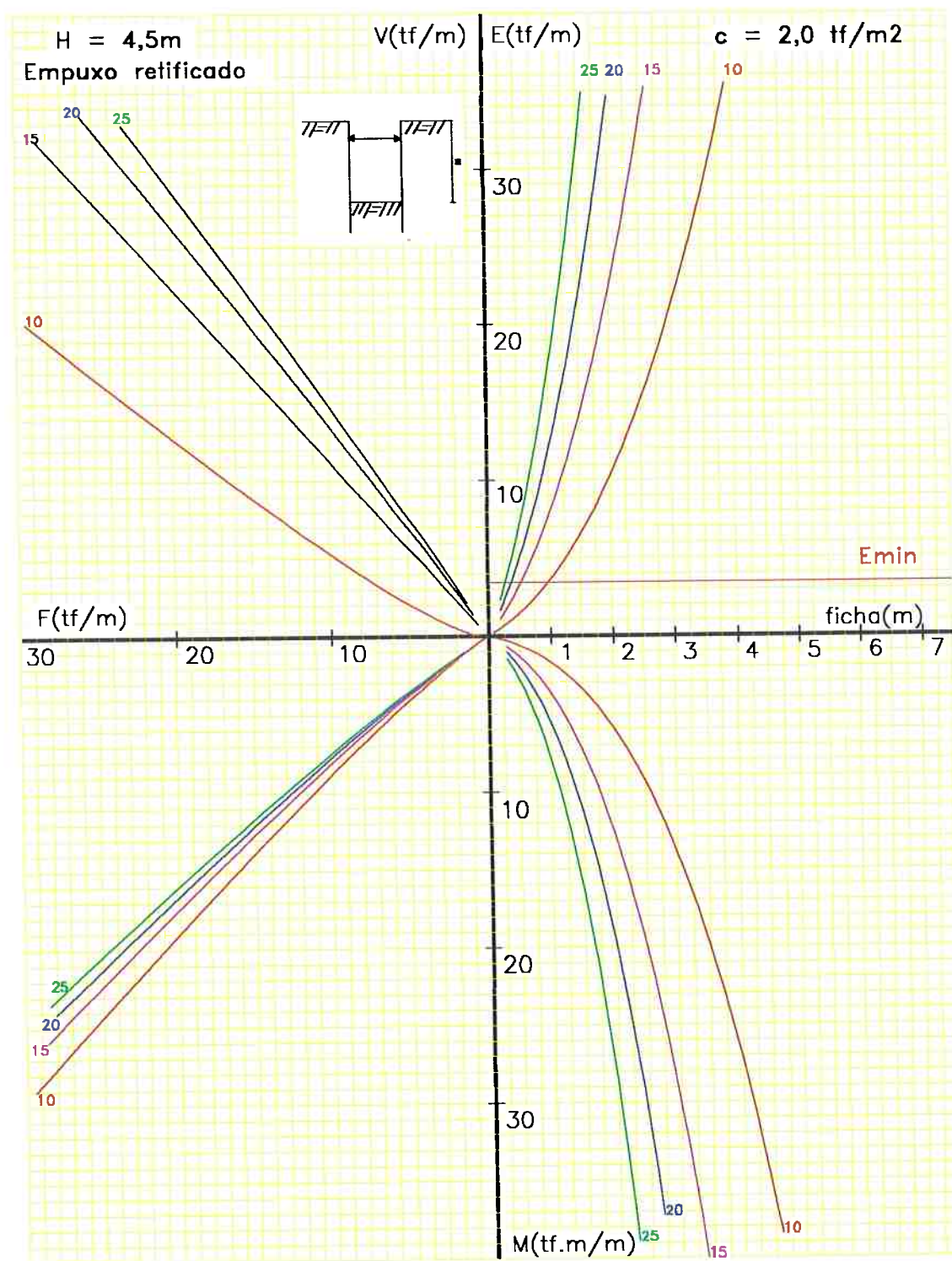


Fig. I.83- Ábaco tipo ES1

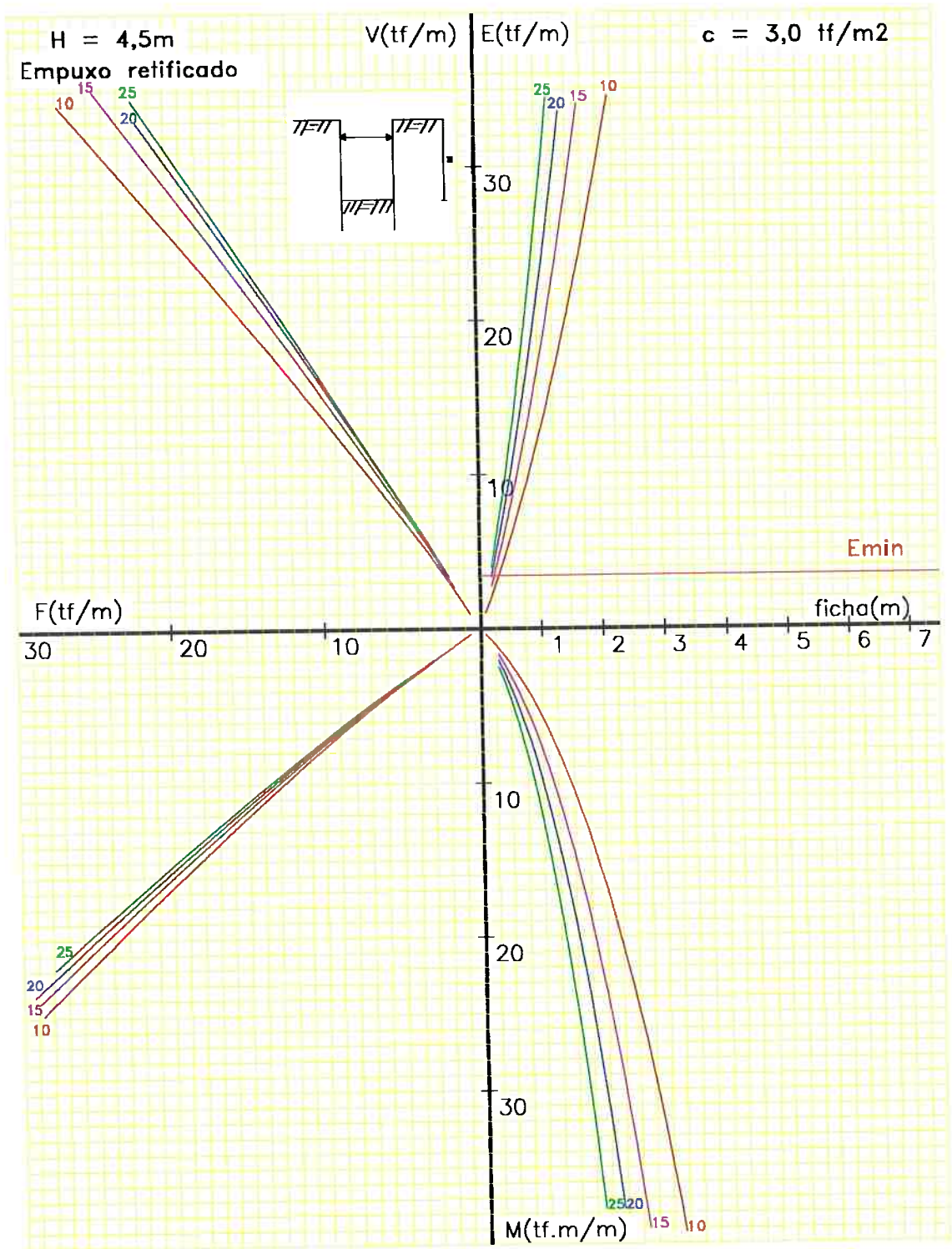


Fig. I.84- Ábaco tipo ES1

H = 5,5 m

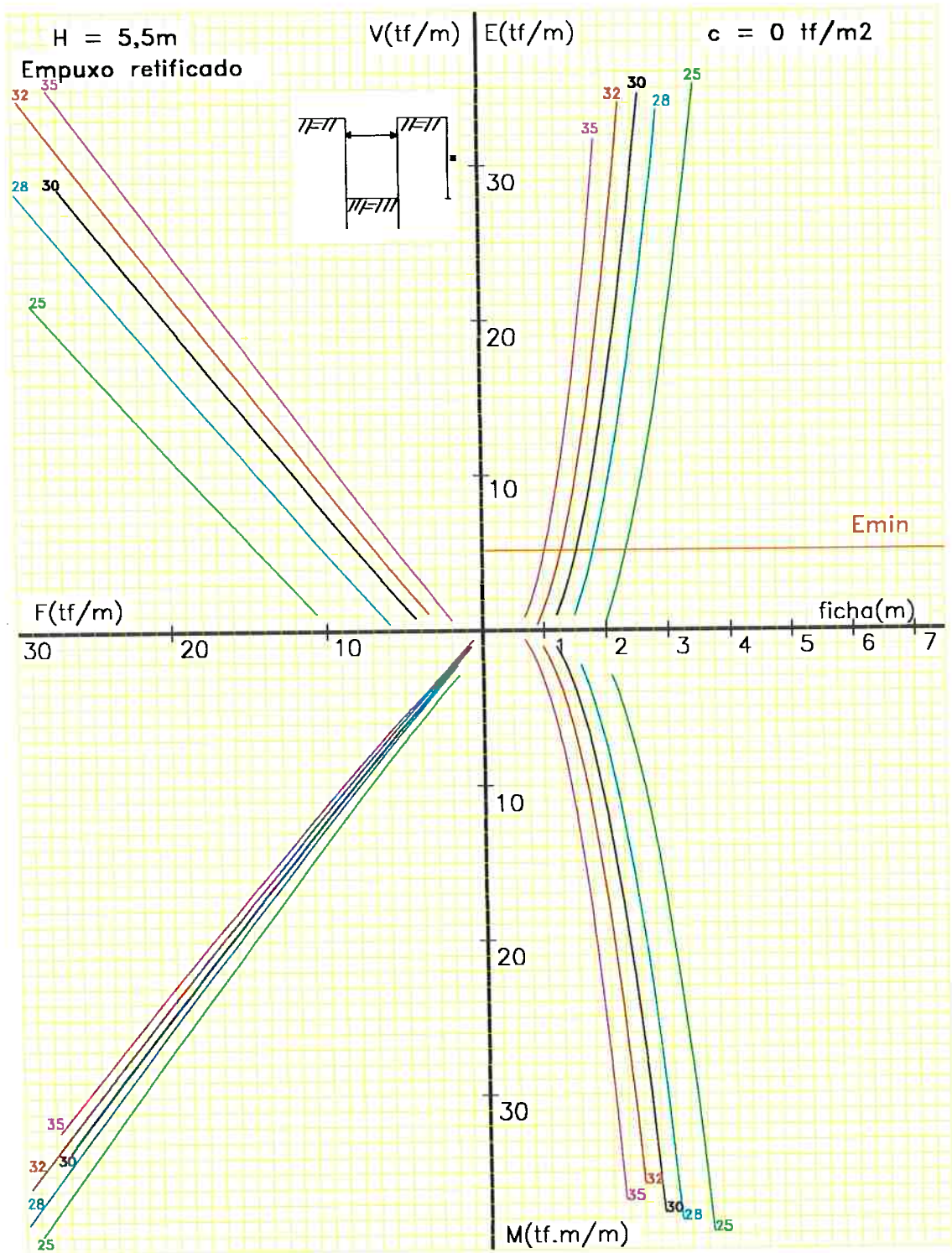


Fig. I.85- Ábaco tipo ES1

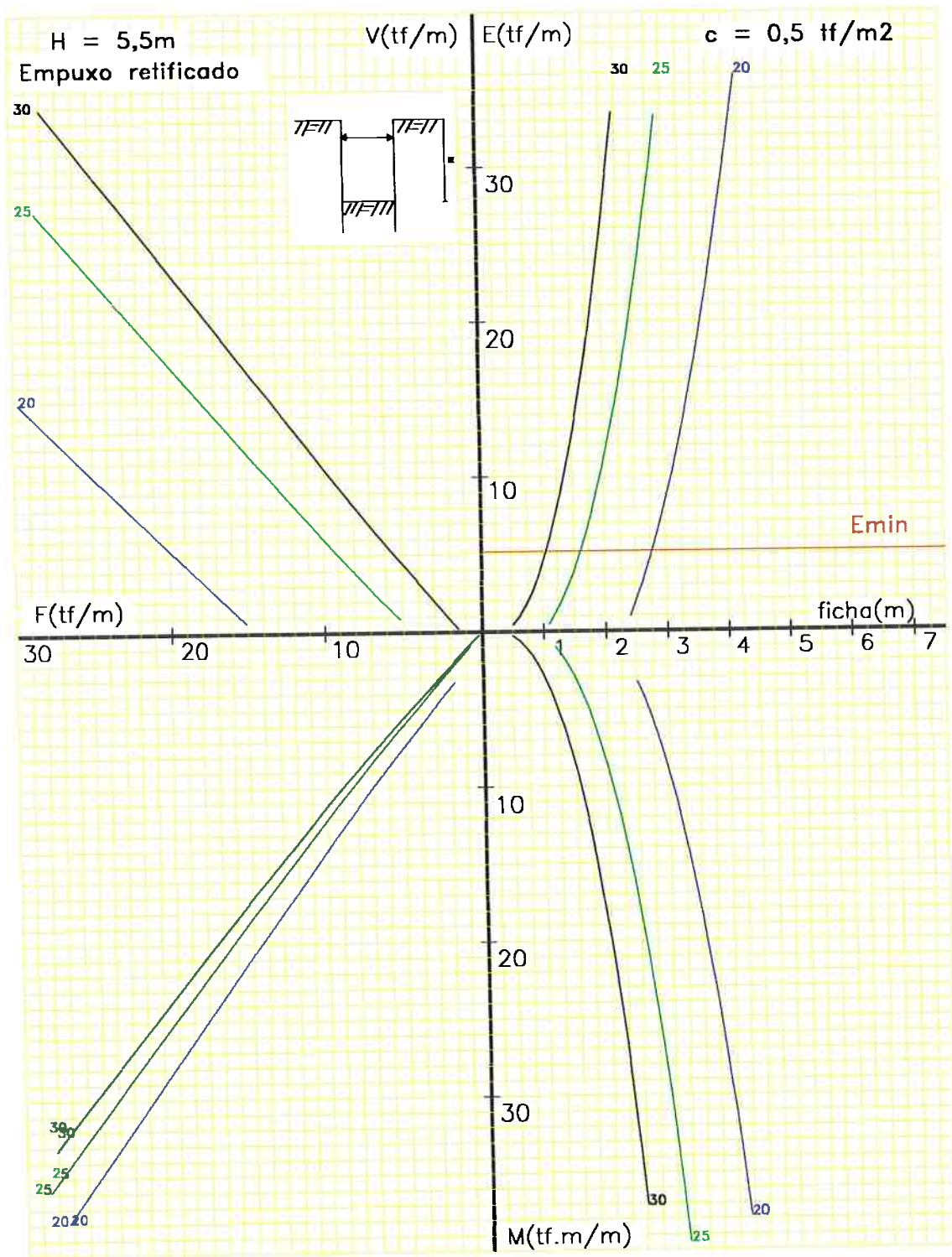


Fig. I.86- Ábaco tipo ES1

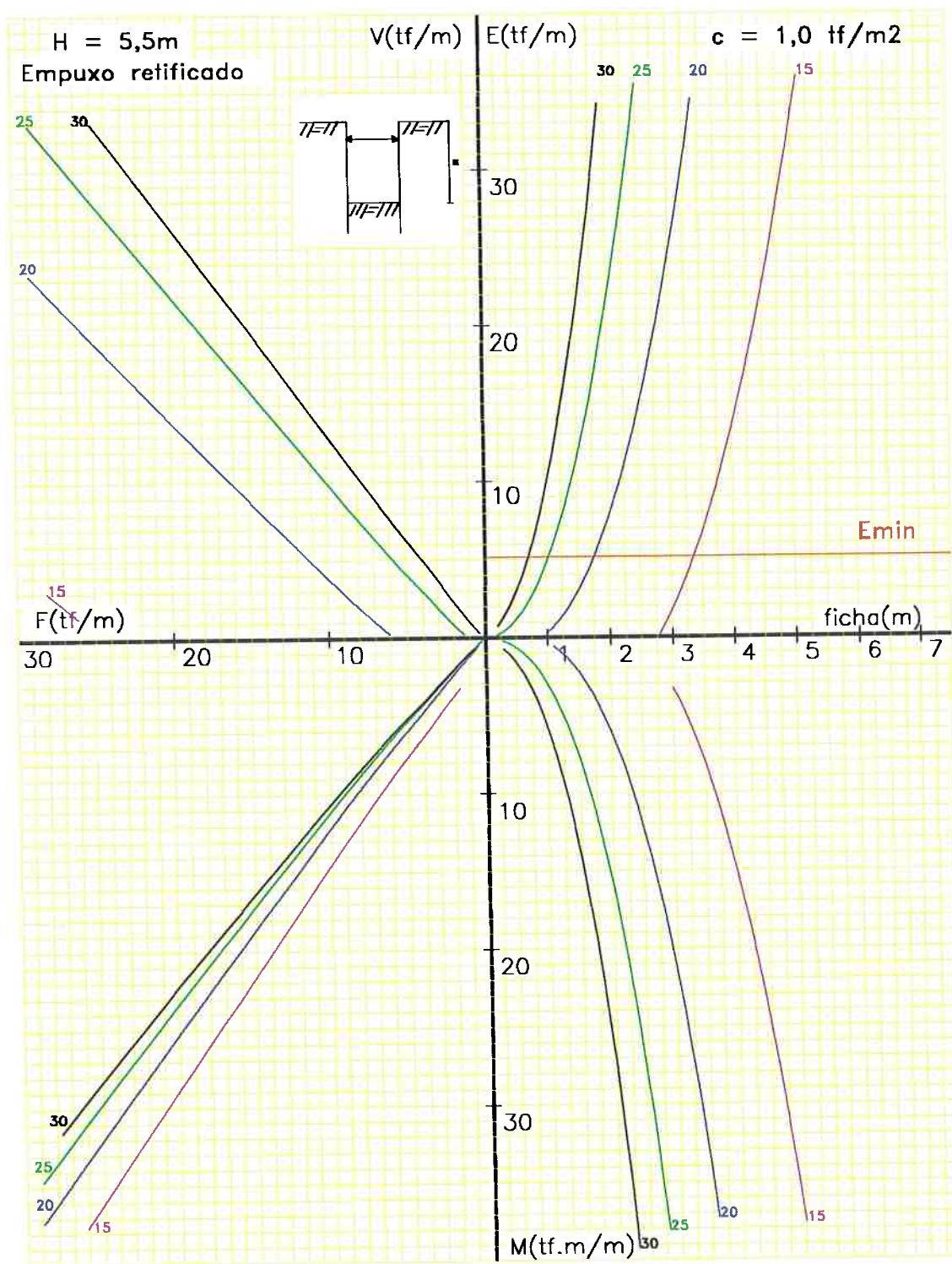


Fig. I.87- Ábaco tipo ES1

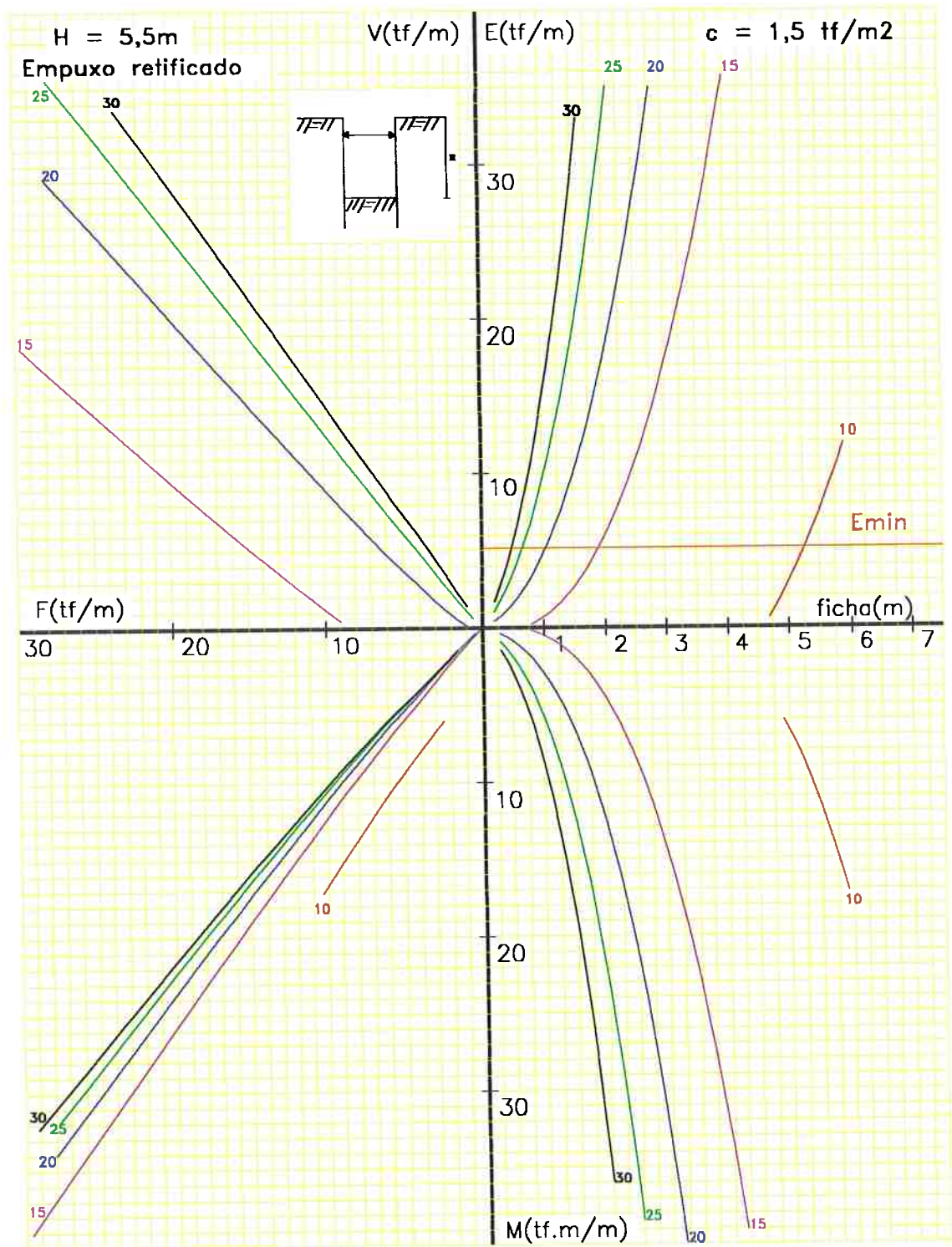


Fig. I.88- Ábaco tipo ES1

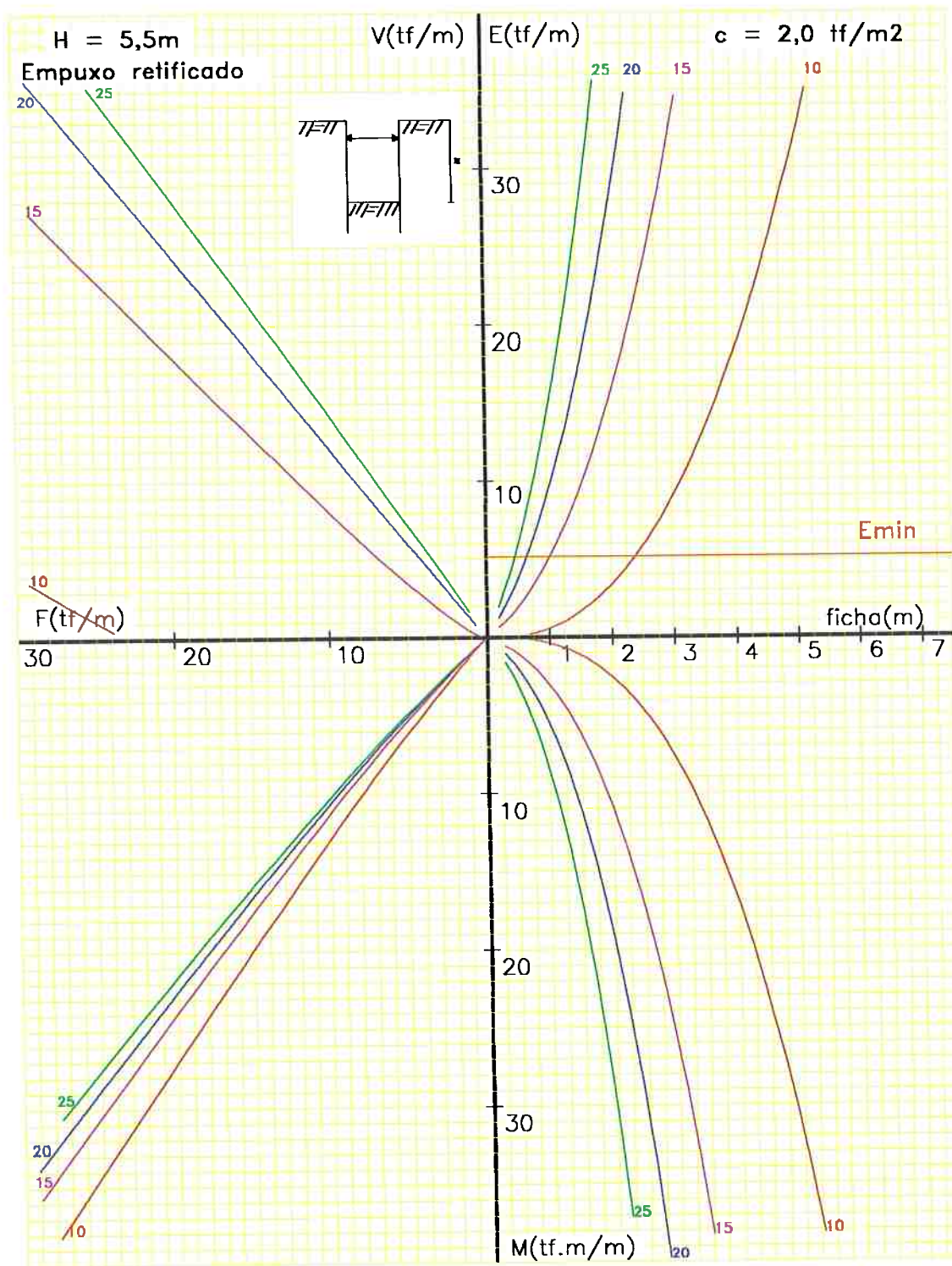


Fig. I.89- Ábaco tipo ES1

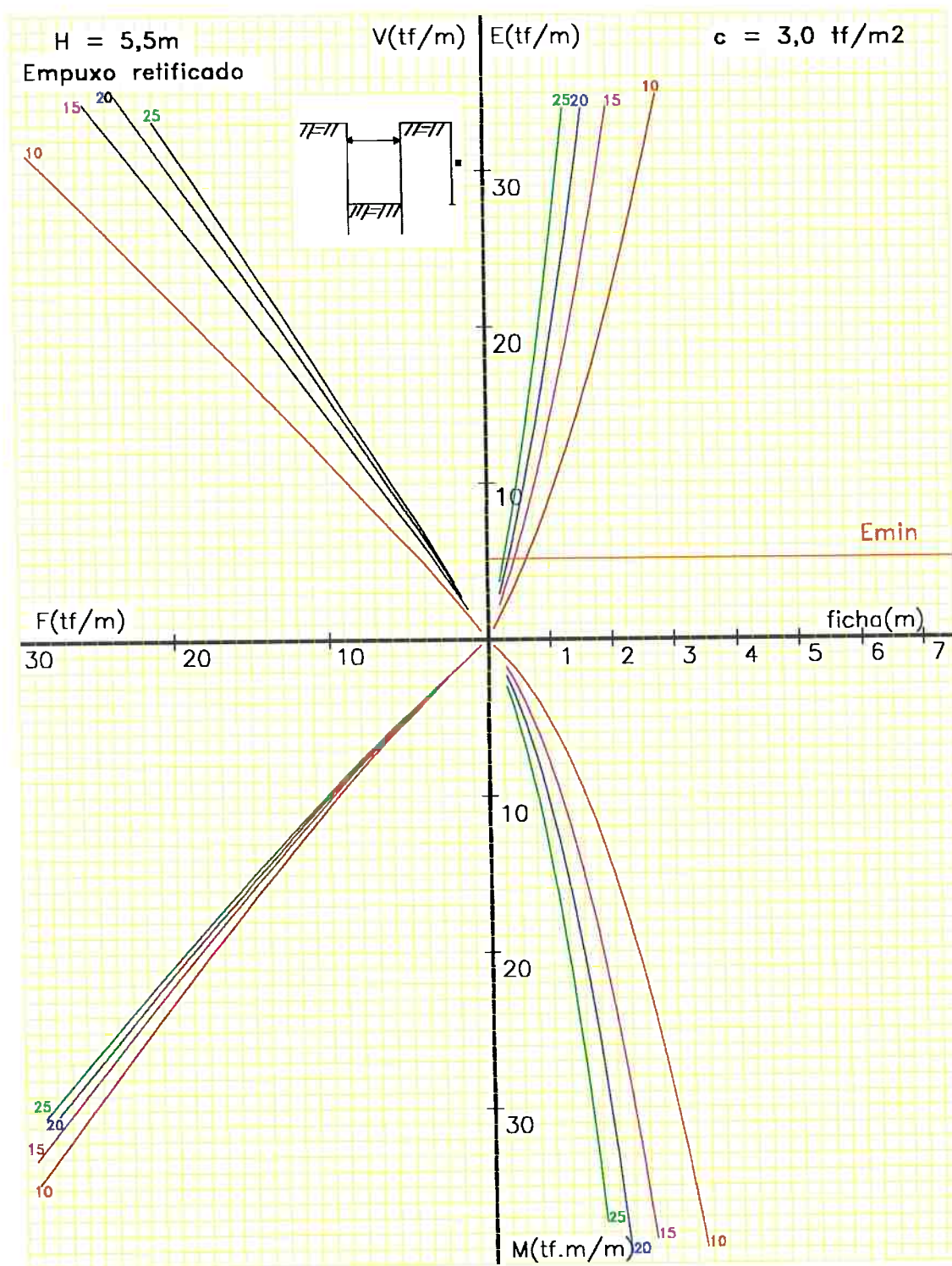


Fig. I.90- Ábaco tipo ES1

H = 6,5 m

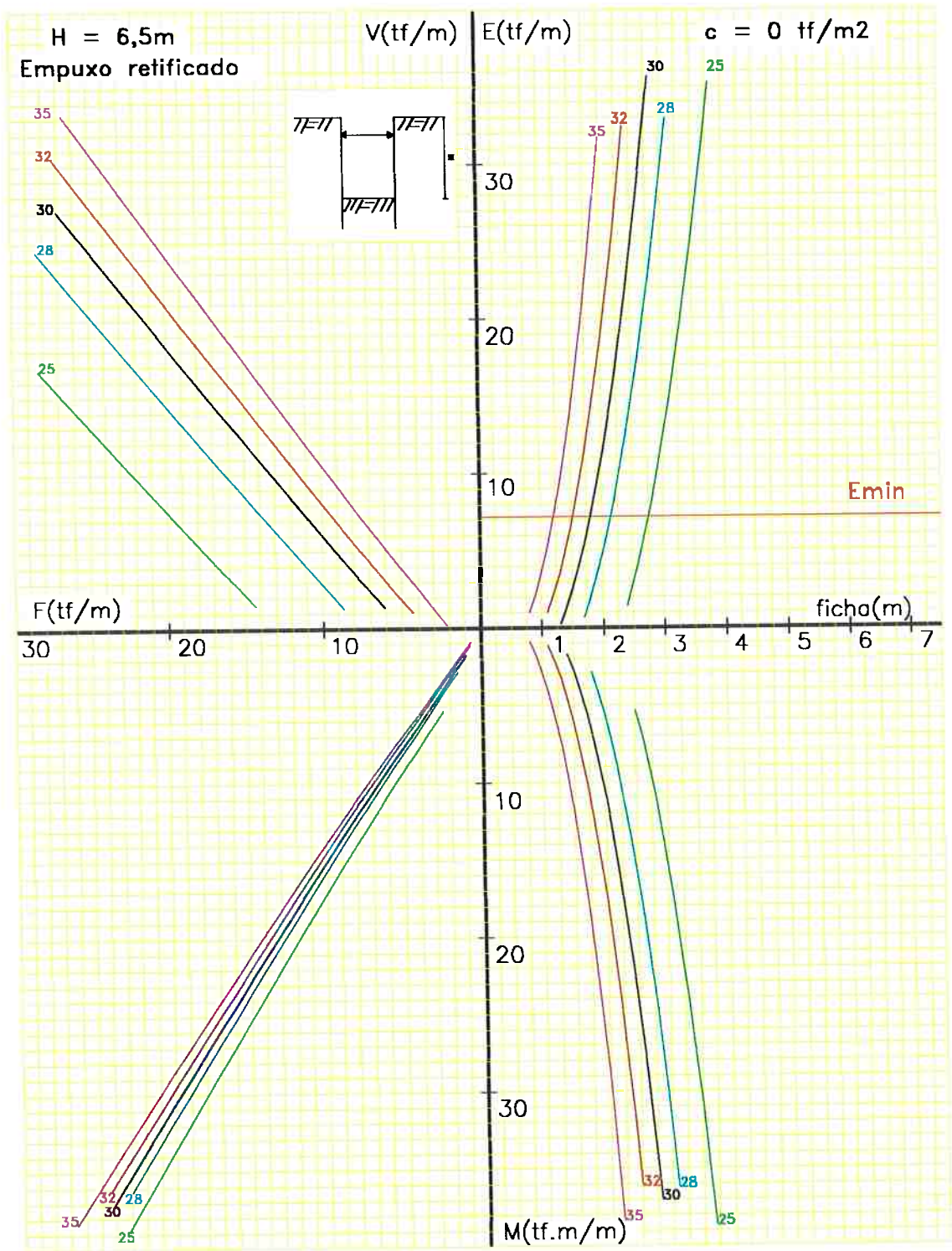


Fig. I.91- Ábaco tipo ES1

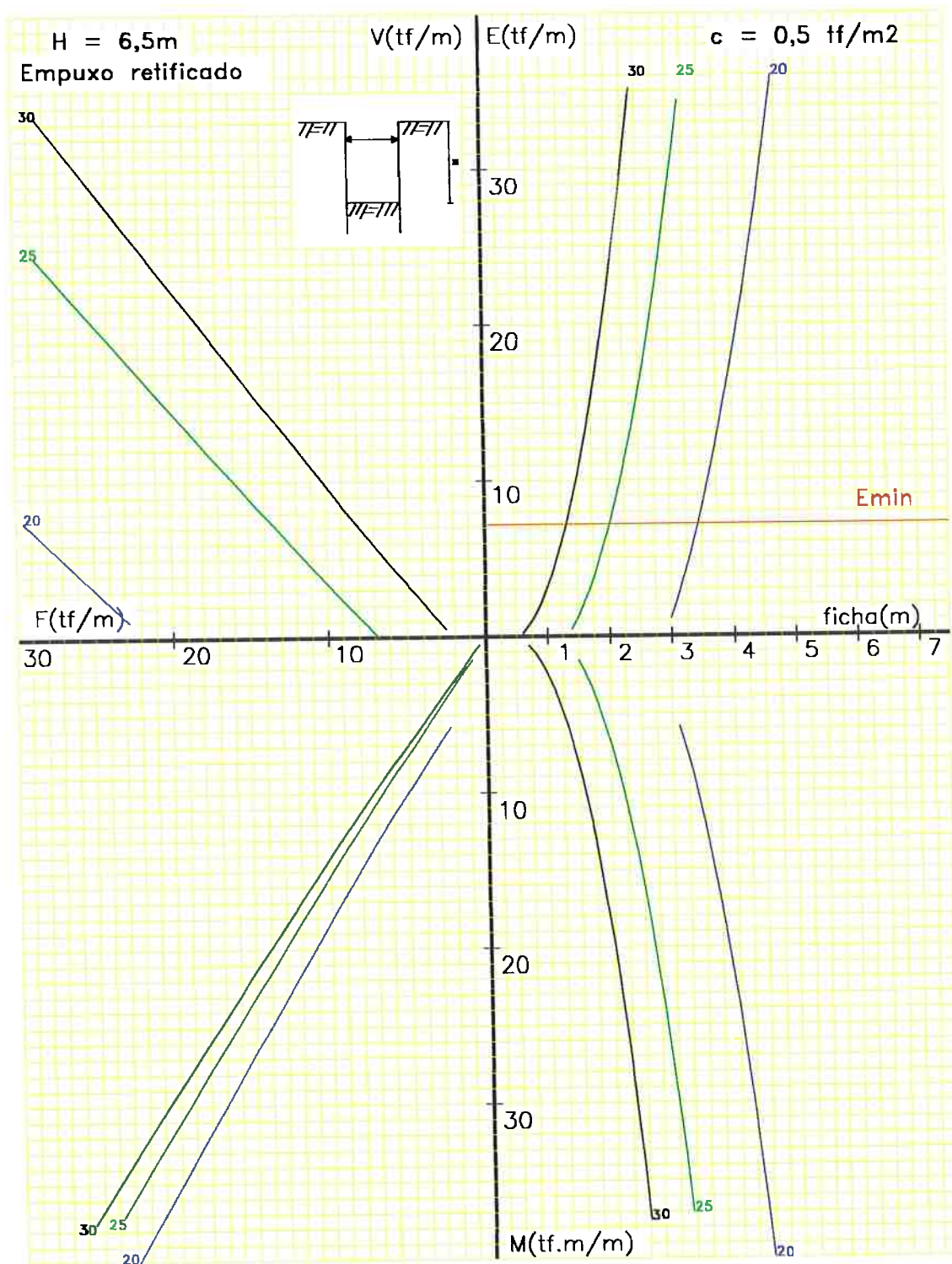


Fig. I.92- Ábaco tipo ES1

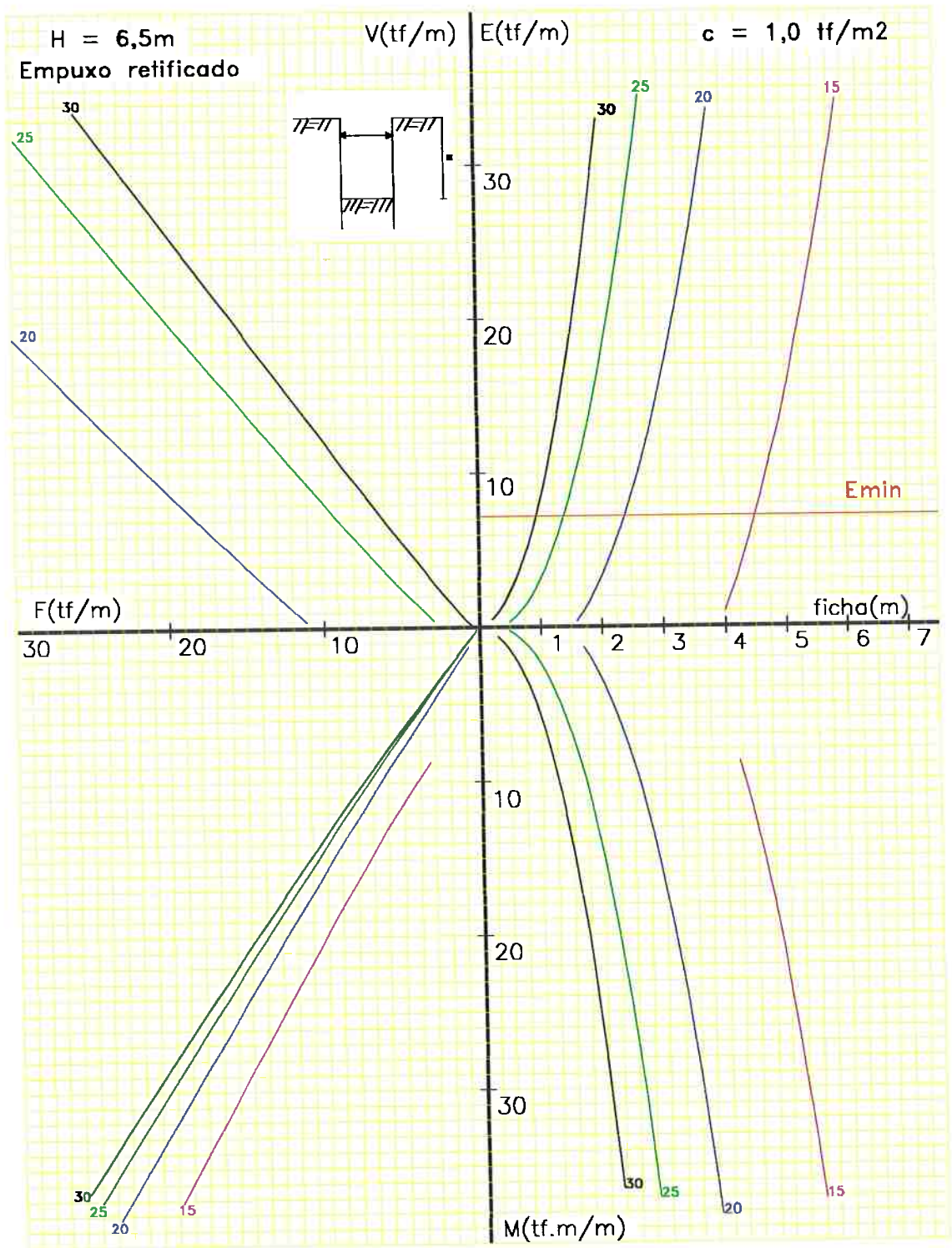


Fig. I.93- Ábaco tipo ES1

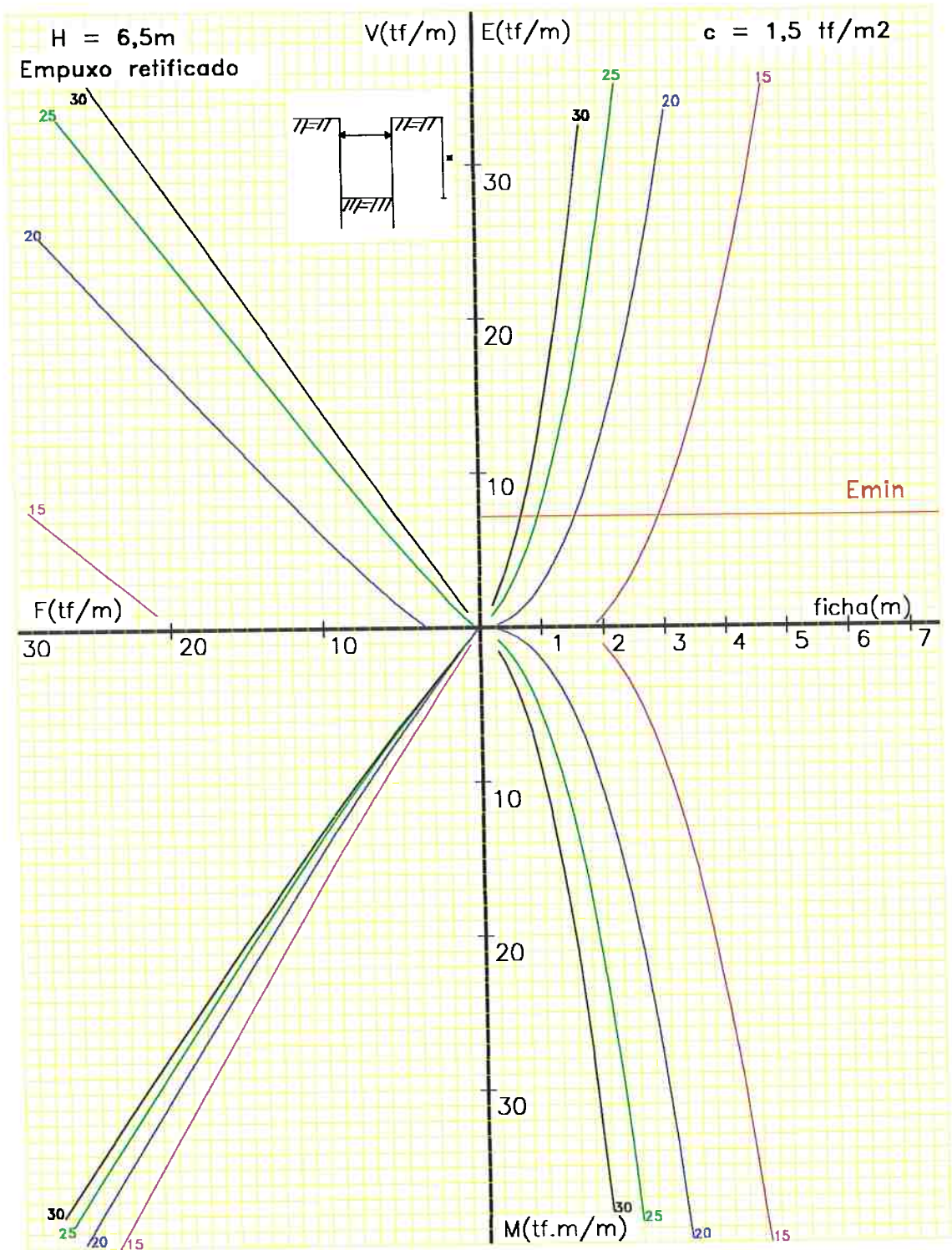


Fig. I.94- Ábaco tipo ES1

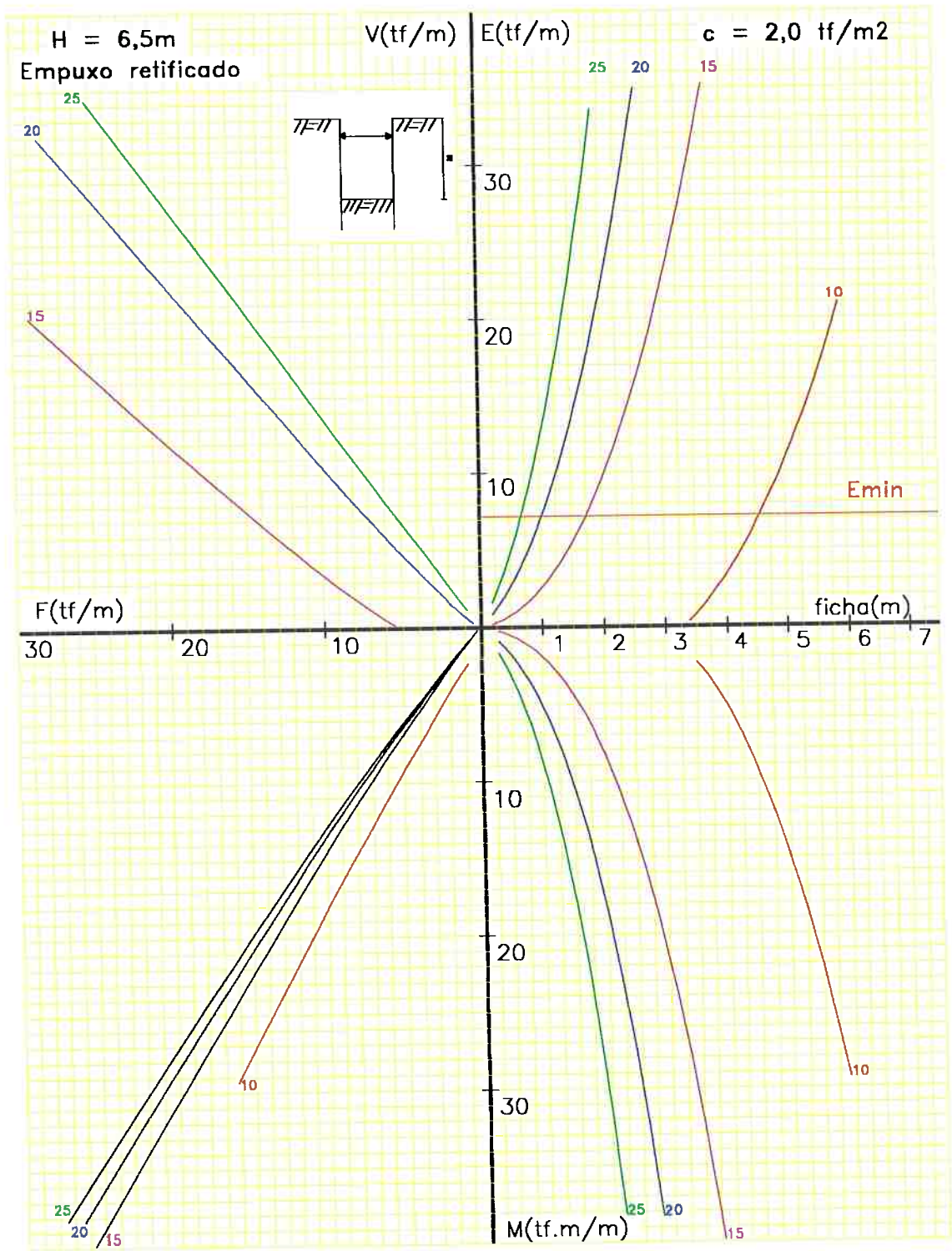


Fig. I.95- Ábaco tipo ES1

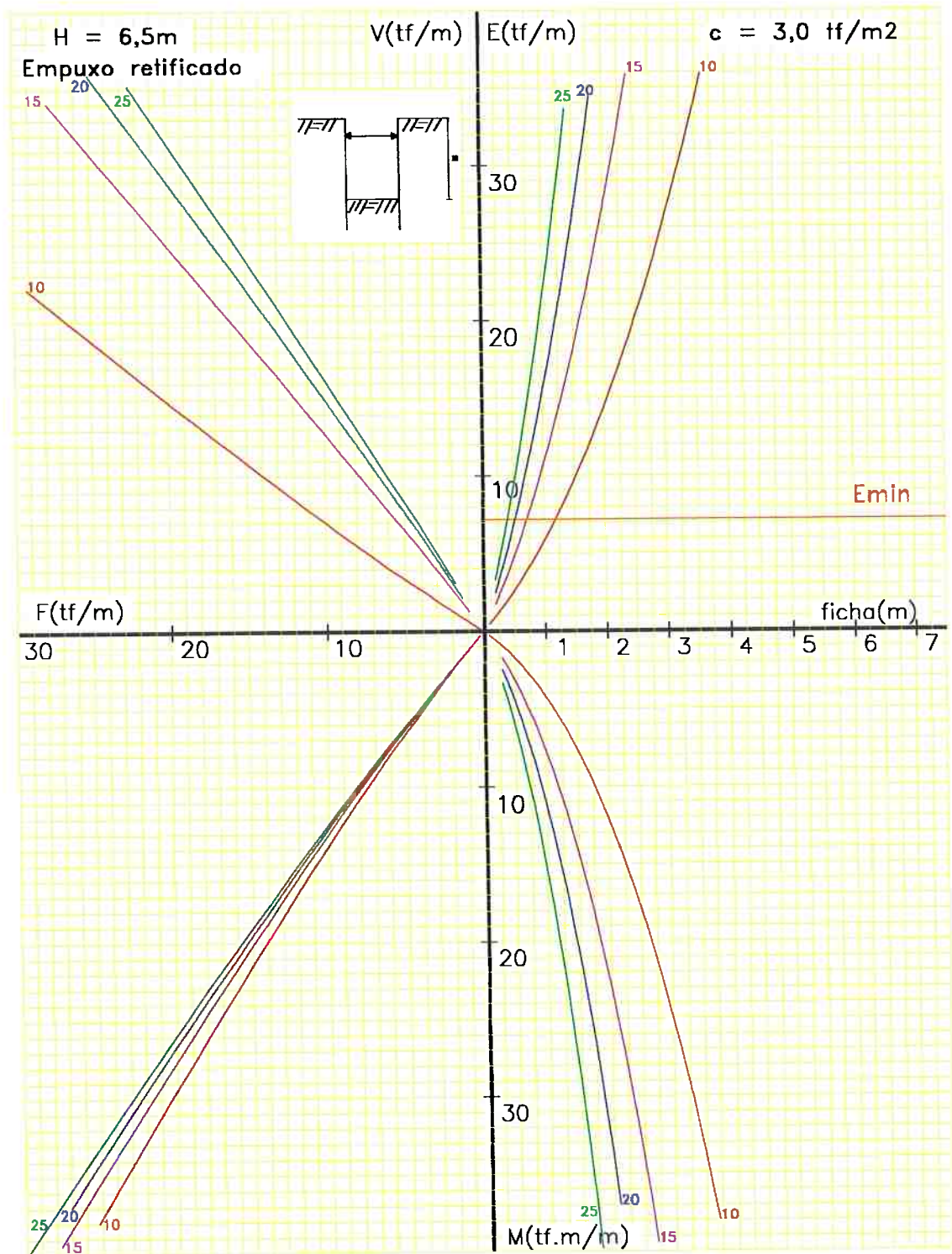


Fig. I.96- Ábaco tipo ES1

EMPUXO TRIANGULAR

**NÍVEL DE ÁGUA
NA SUPERFÍCIE**

H = 3,5 m

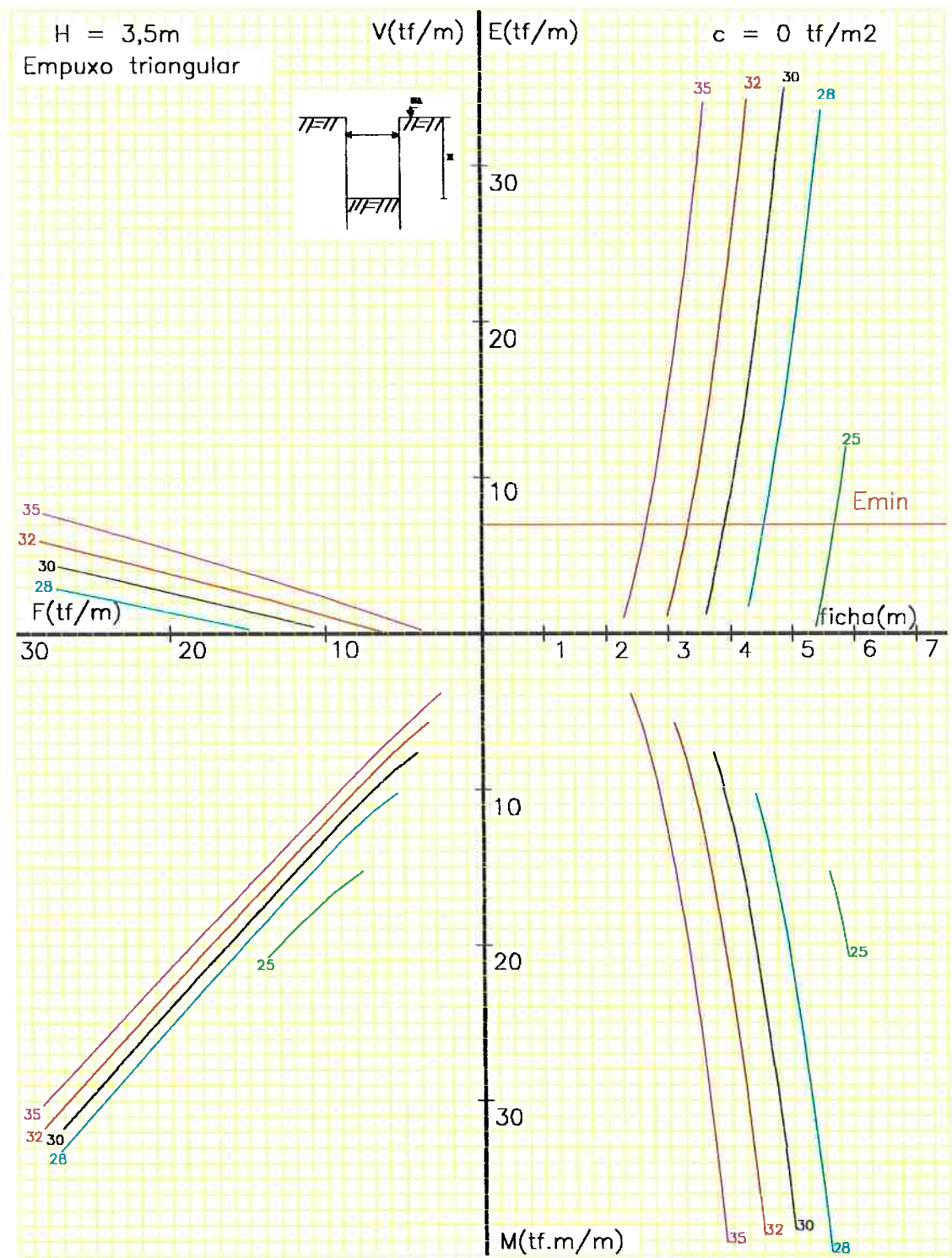


Fig. I.97- Ábaco tipo ES1

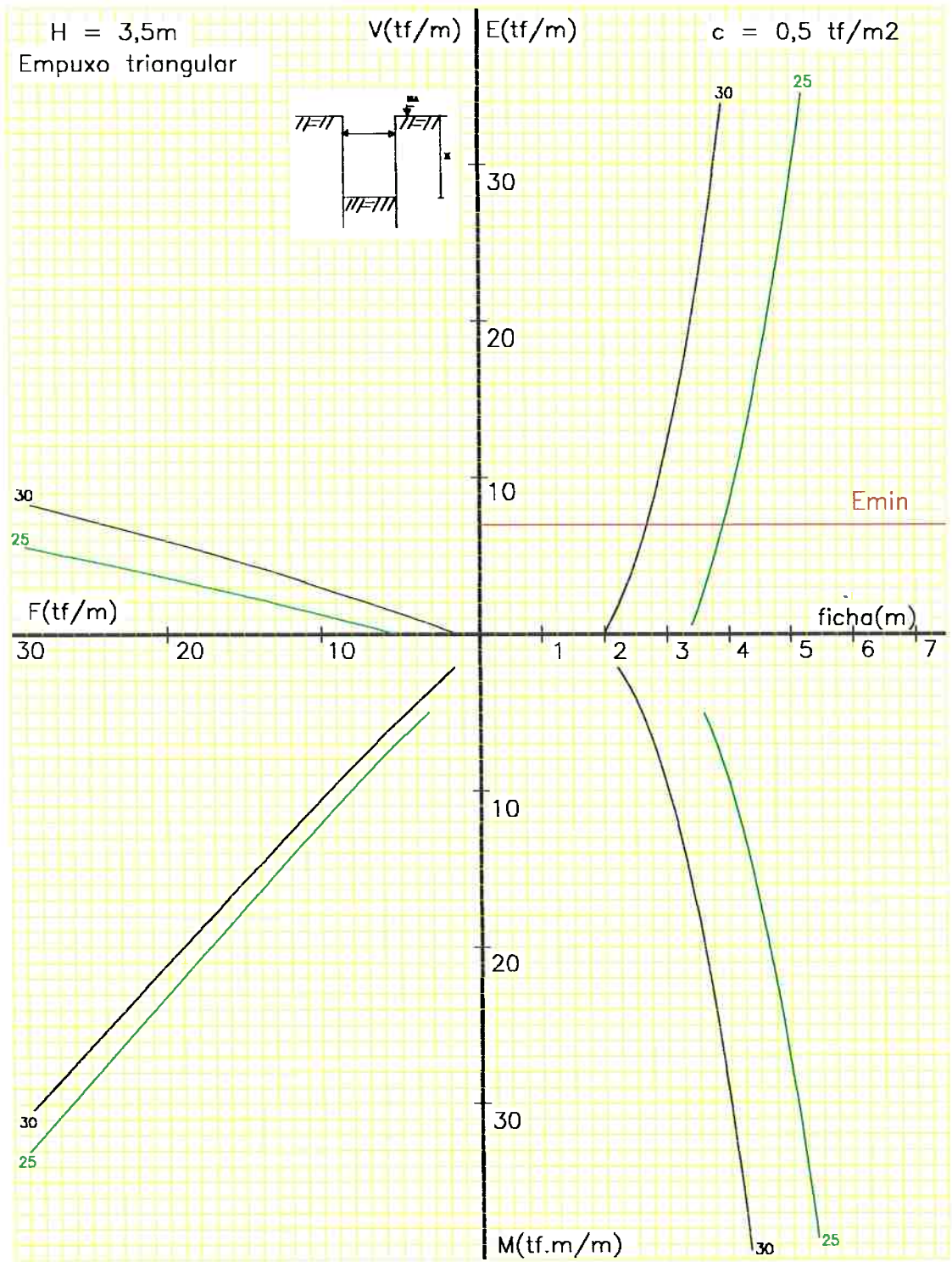


Fig. I.98- Ábaco tipo ES1

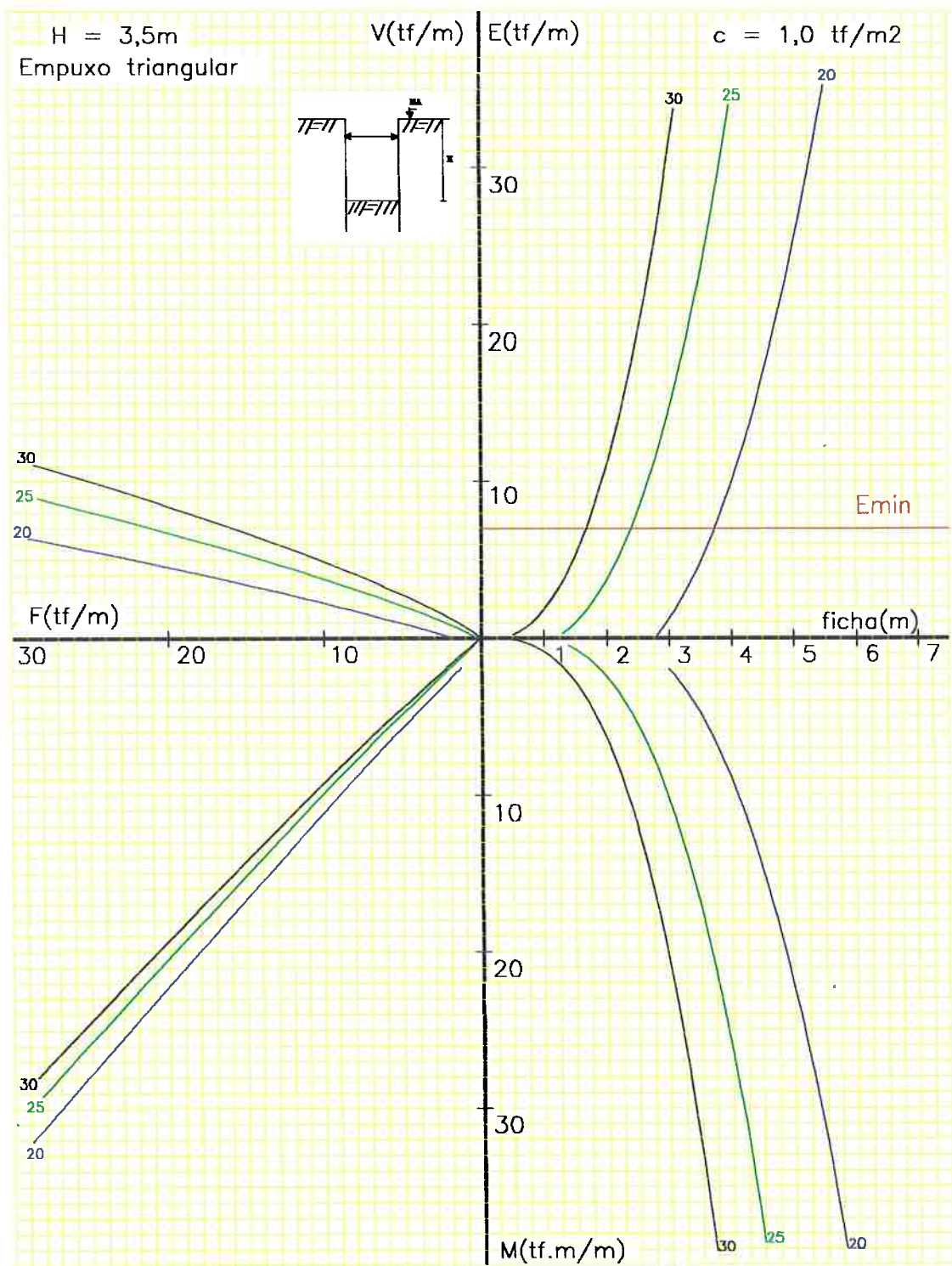


Fig. I.99- Ábaco tipo ES1

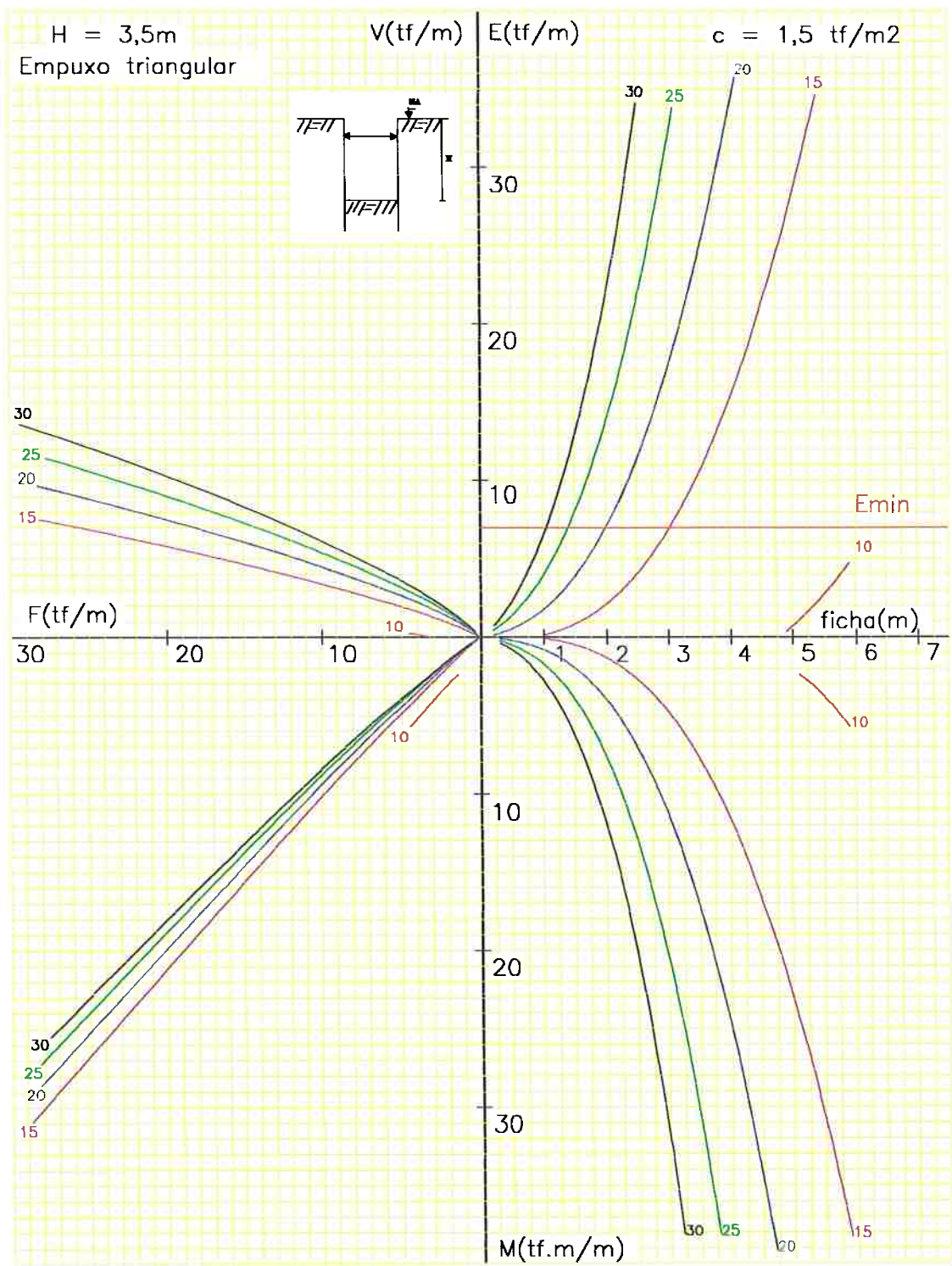


Fig. I.100- Ábaco tipo ES1

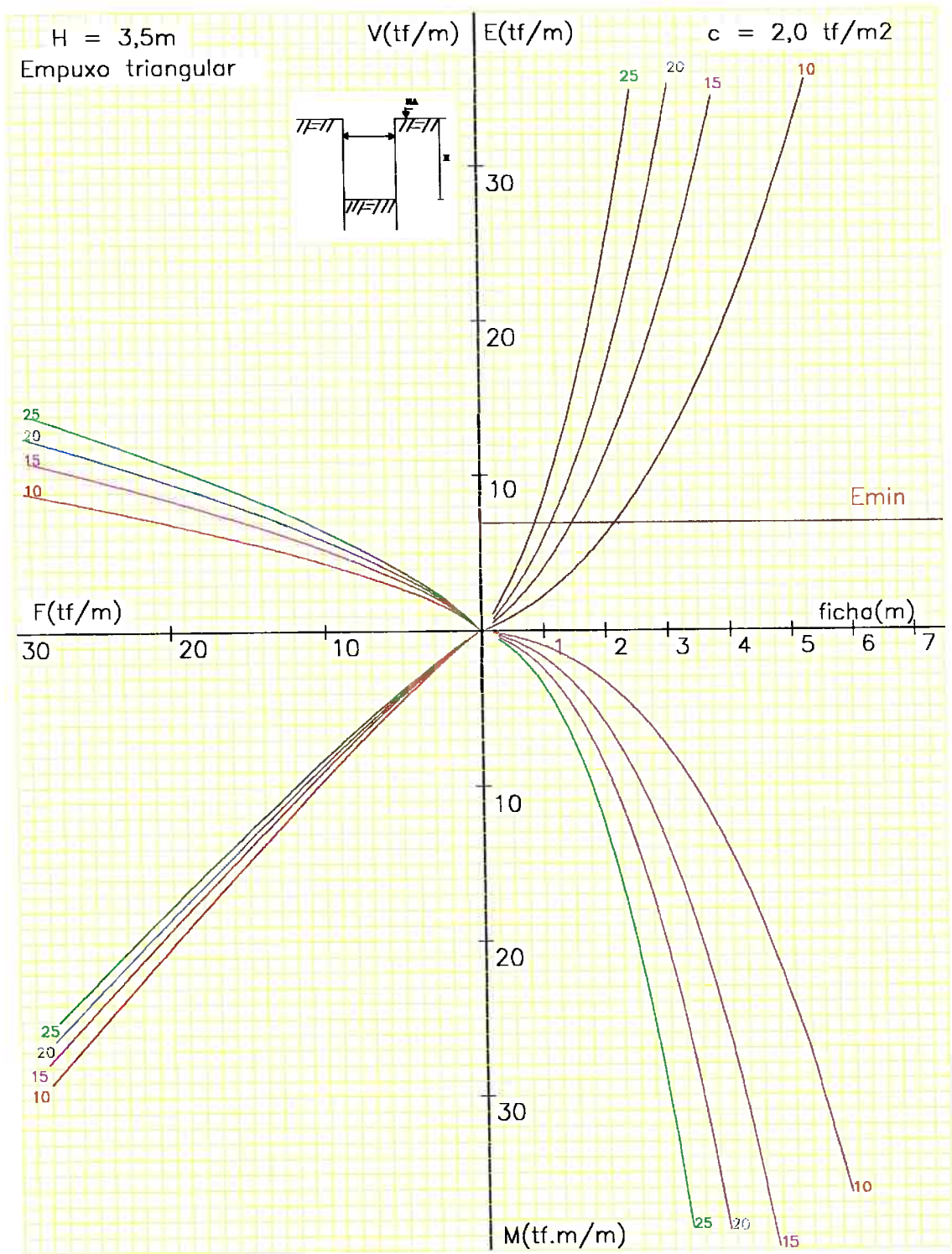


Fig. I.101- Ábaco tipo ES1

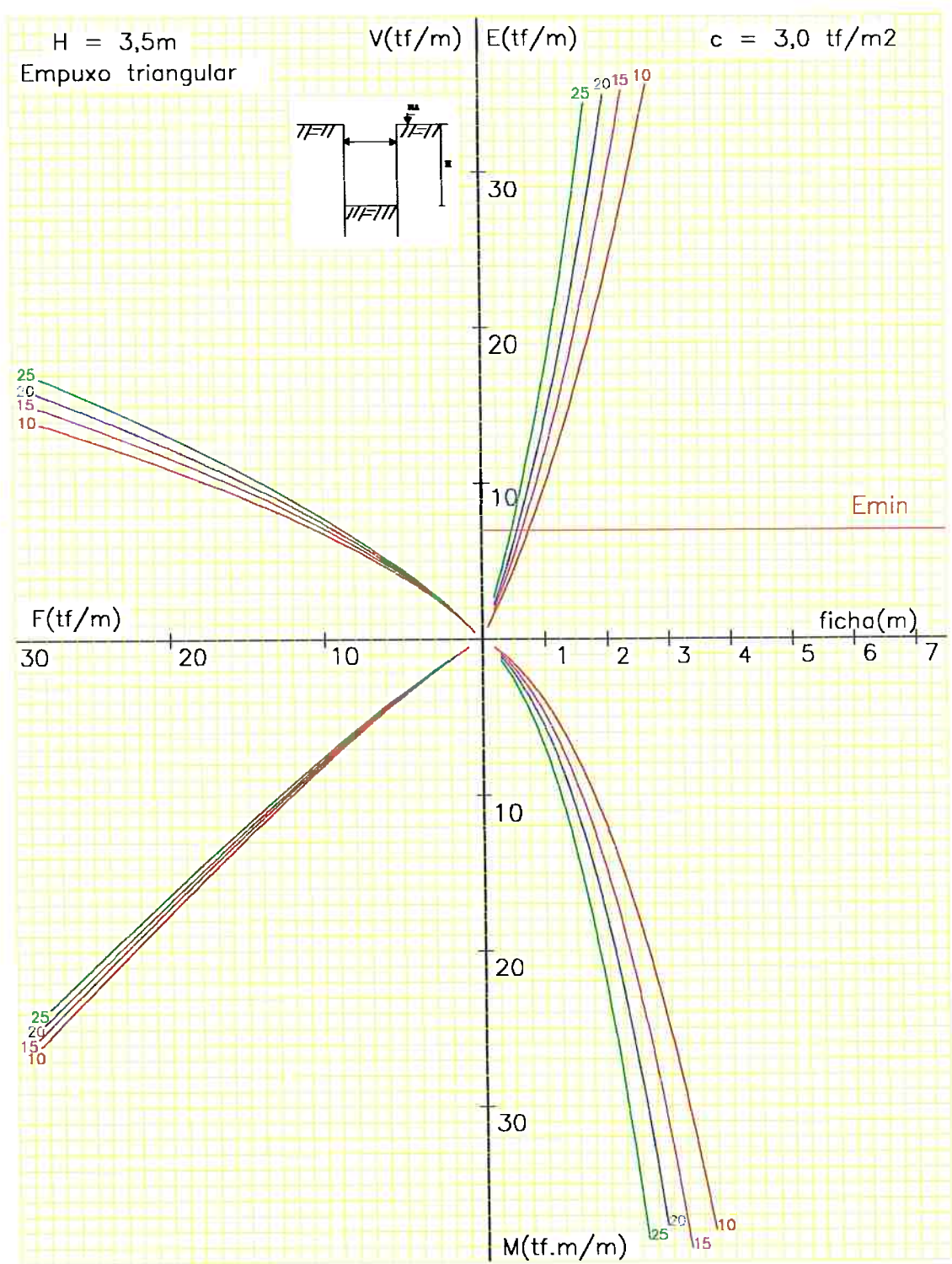


Fig. I.102- Ábaco tipo ES1

H = 4,5 m

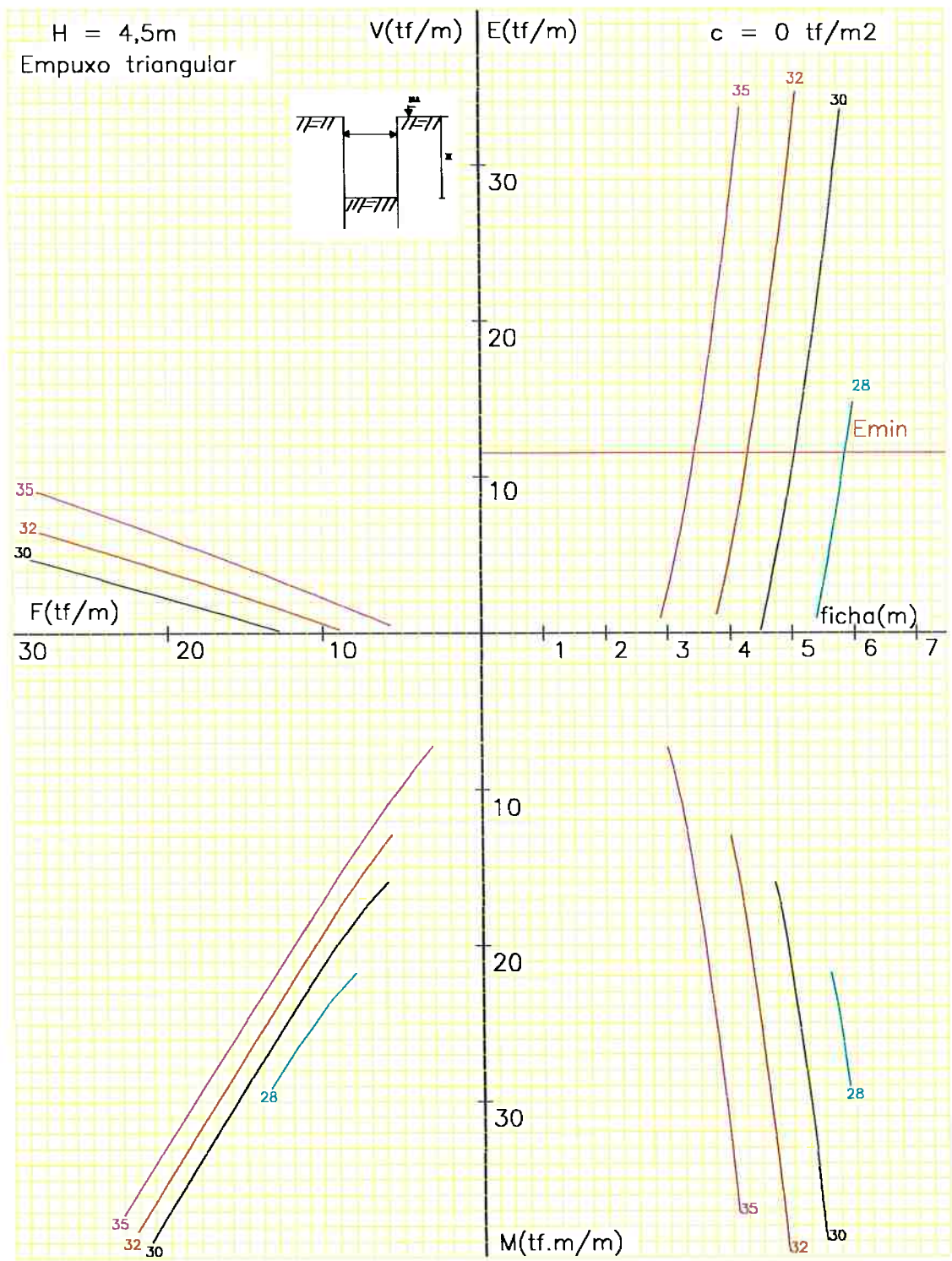


Fig. I.103- Ábaco tipo ES1

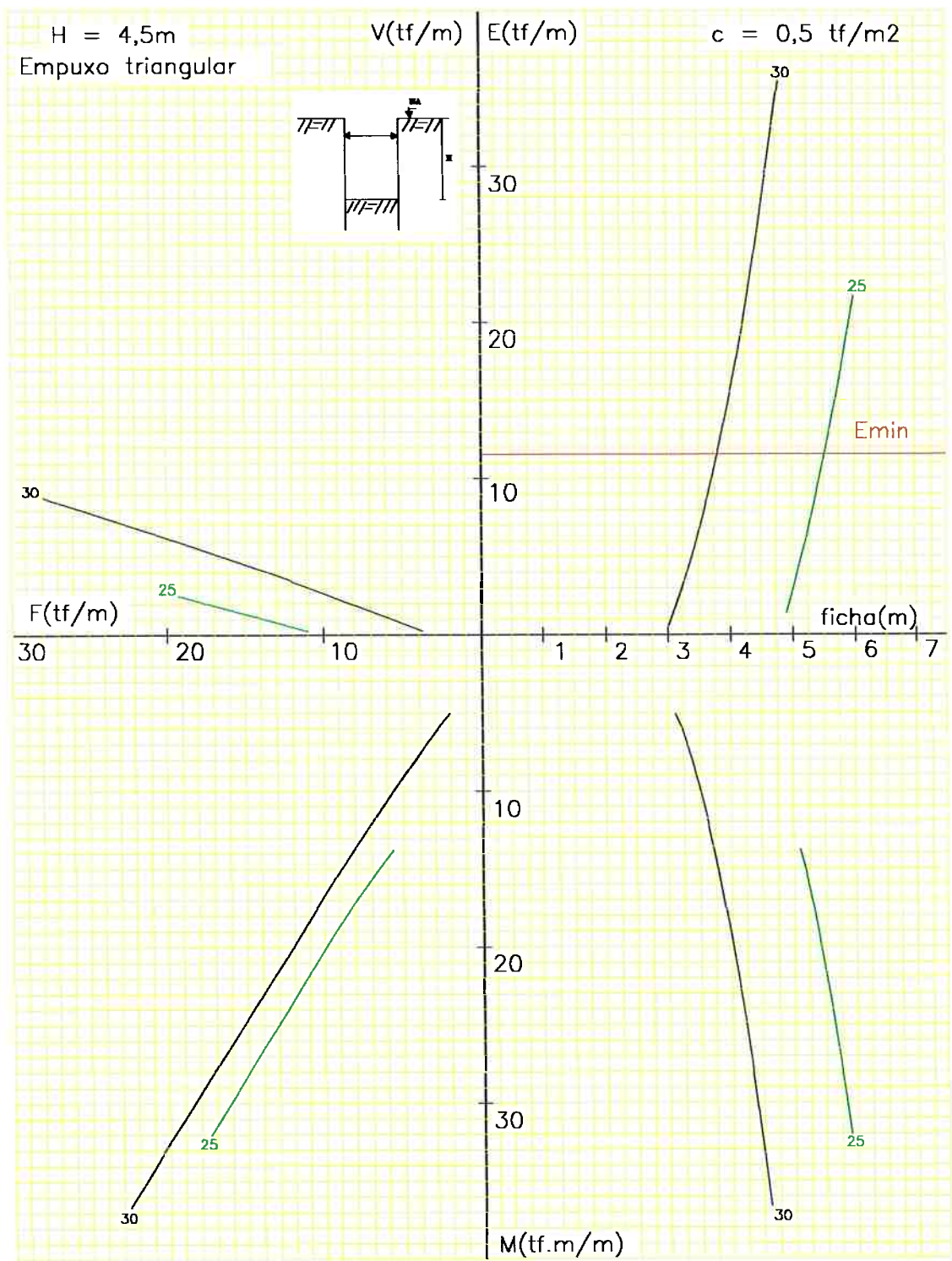


Fig. I.104- Ábaco tipo ES1

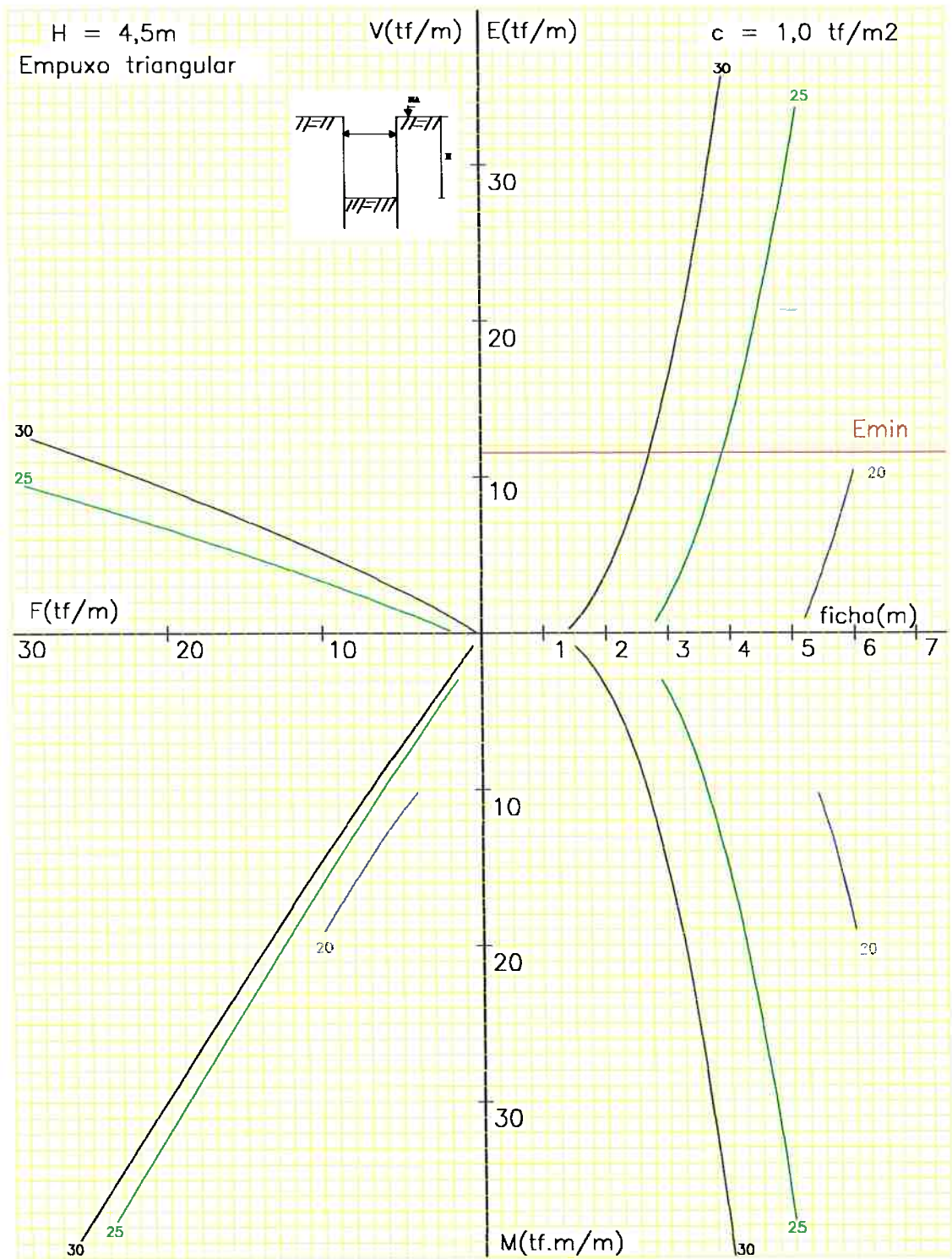


Fig. I.105- Ábaco tipo ES1

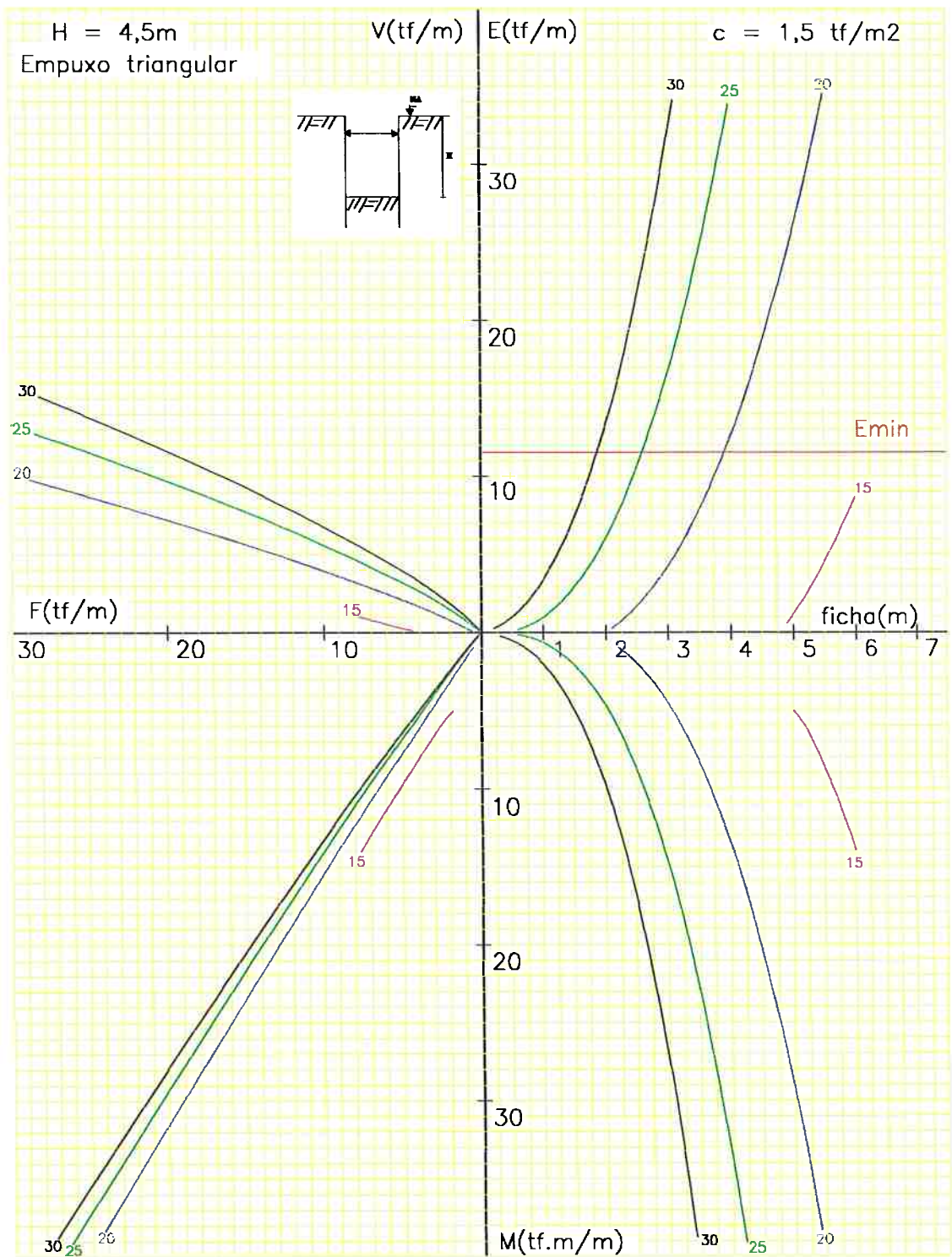


Fig. I.106- Ábaco tipo ES1

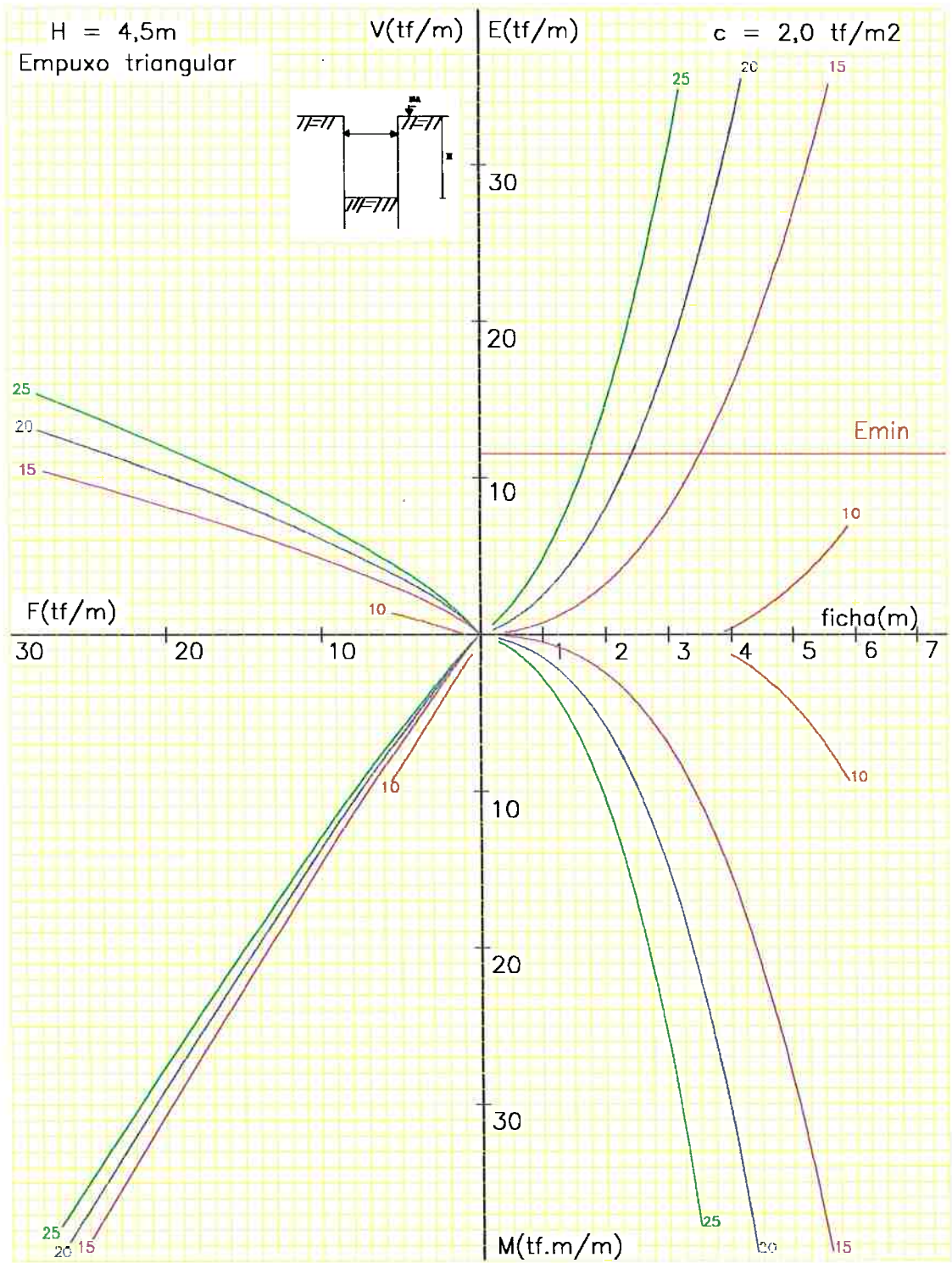


Fig. I.107- Ábaco tipo ES1

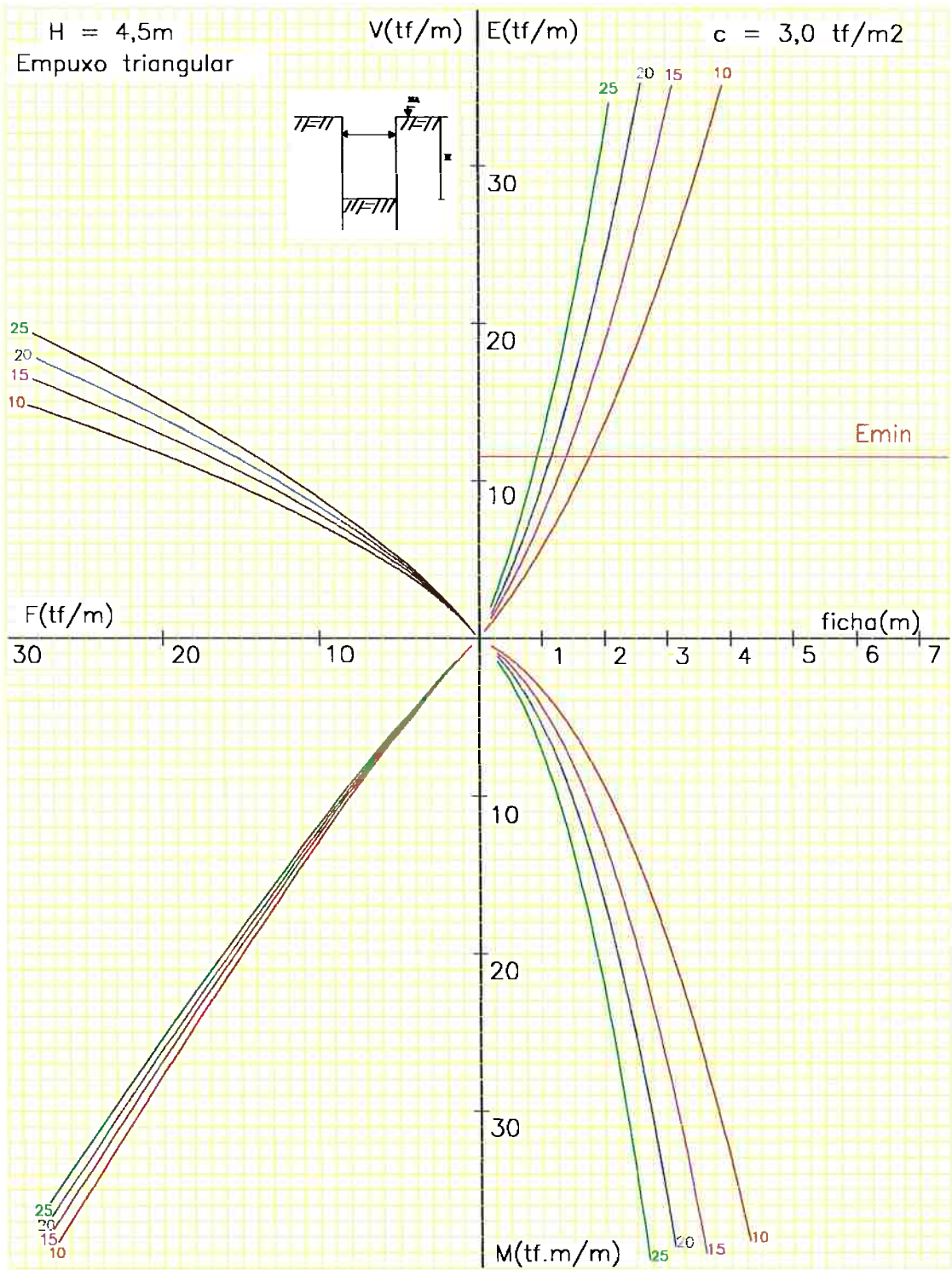


Fig. I.108- Ábaco tipo ES1

H = 5,5 m

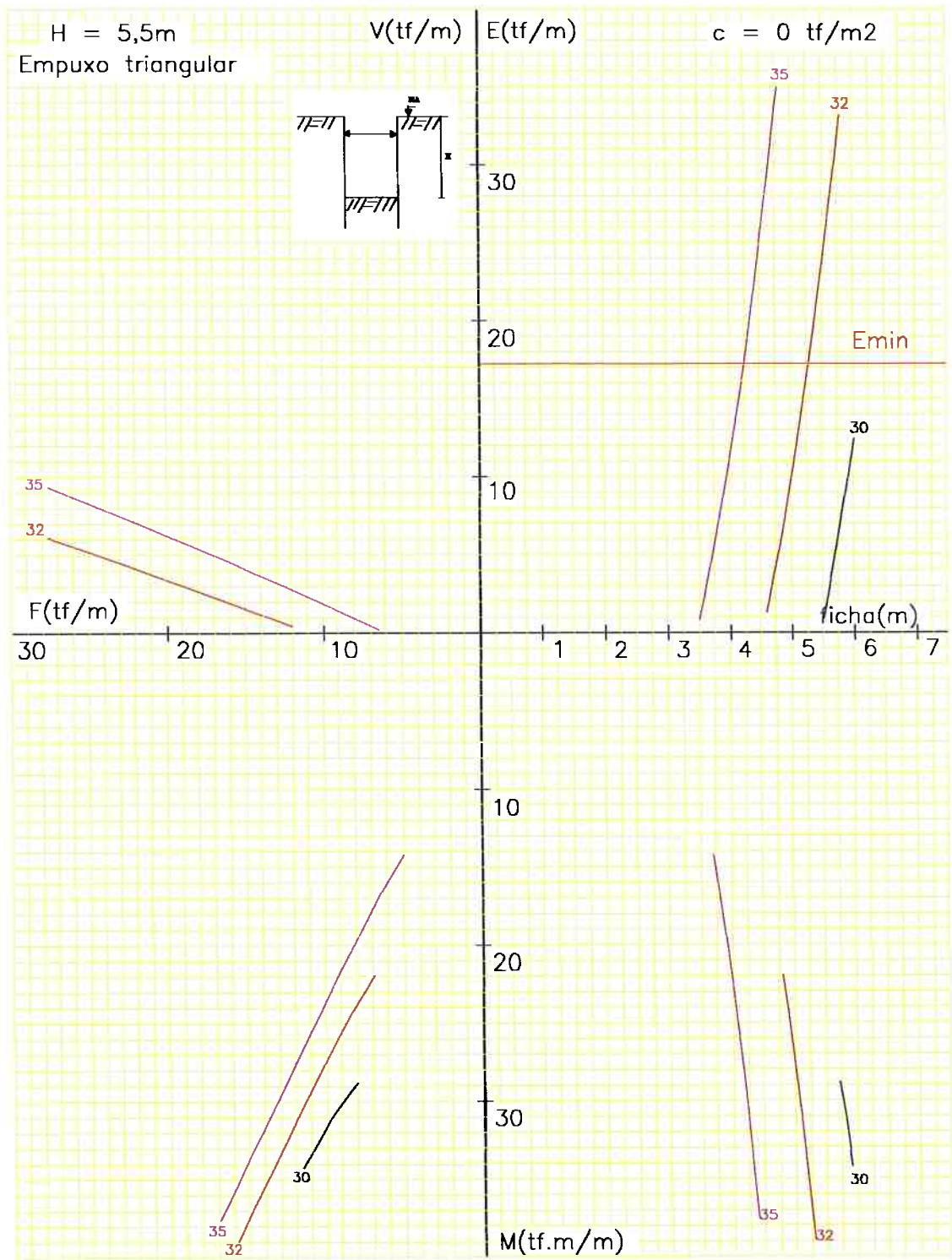


Fig. I.109- Ábaco tipo ES1

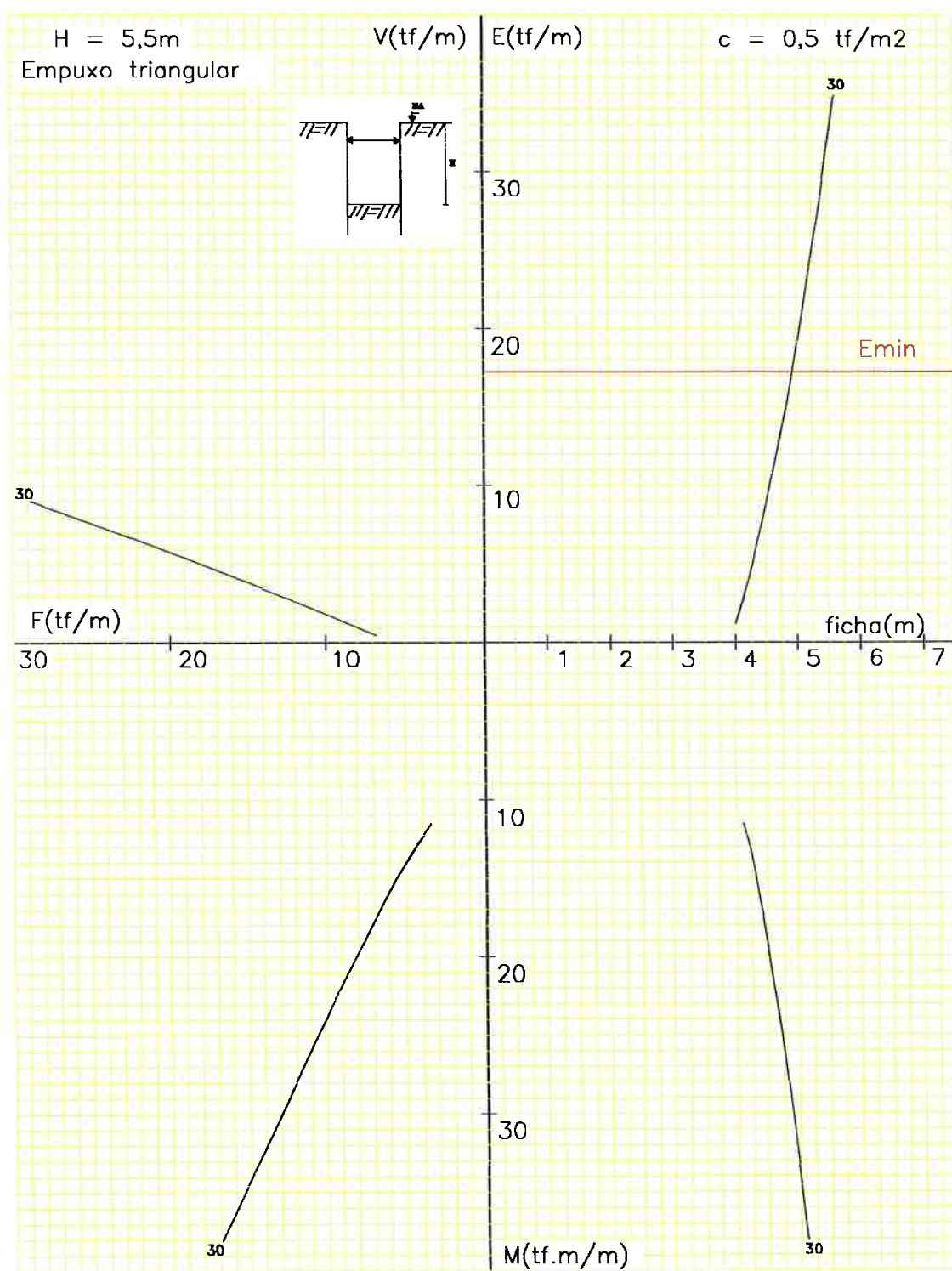


Fig. I.110- Ábaco tipo ES1

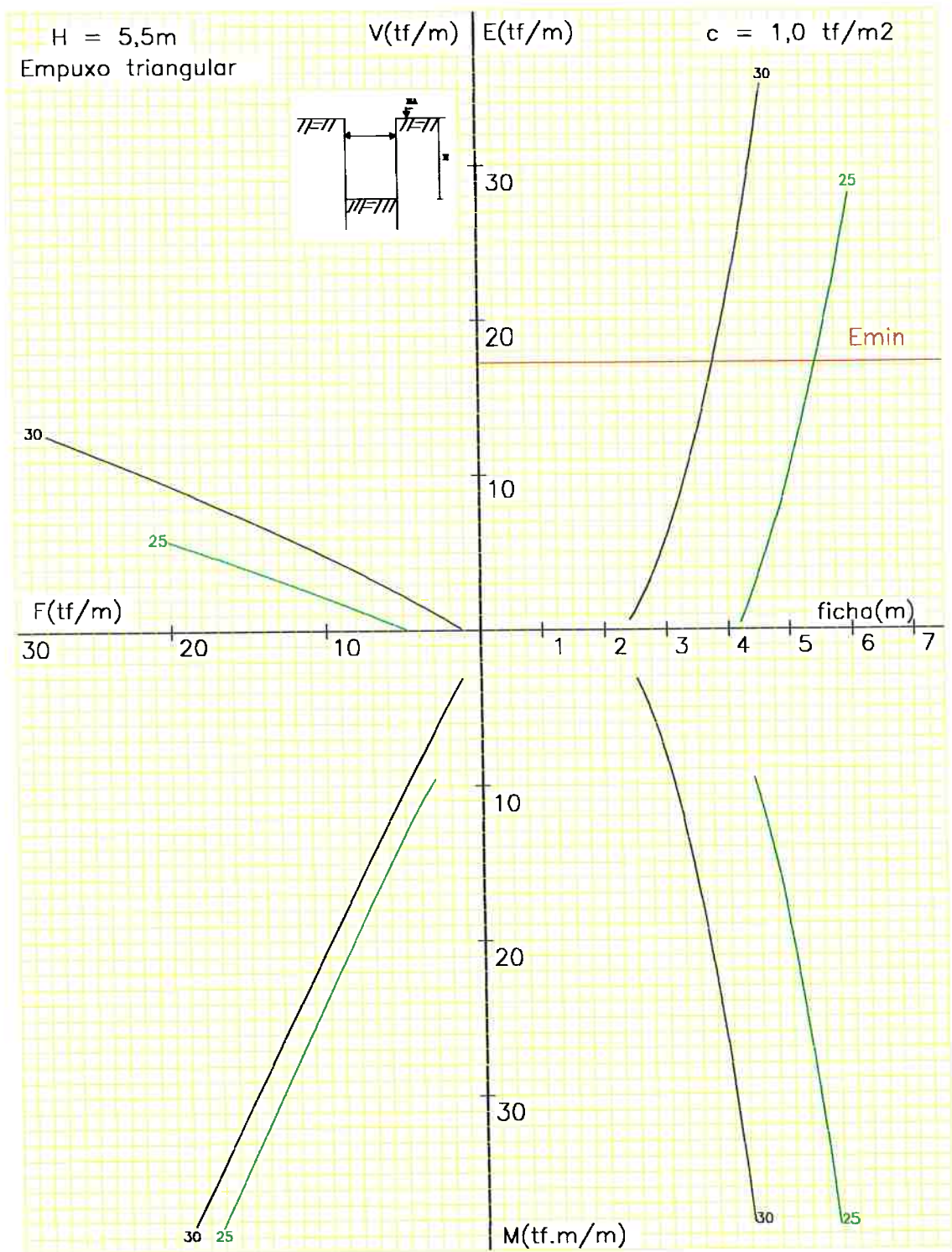


Fig. I.111- Ábaco tipo ES1

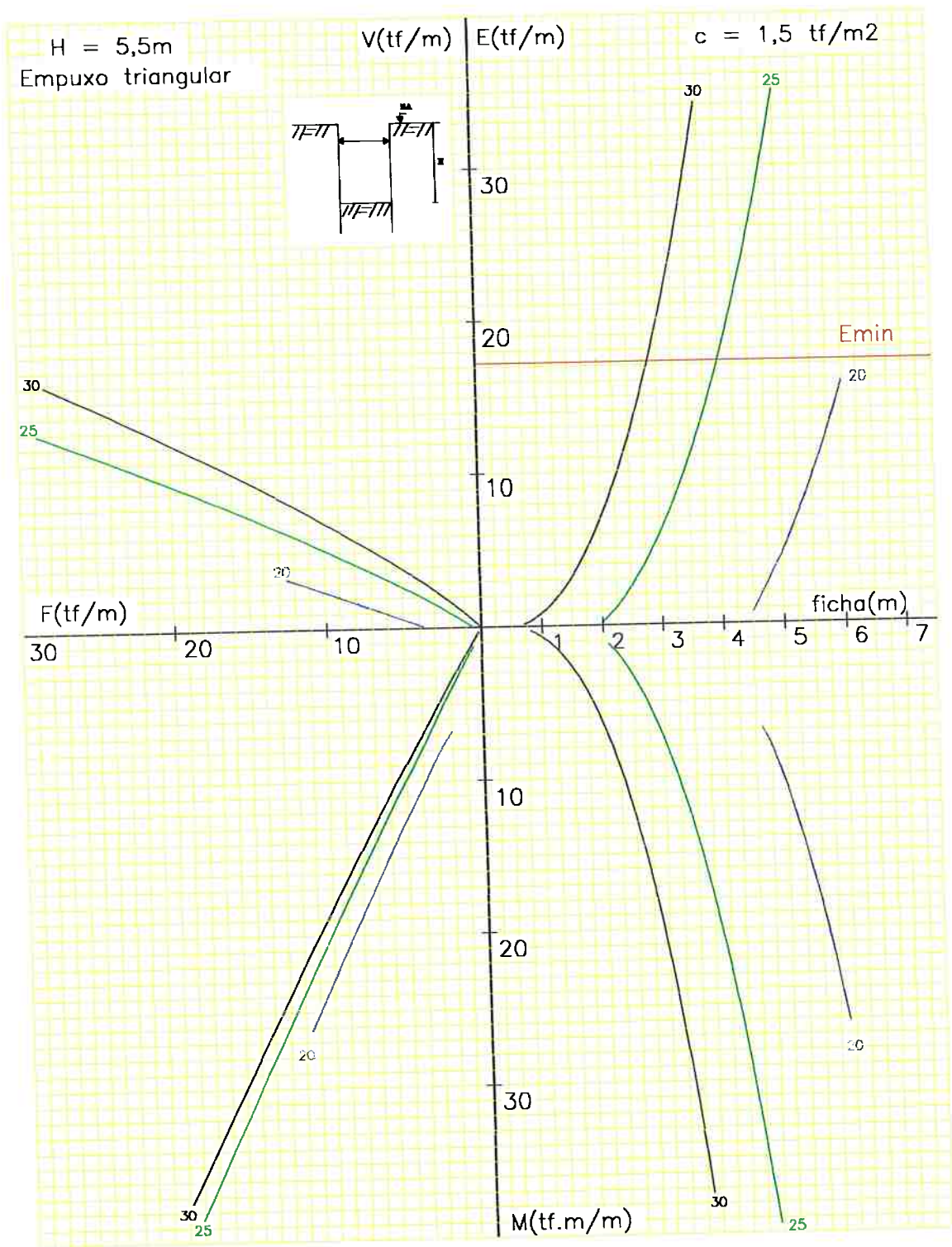


Fig. I.112- Ábaco tipo ES1

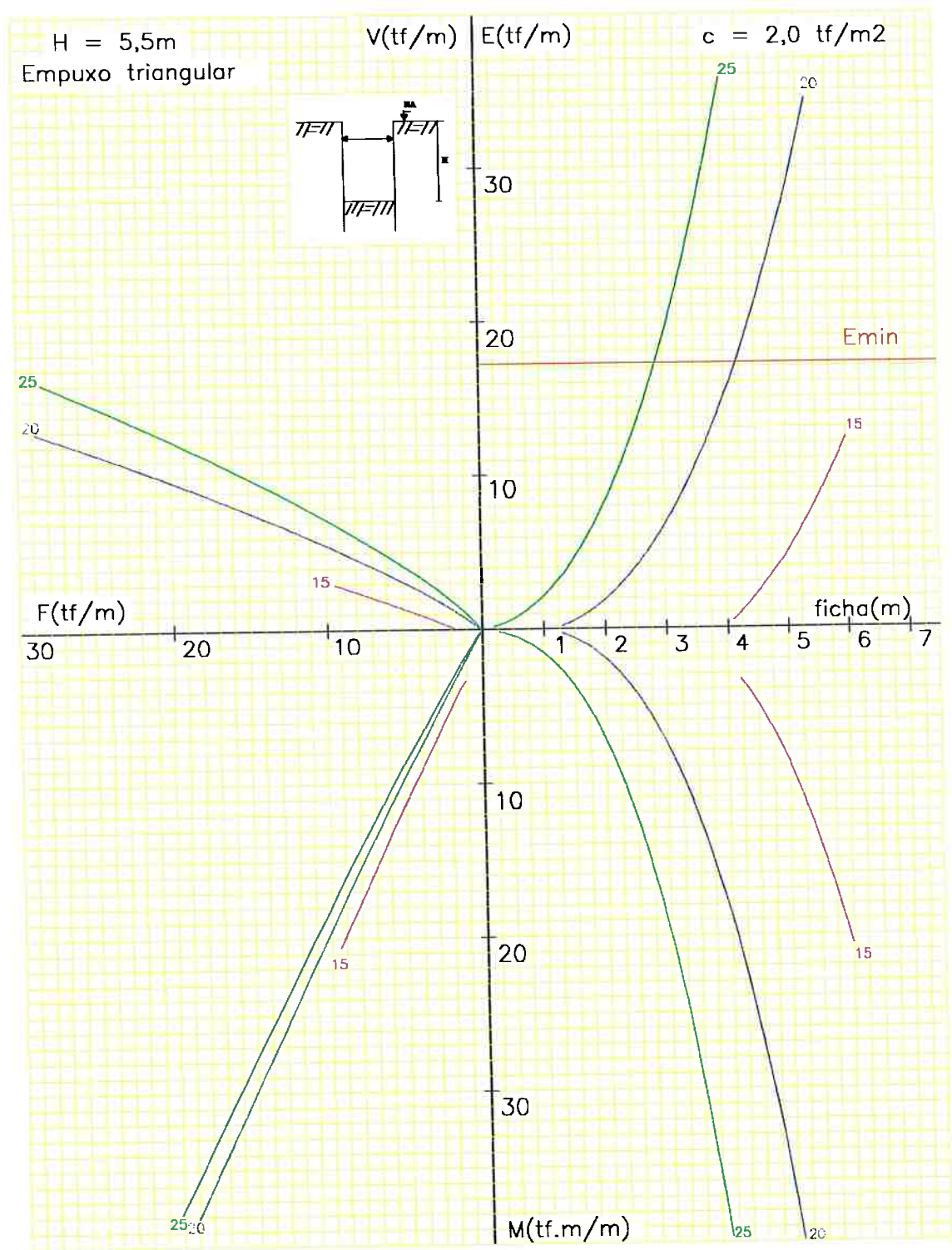


Fig. I.113- Ábaco tipo ES1

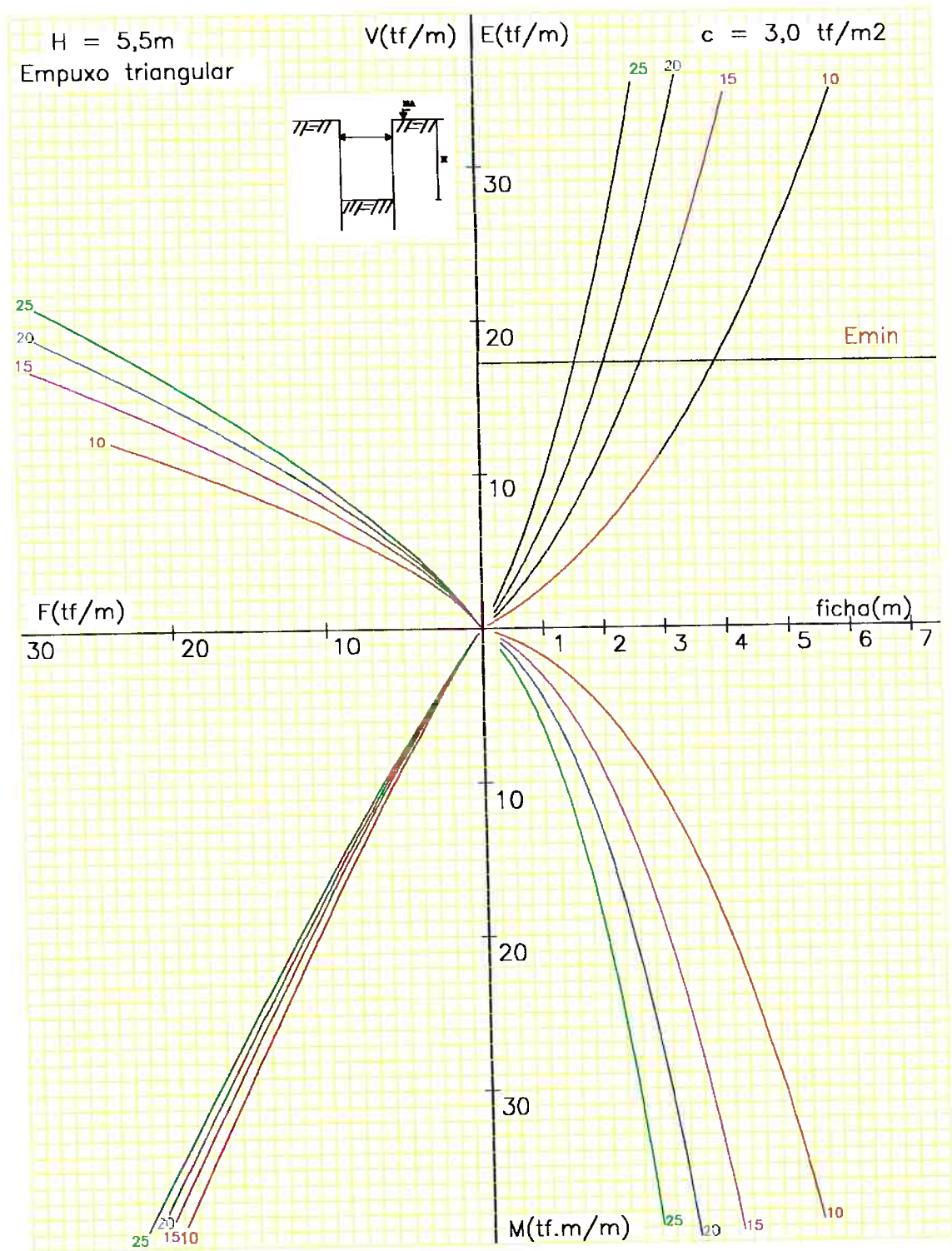


Fig. I.114- Ábaco tipo ES1

H = 6,5 m

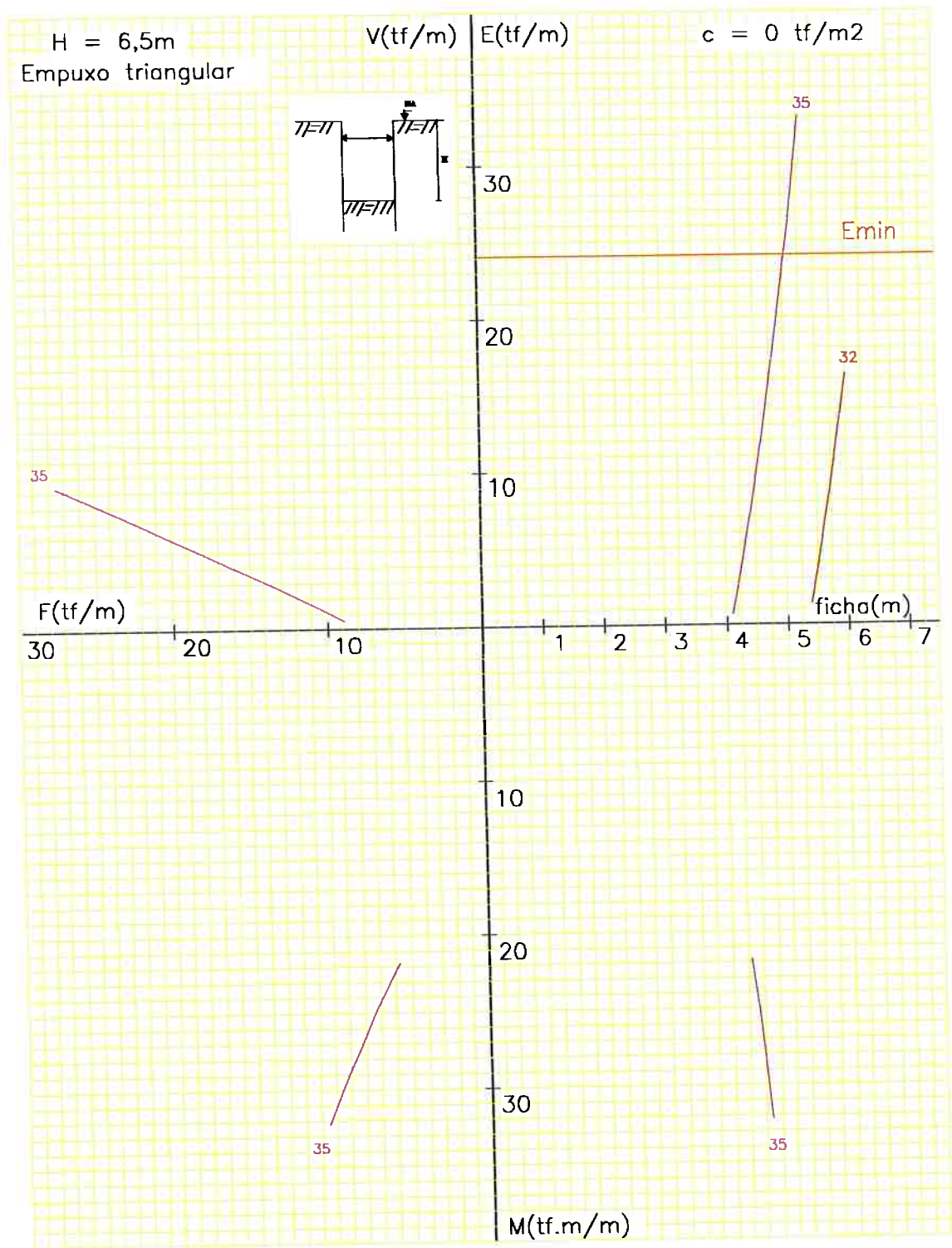


Fig. I.115- Ábaco tipo ES1

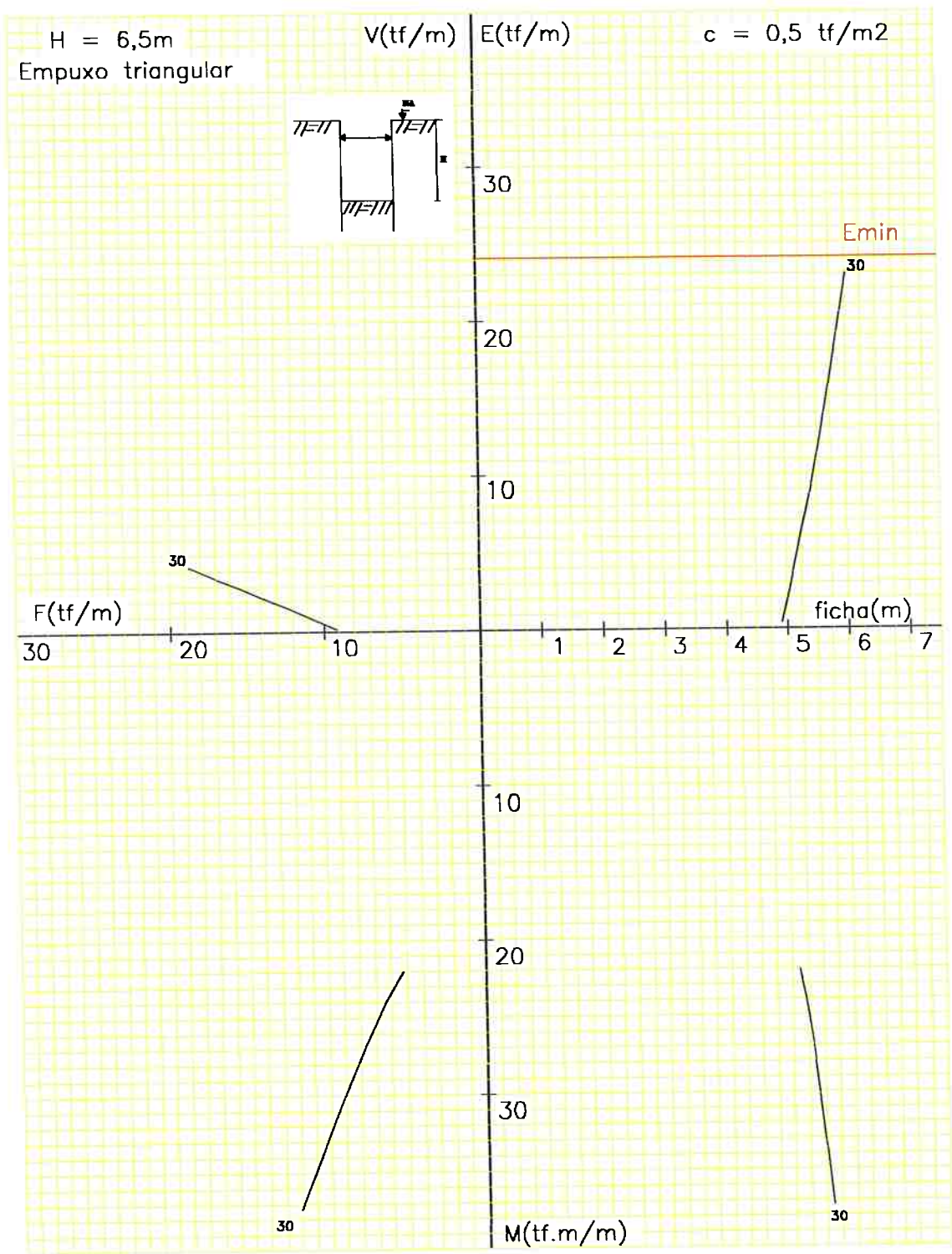


Fig. I.116- Ábaco tipo ES1

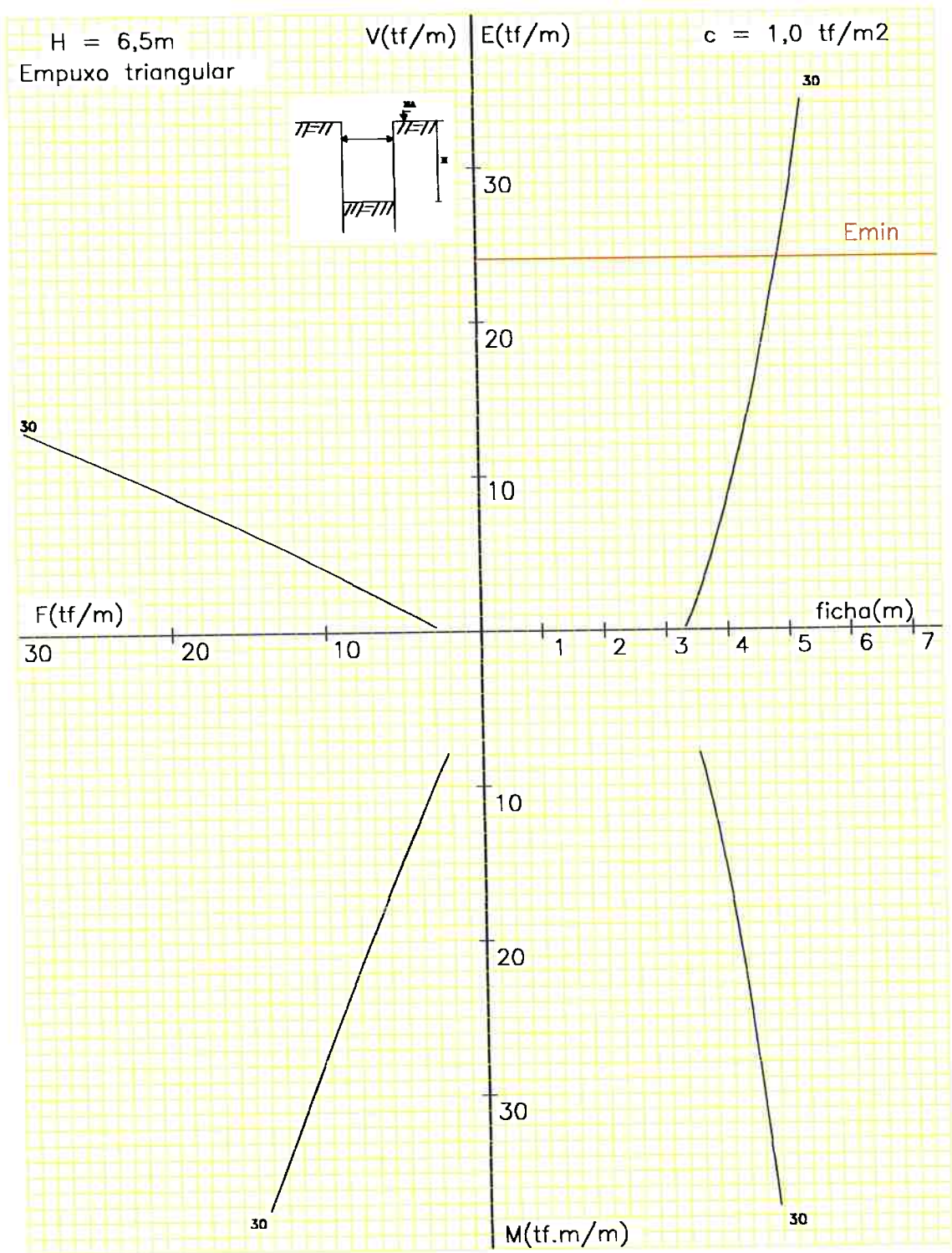


Fig. I.117- Ábaco tipo ES1

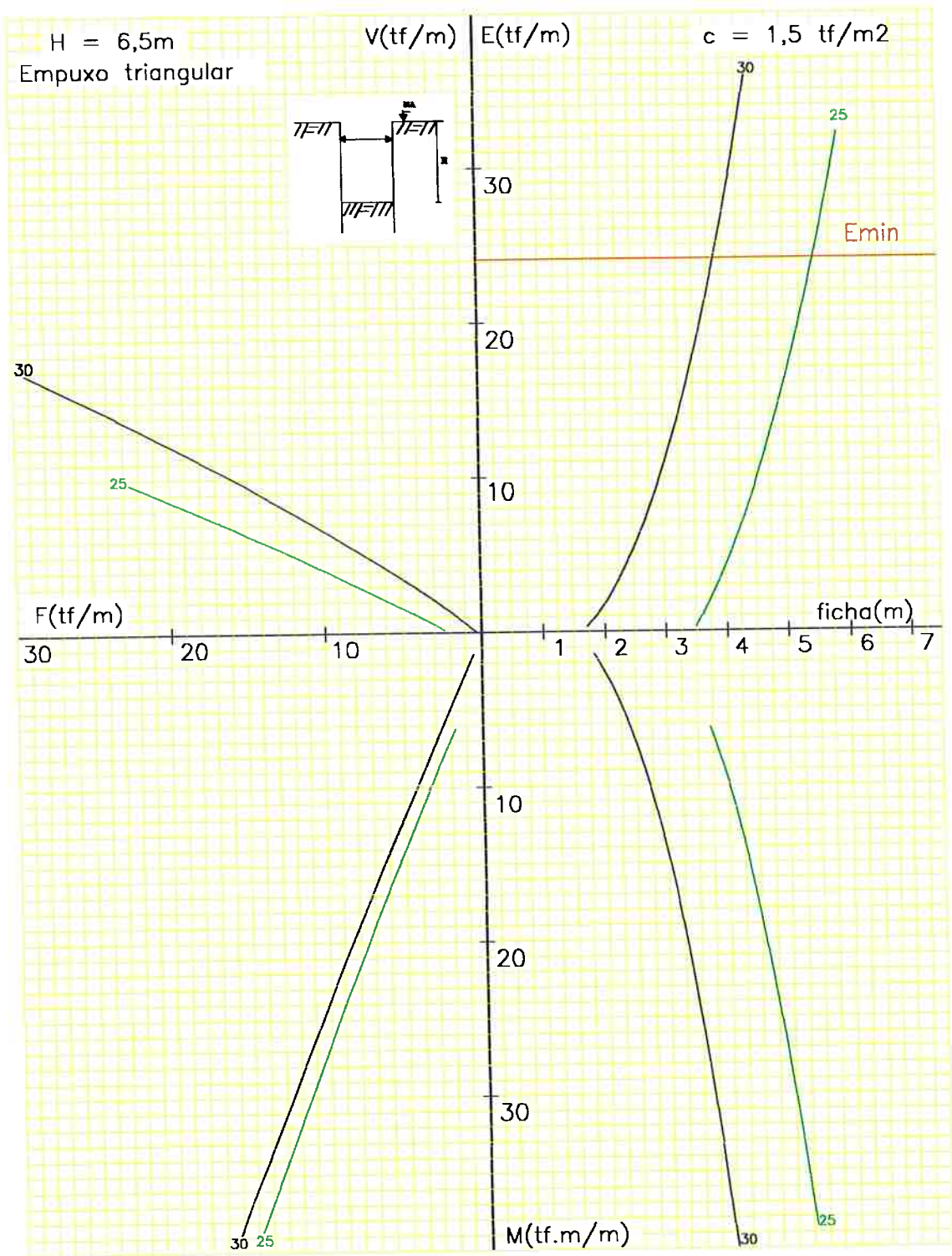


Fig. I.118- Ábaco tipo ES1

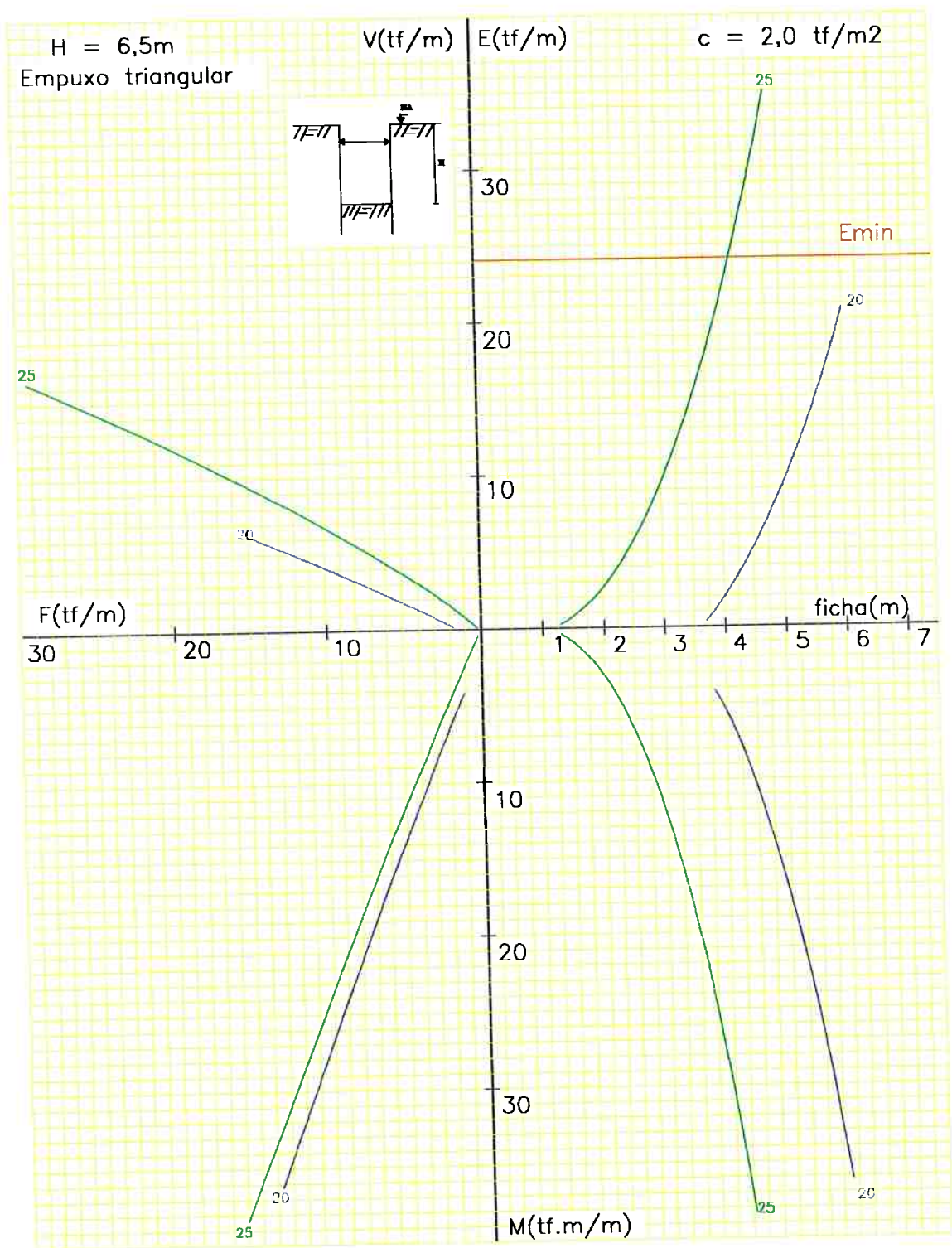


Fig. I.119- Ábaco tipo ES1

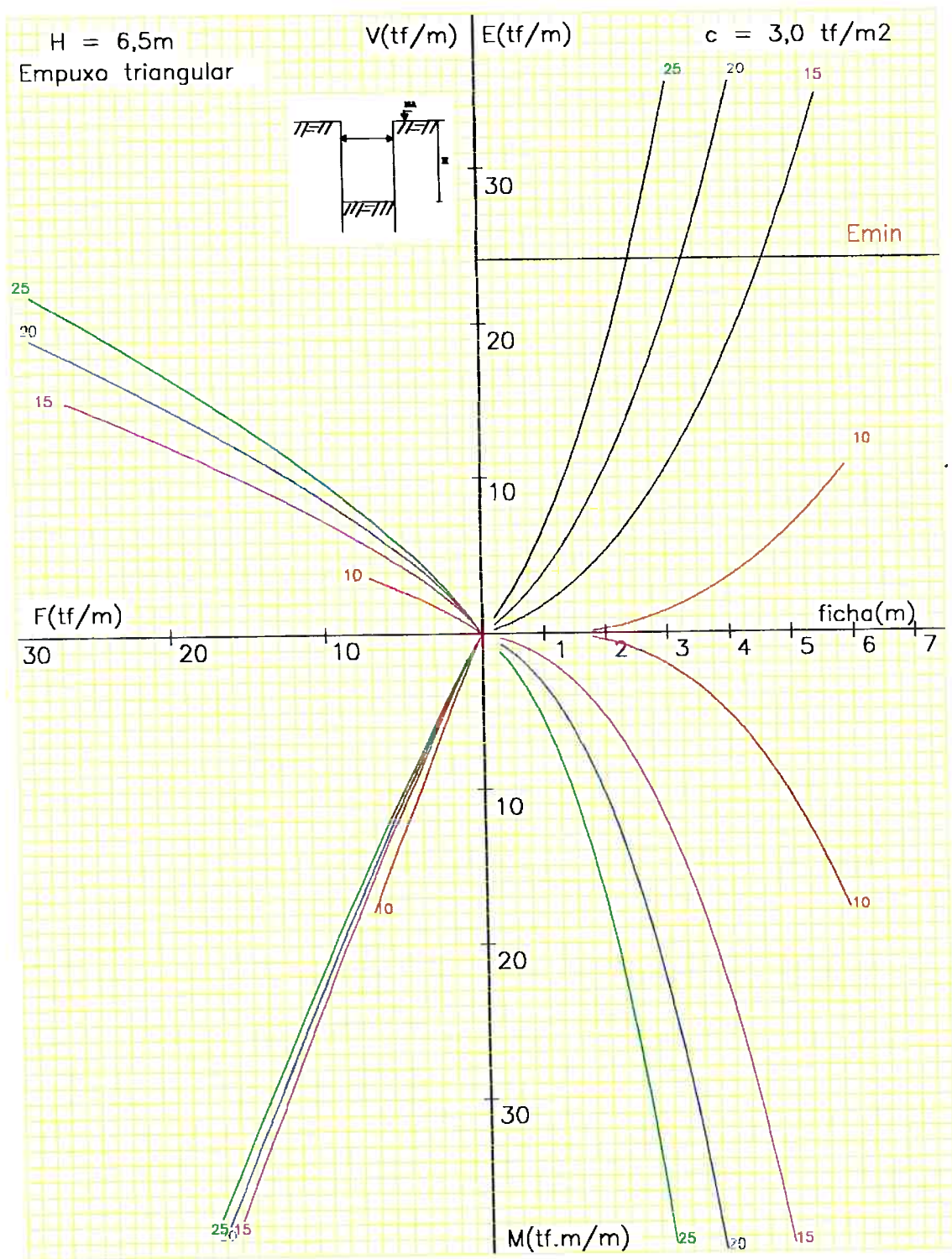


Fig. I.120- Ábaco tipo ES1

**NÍVEL DE ÁGUA
À METADE DA ALTURA
DE ESCAVAÇÃO**

H = 3,5 m

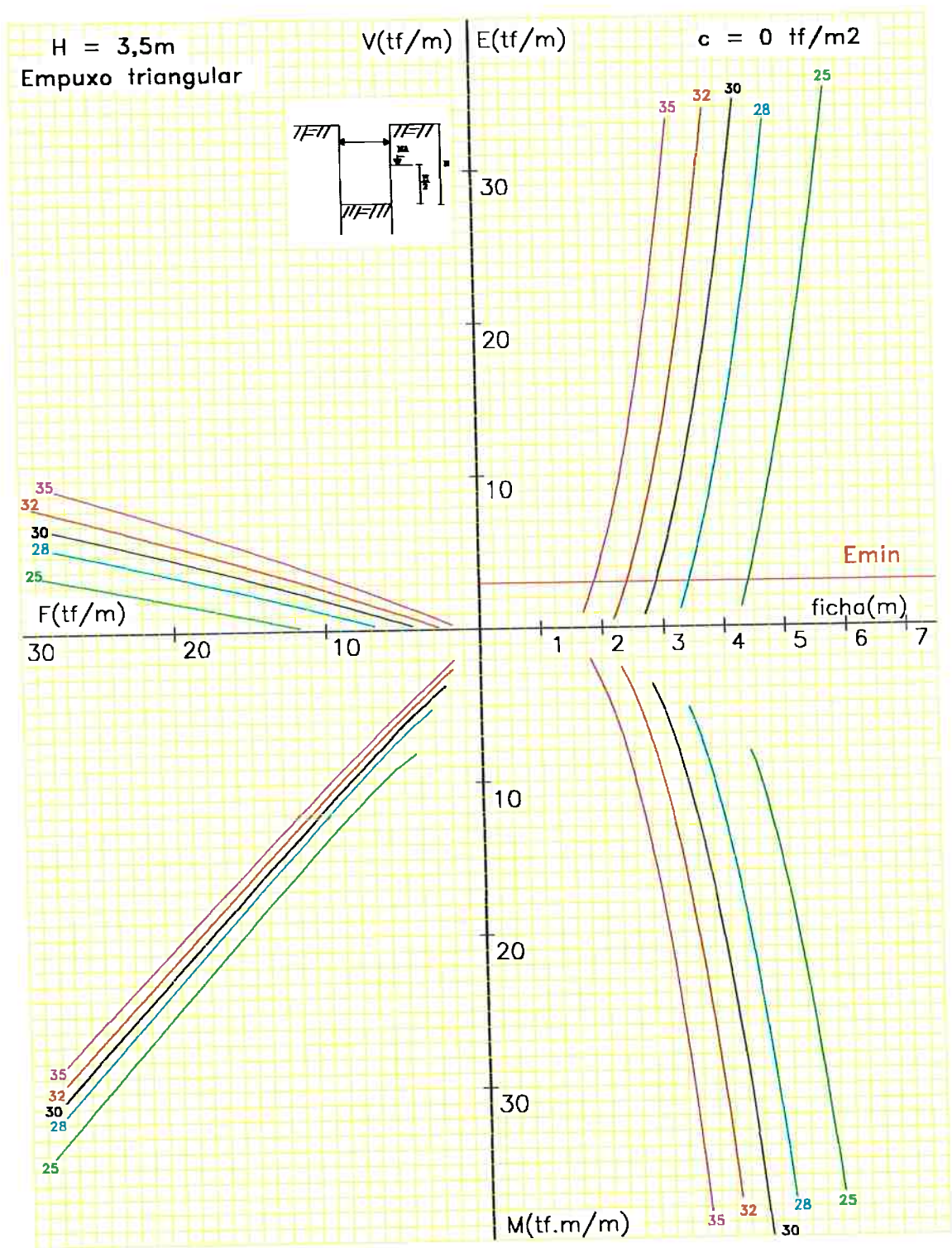


Fig. I.121- Ábaco tipo ES1

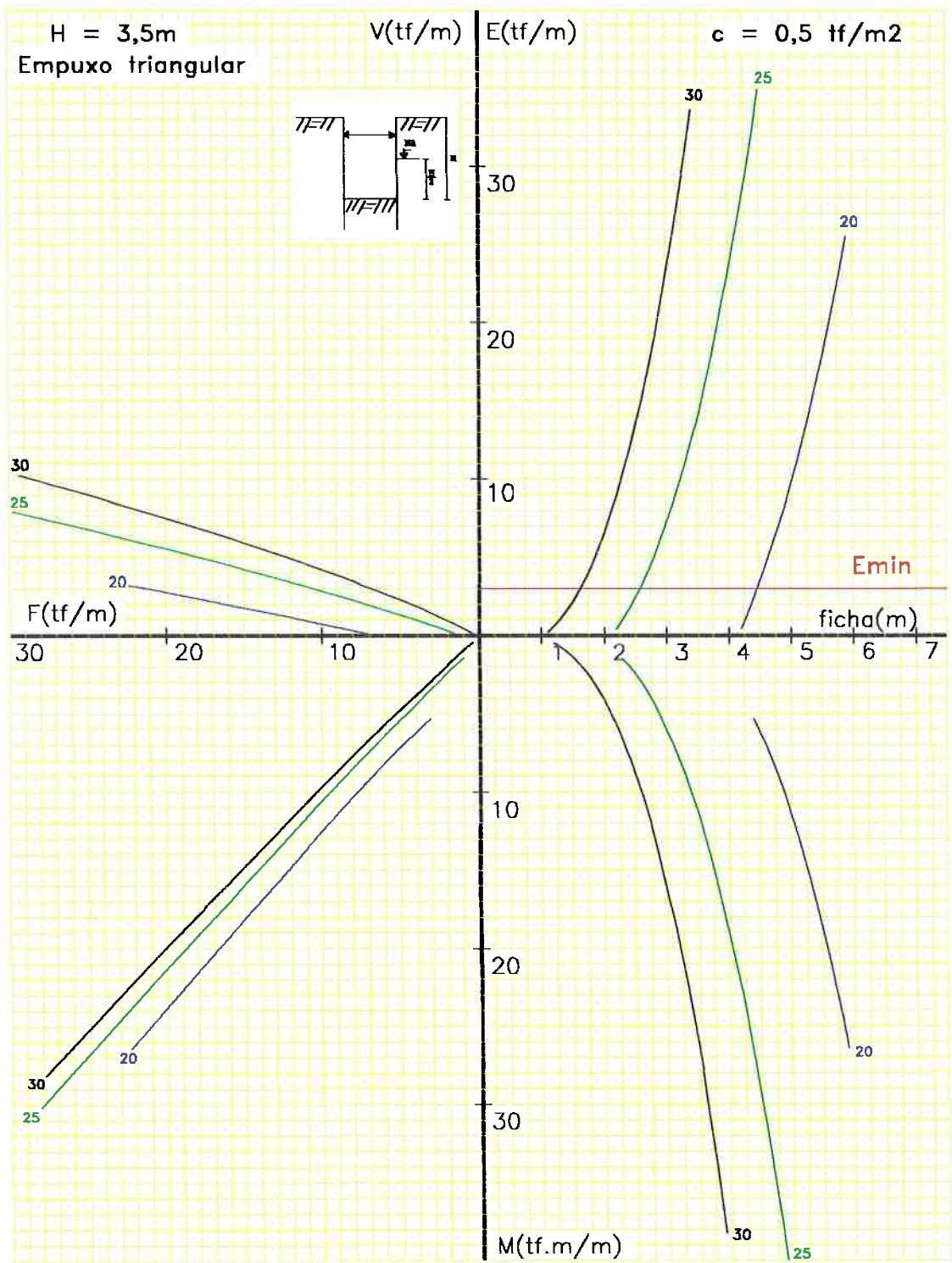


Fig. I.122- Ábaco tipo ES1

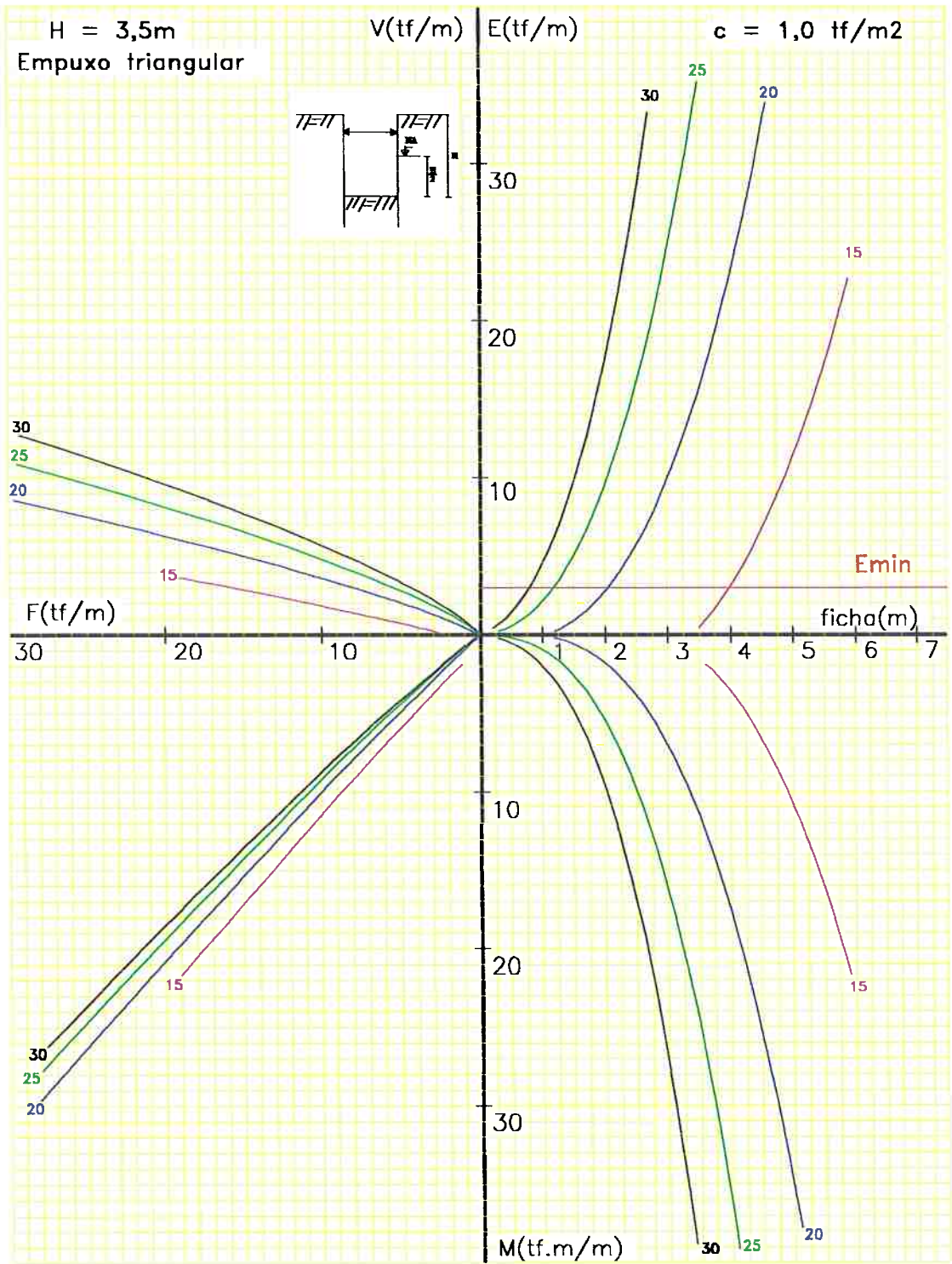


Fig. I.123- Ábaco tipo ES1

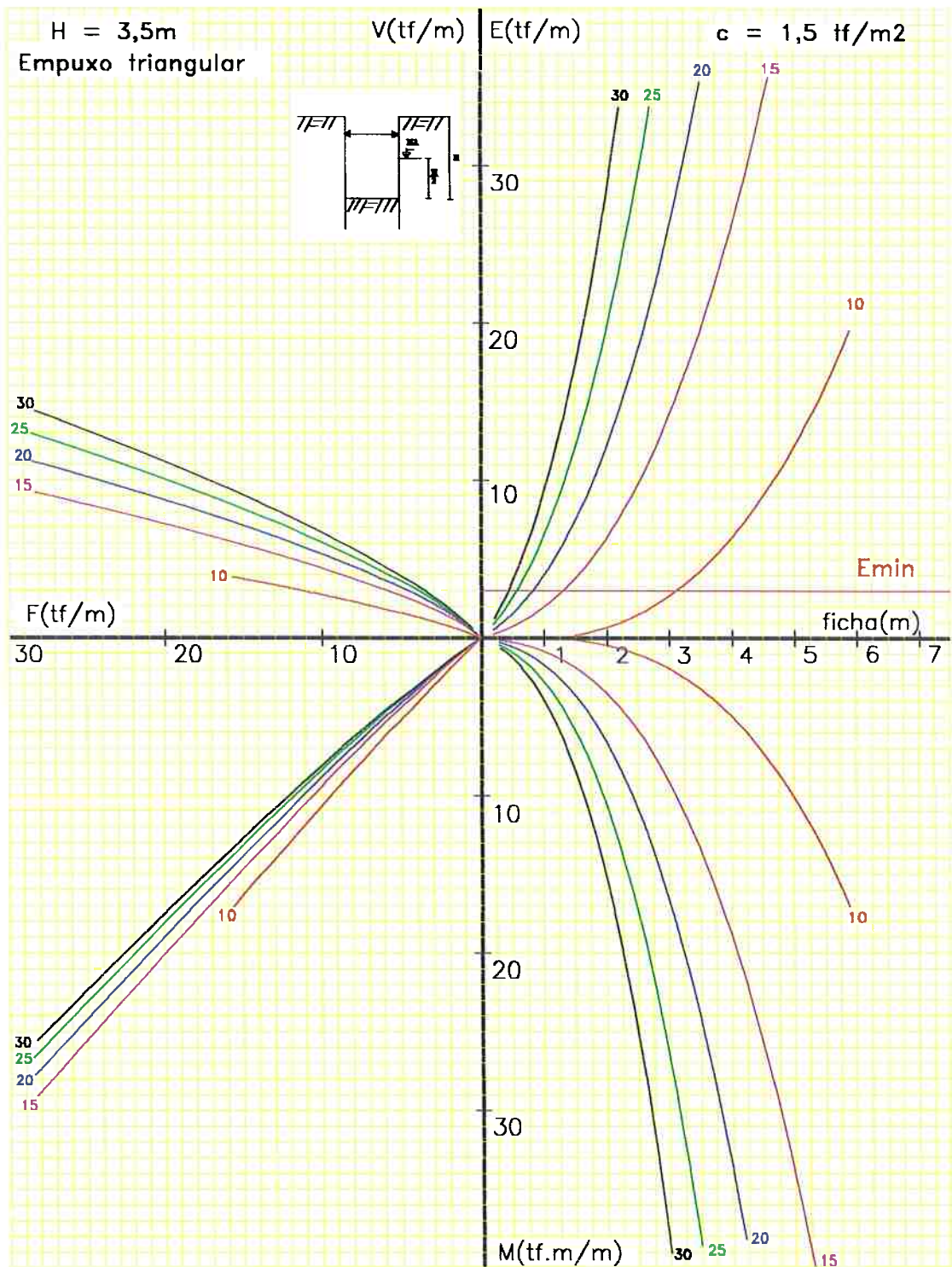


Fig. I.124- Ábaco tipo ES1

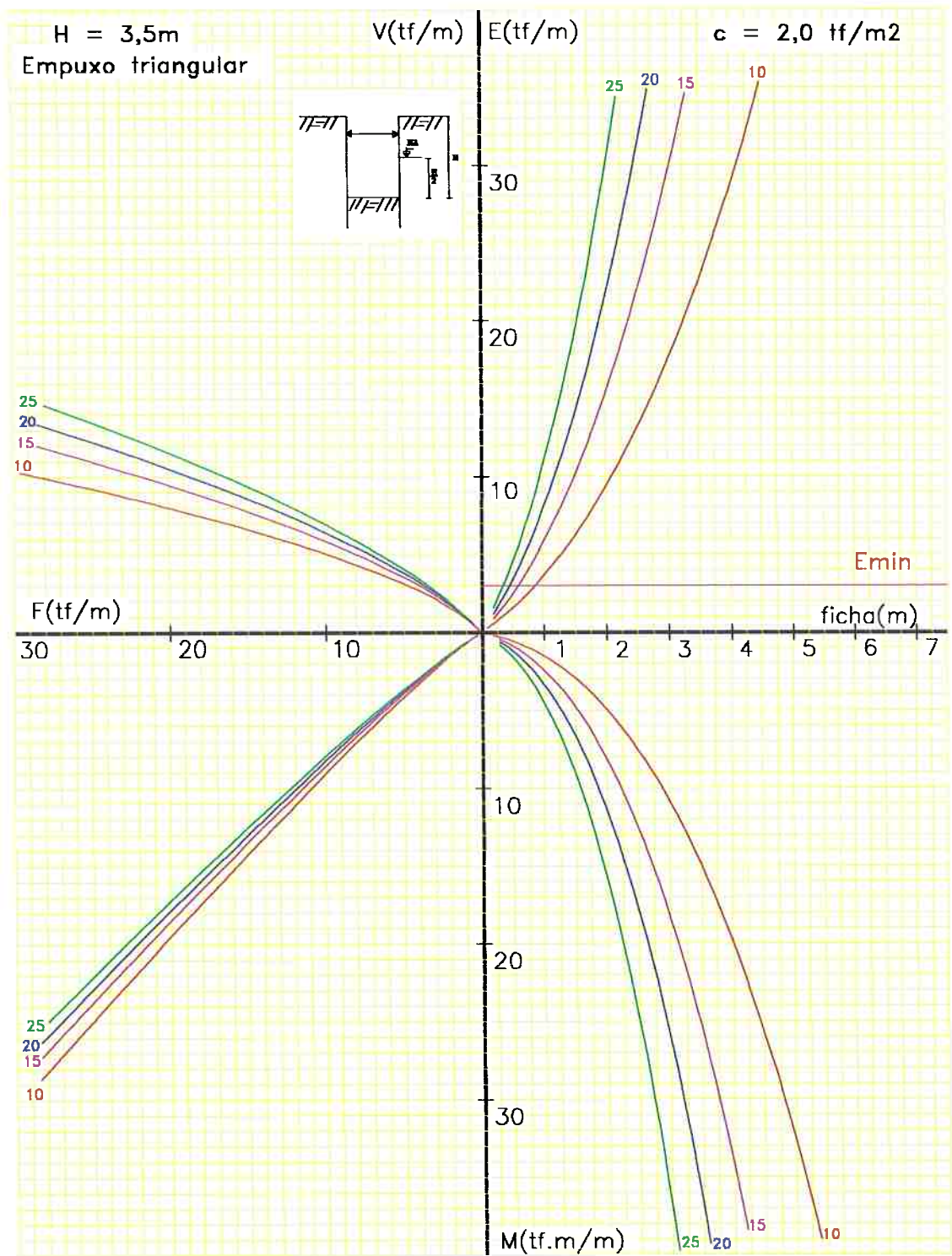


Fig. I.125- Ábaco tipo ES1

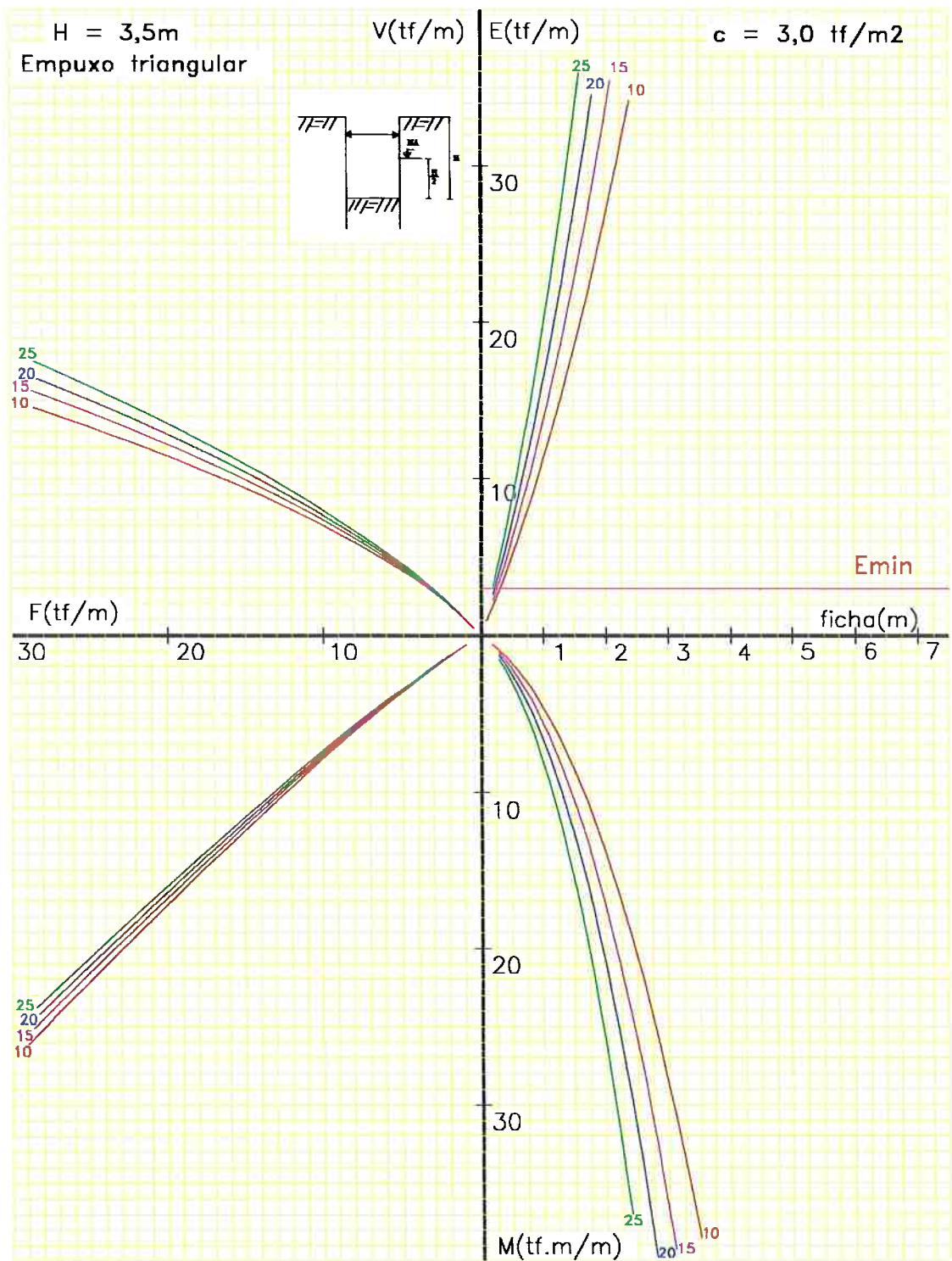


Fig. I.126- Ábaco tipo ES1

H = 4,5 m

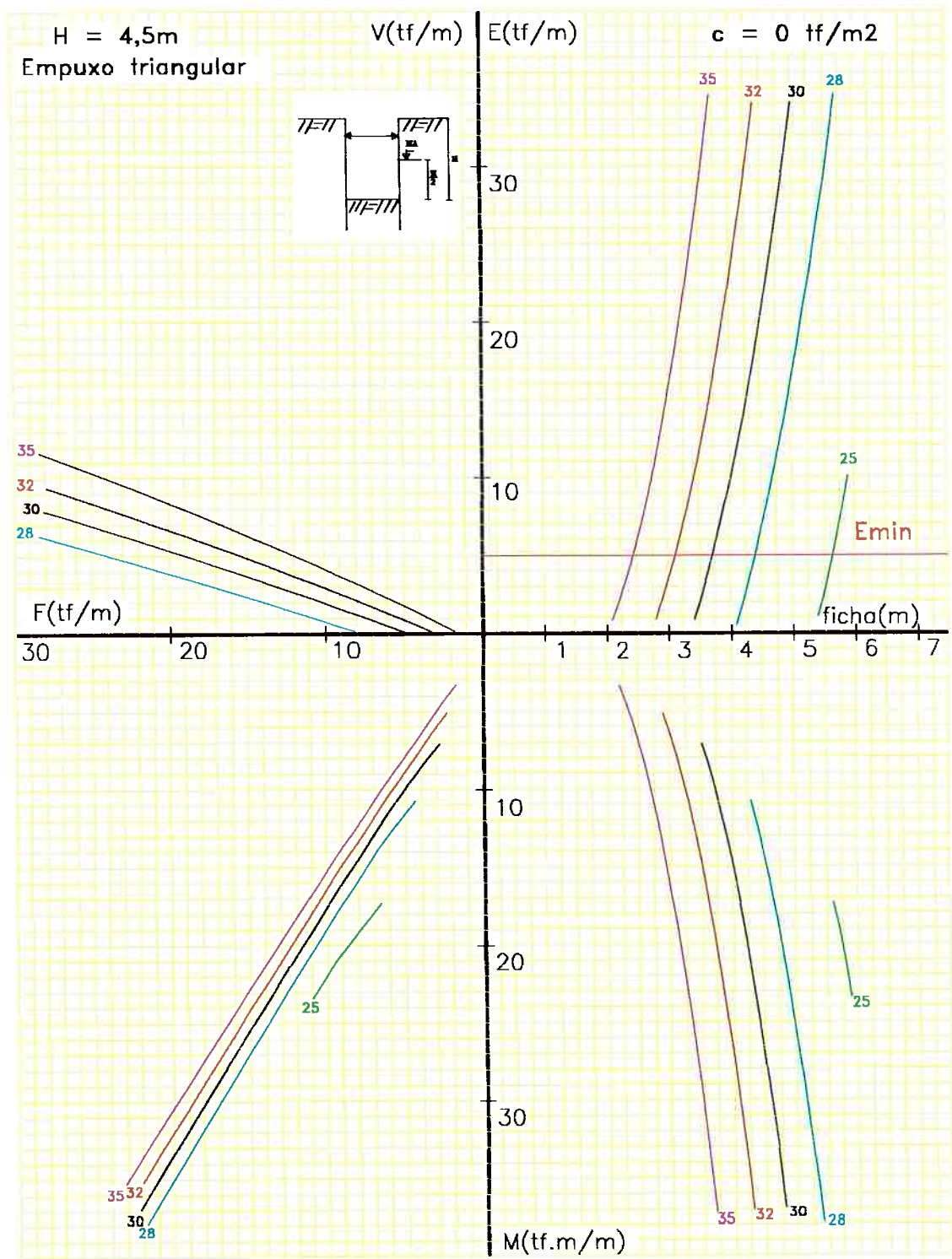


Fig. I.127- Ábaco tipo ES1

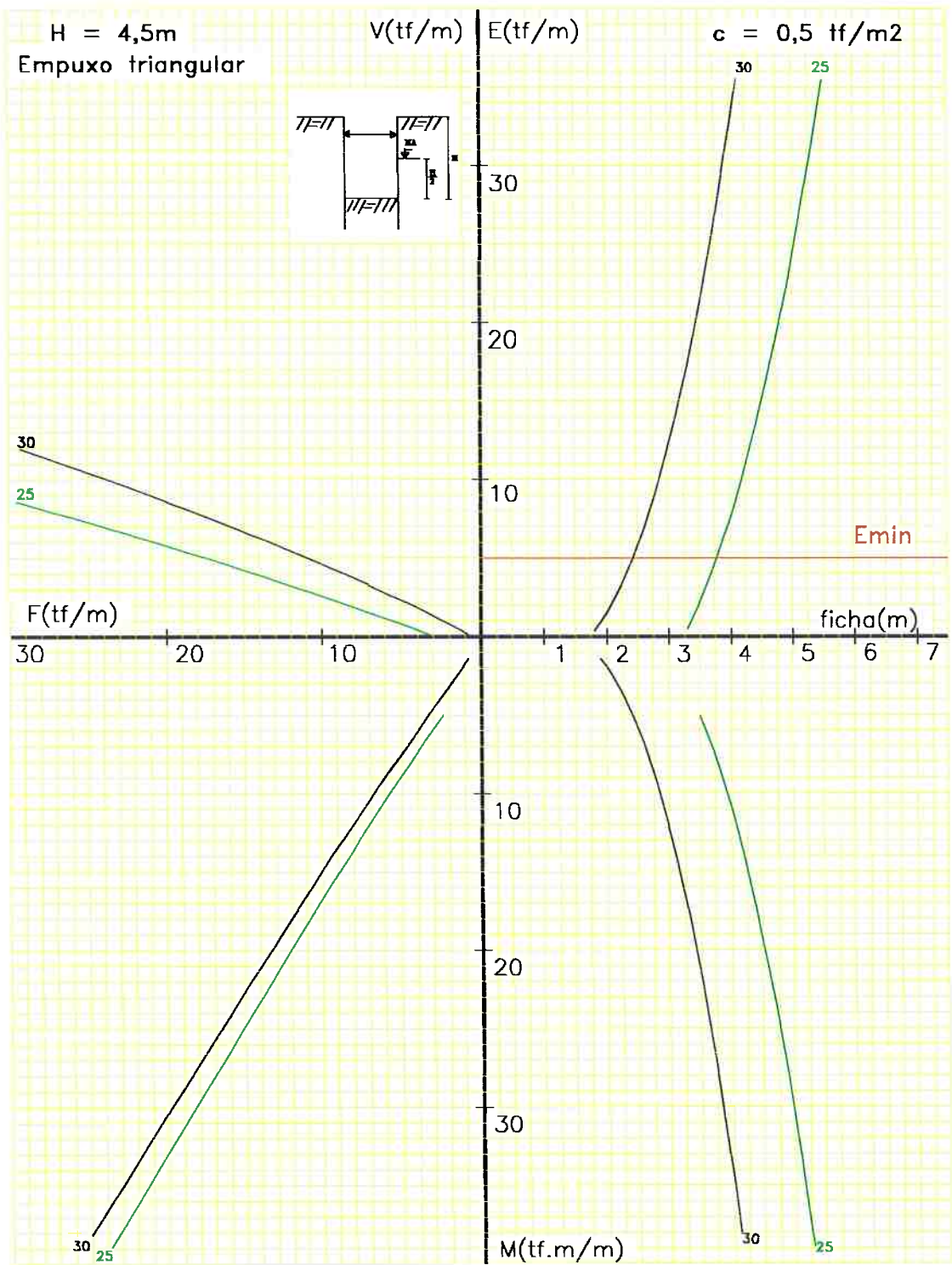


Fig. I.128- Ábaco tipo ES1

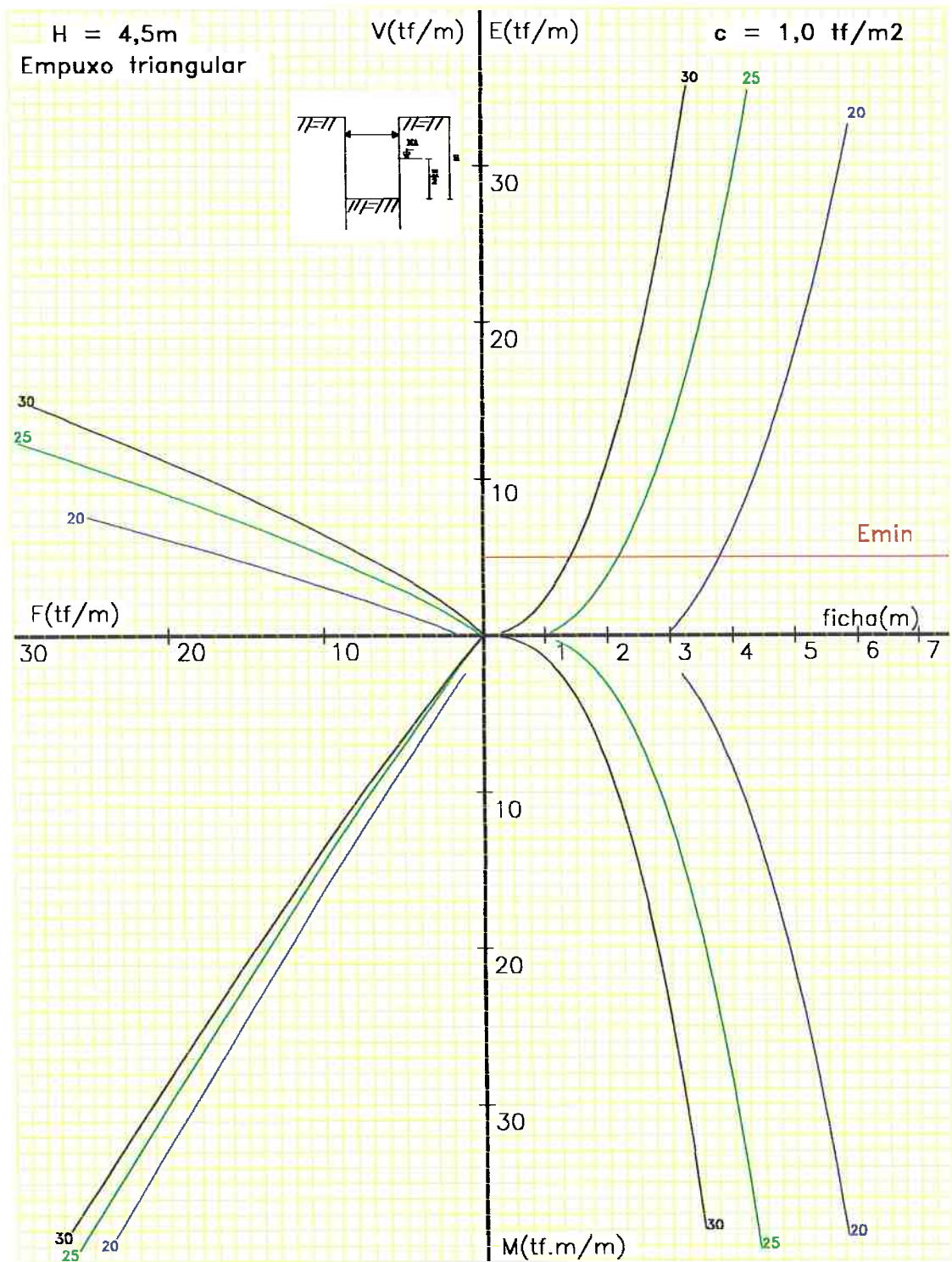


Fig. I.129- Ábaco tipo ES1

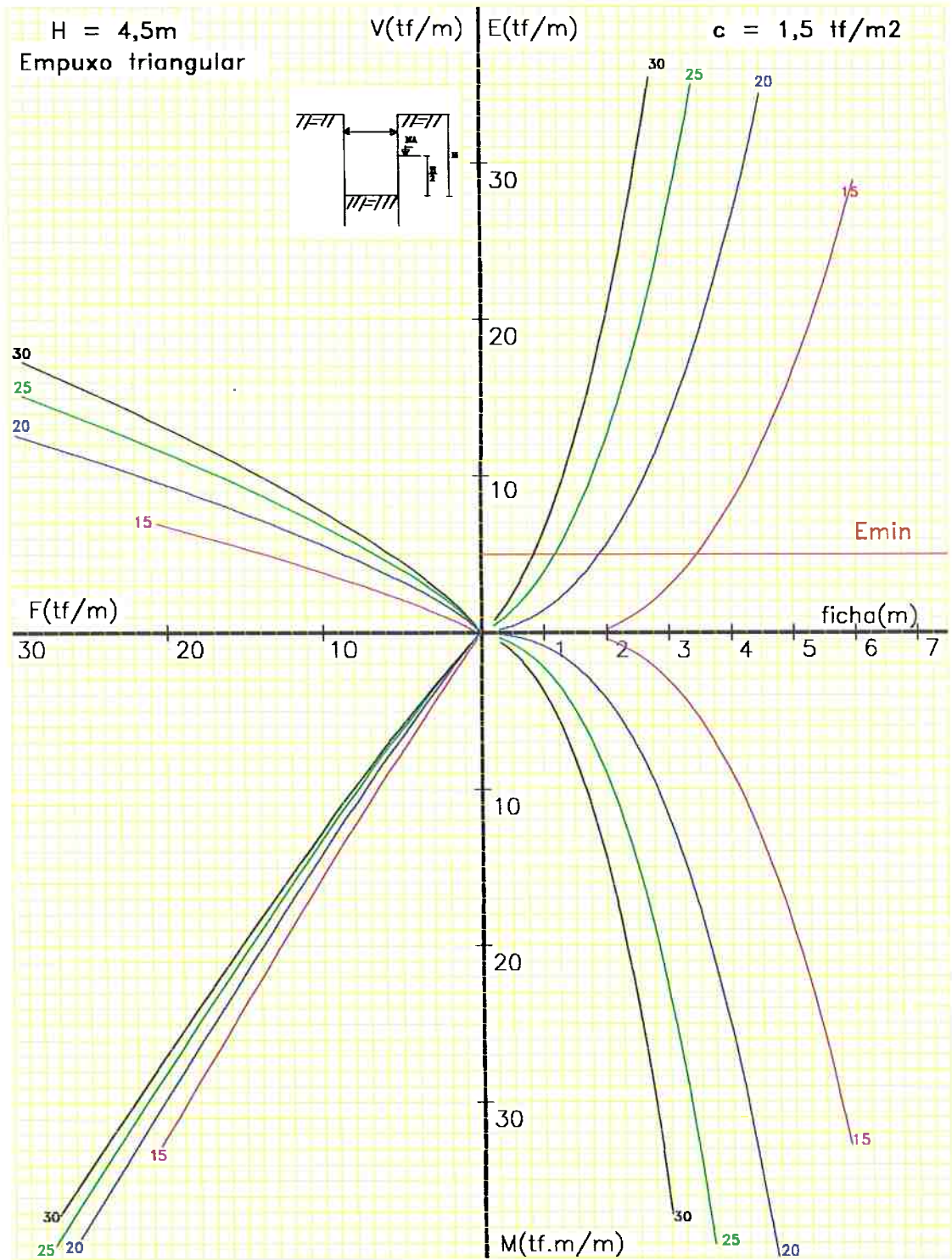


Fig. I.130- Ábaco tipo ES1

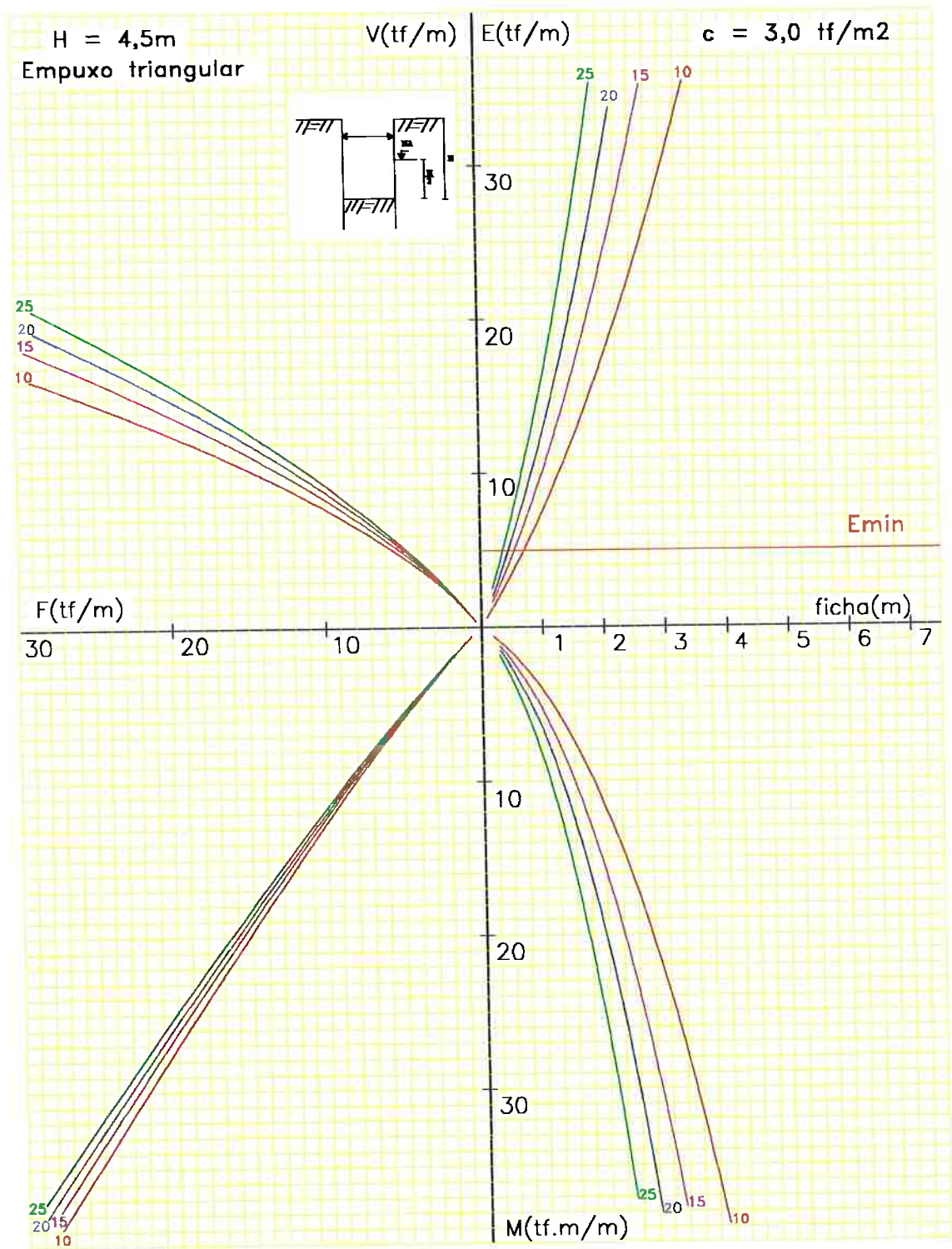


Fig. I.132- Ábaco tipo ES1

H = 5,5 m

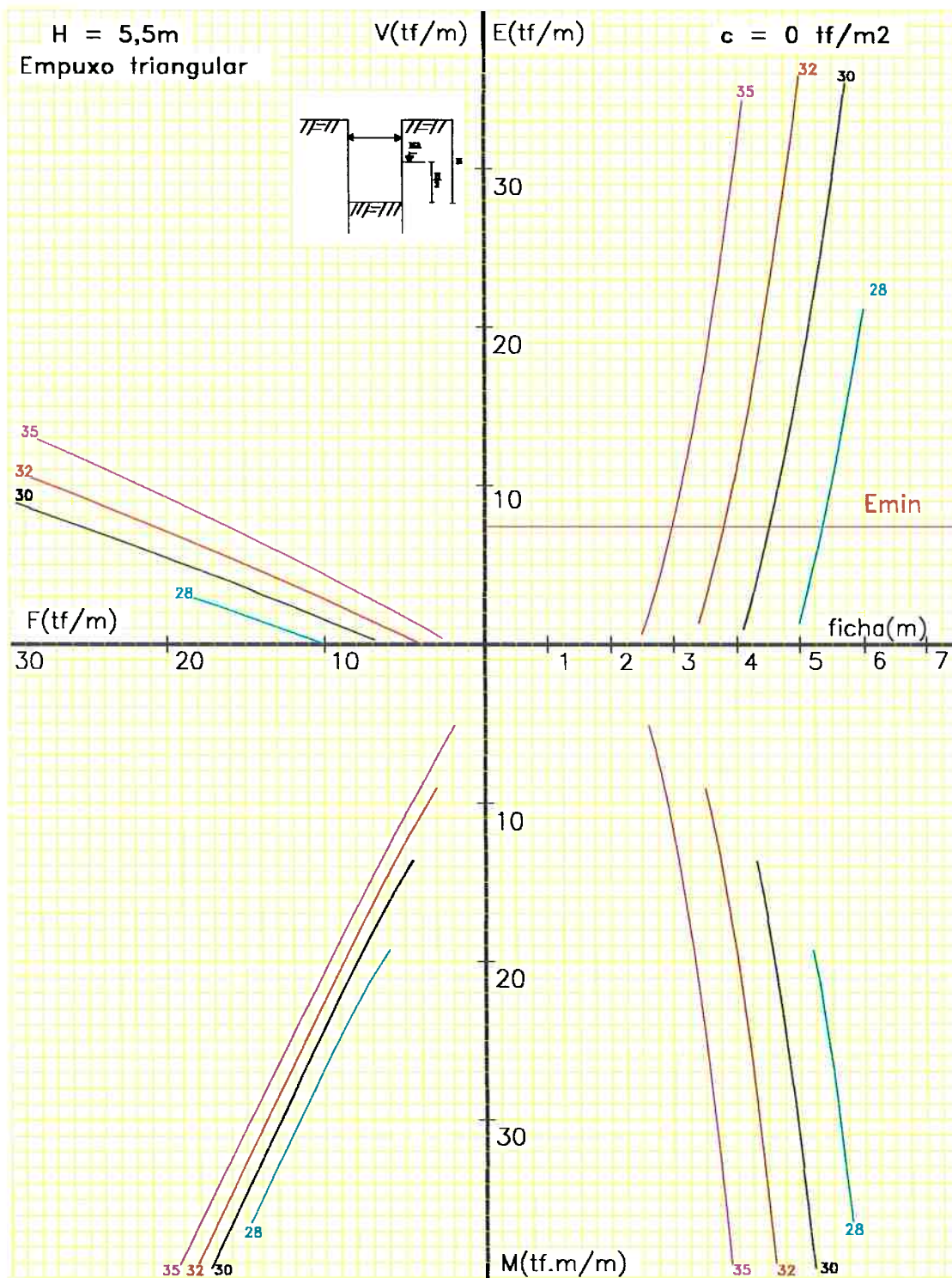


Fig. I.133- Ábaco tipo ES1

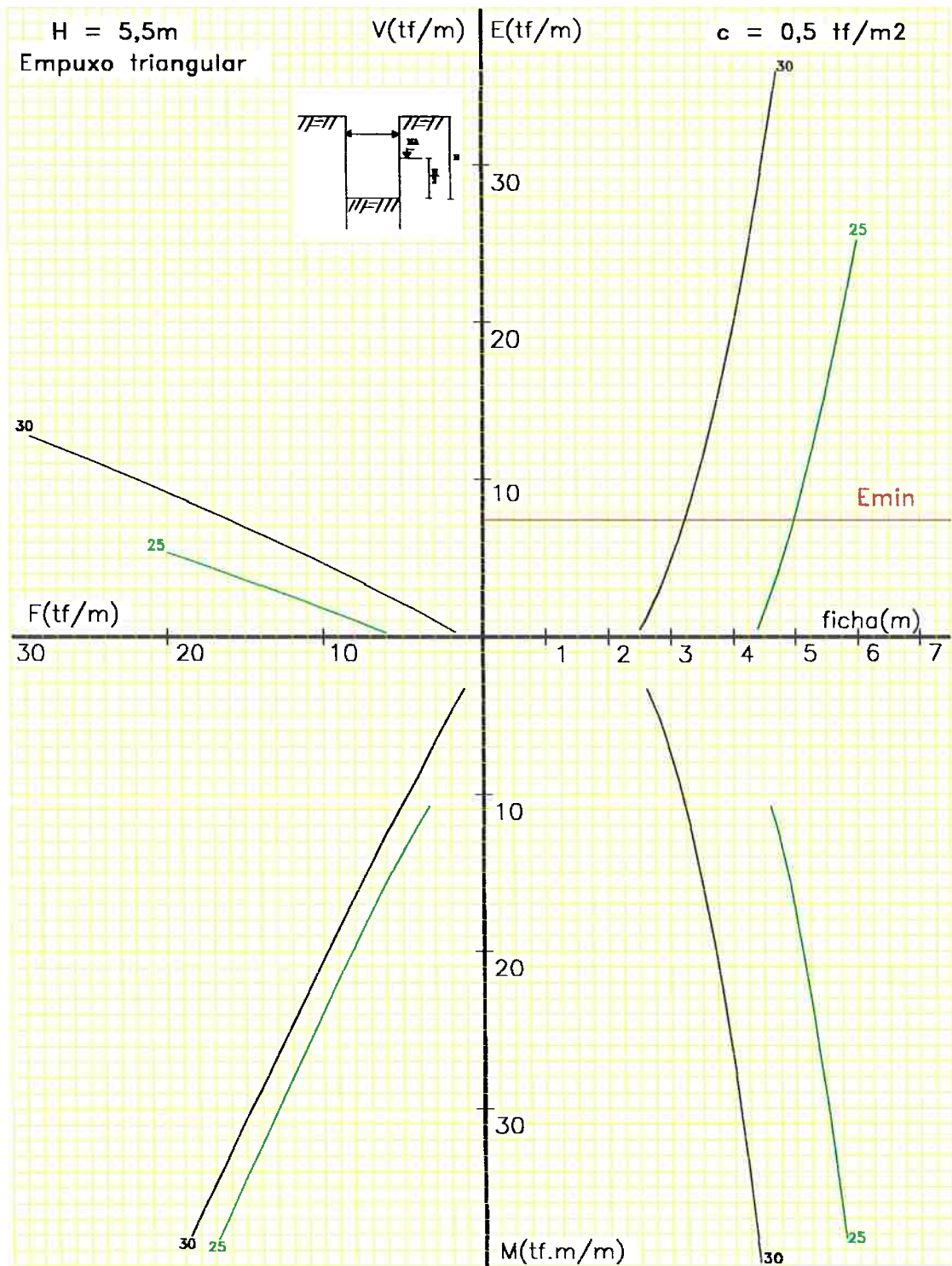


Fig. I.134- Ábaco tipo ES1

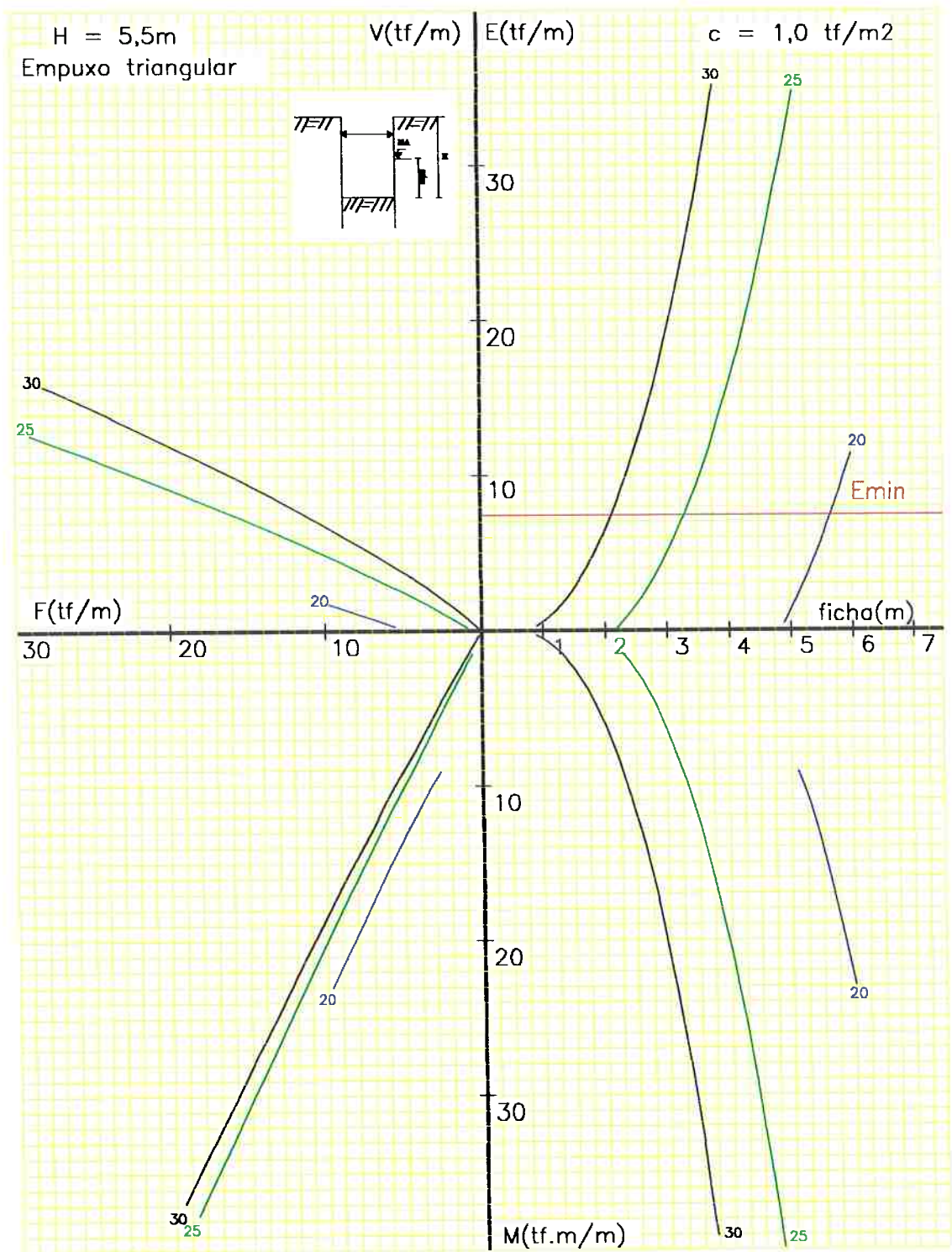


Fig. I.135- Ábaco tipo ES1

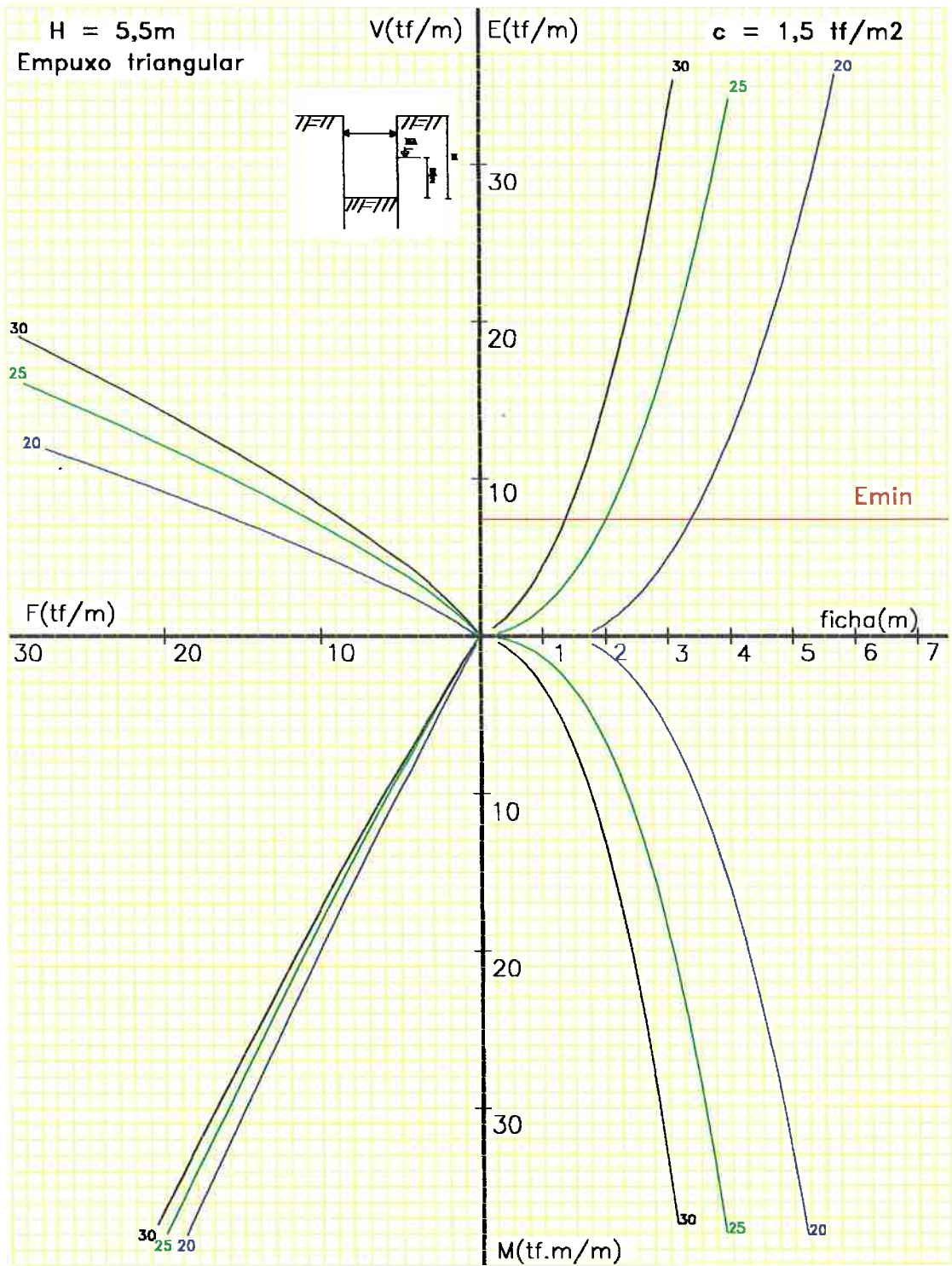


Fig. I.136- Ábaco tipo ES1

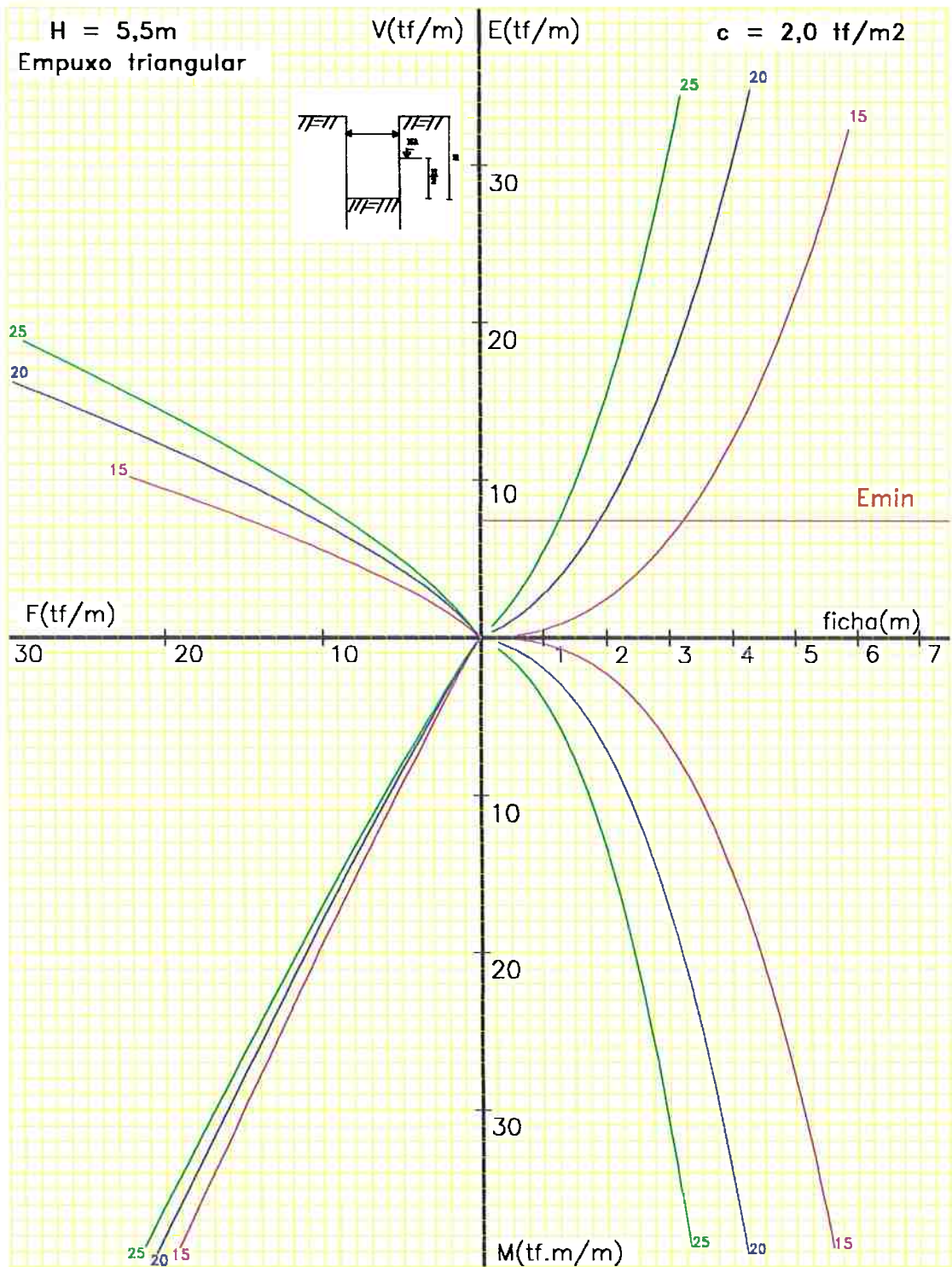


Fig. I.137- Ábaco tipo ES1

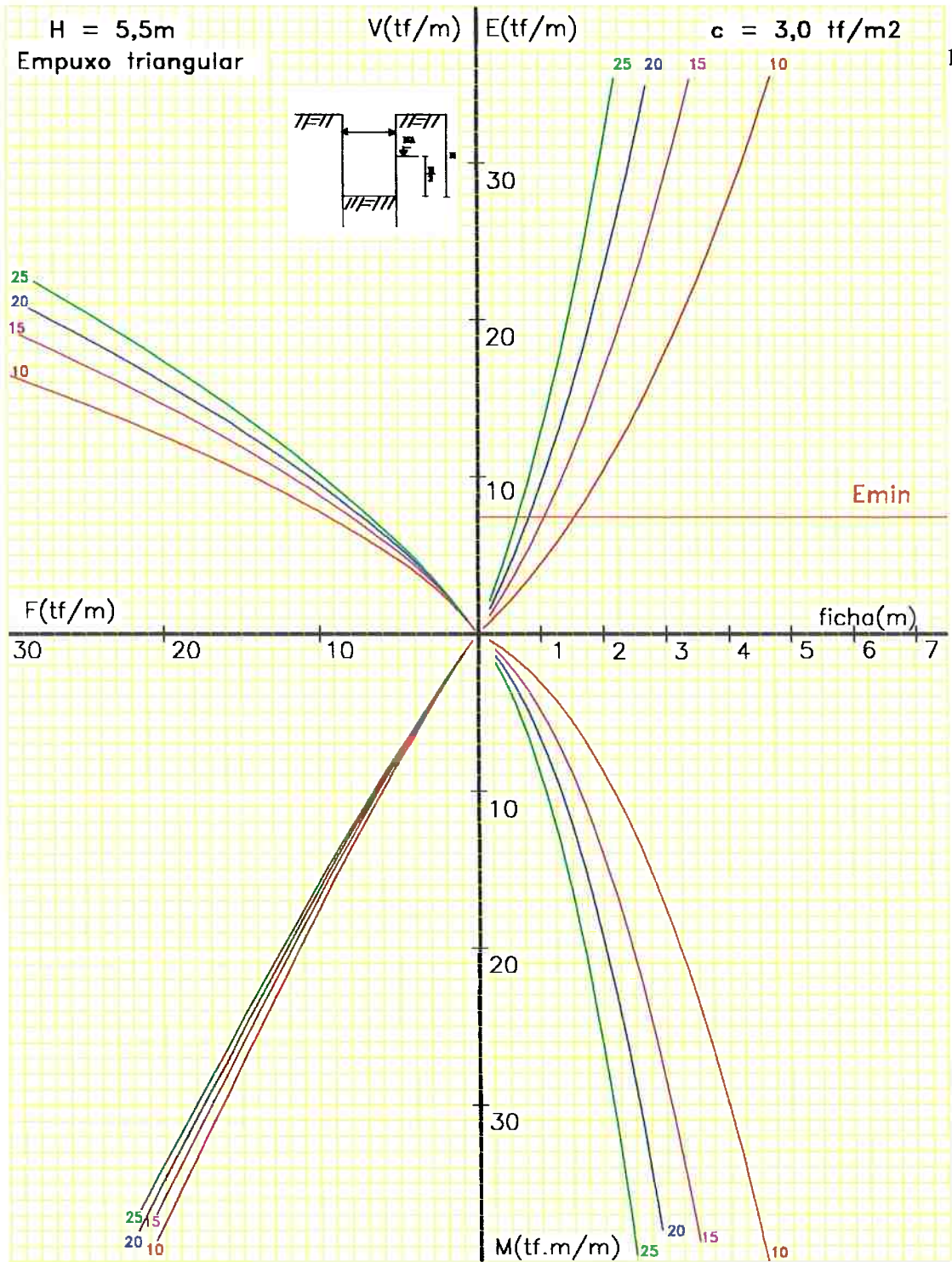


Fig. I.138- Ábaco tipo ES1

H = 6,5 m.

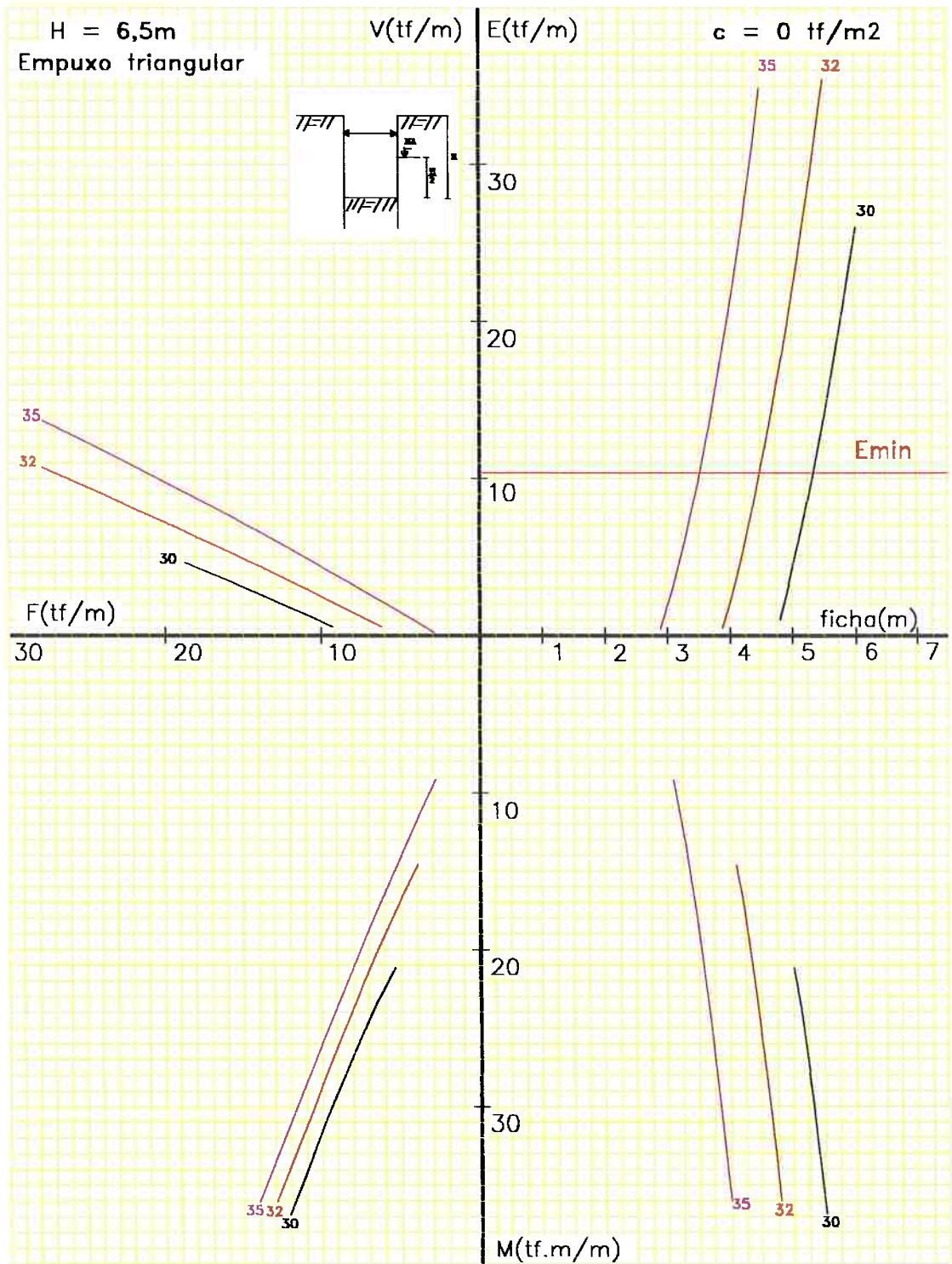


Fig. I.139- Ábaco tipo ES1

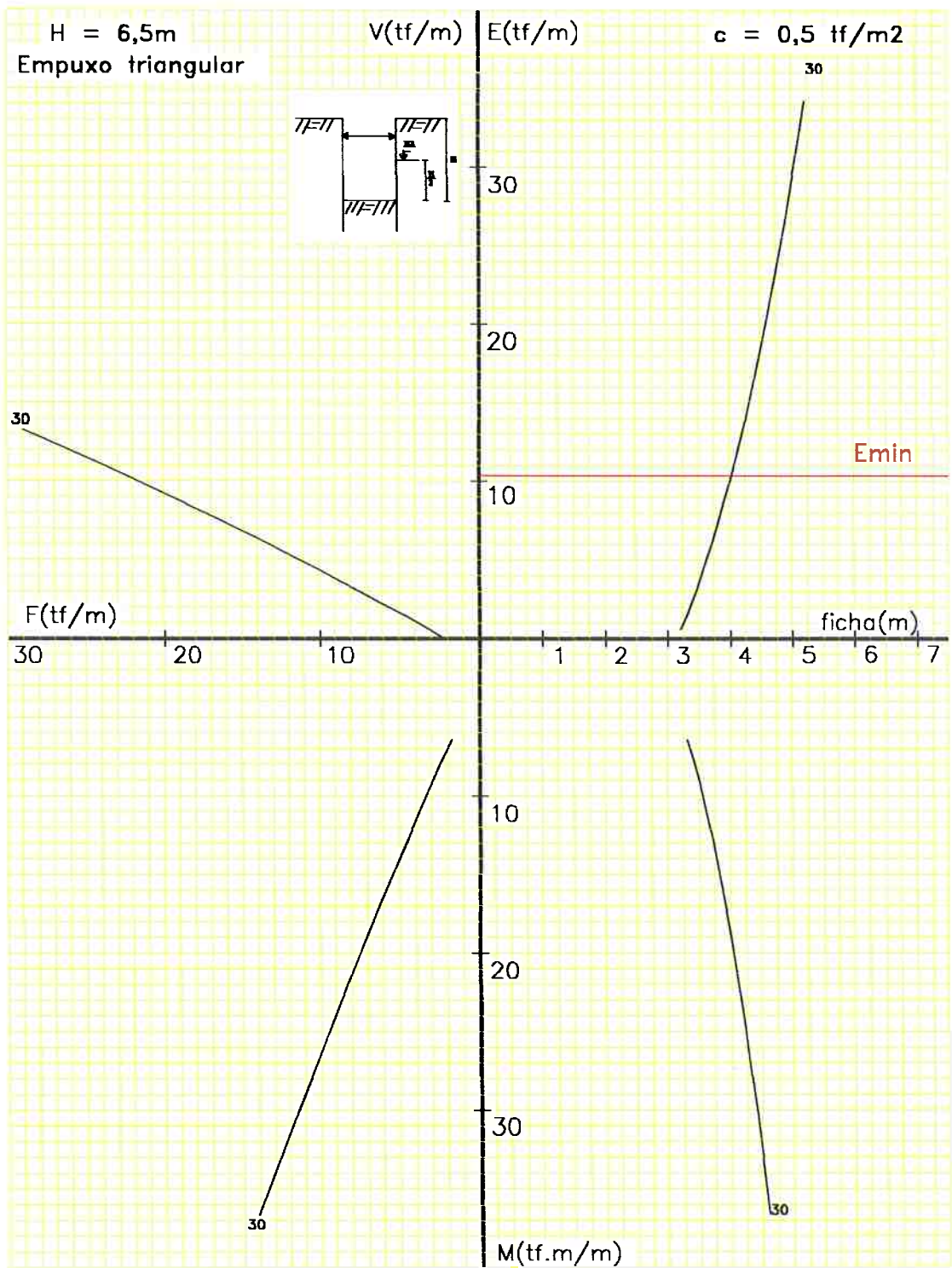


Fig. I.140- Ábaco tipo ES1

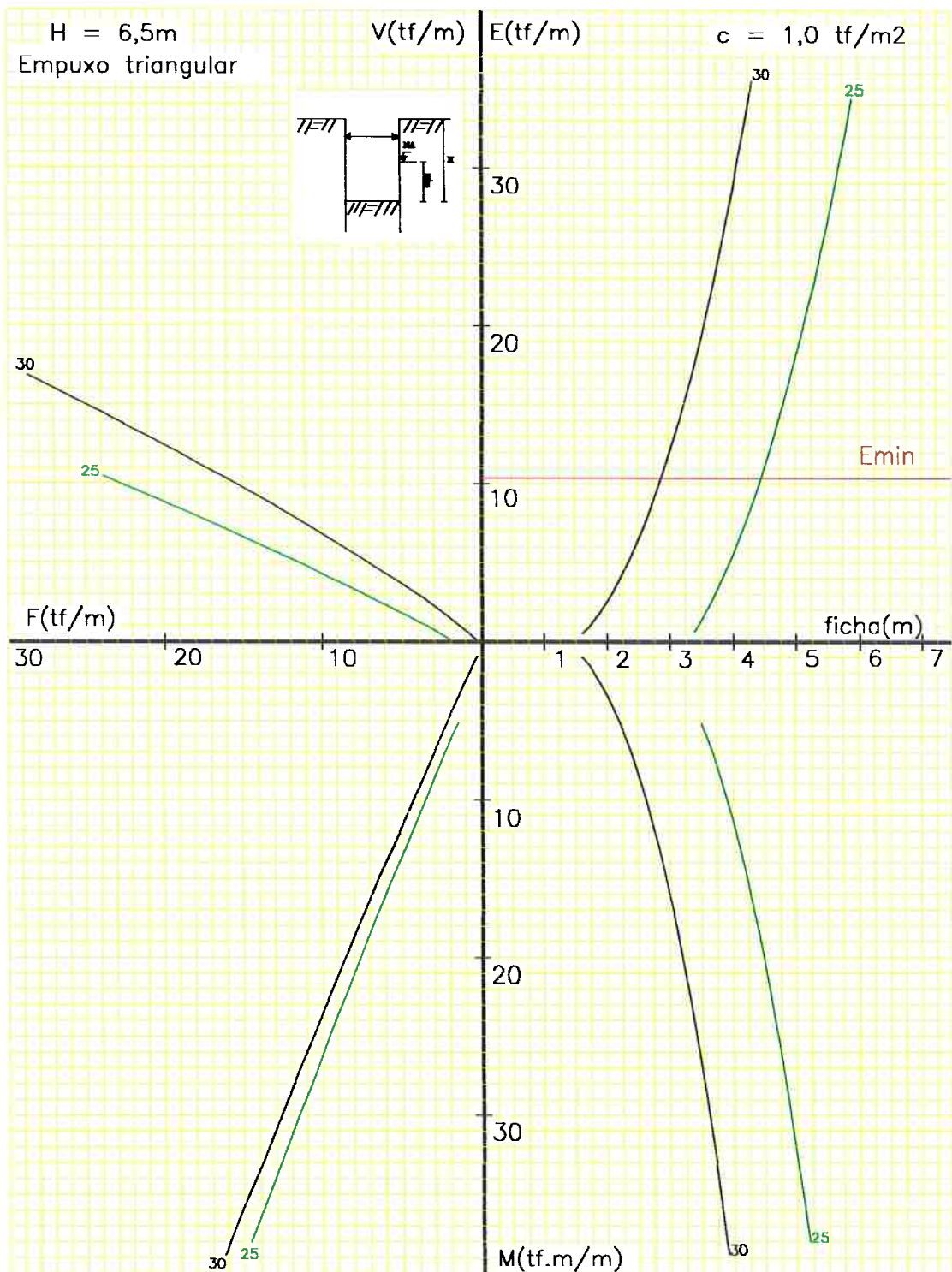


Fig. I.141- Ábaco tipo ES1

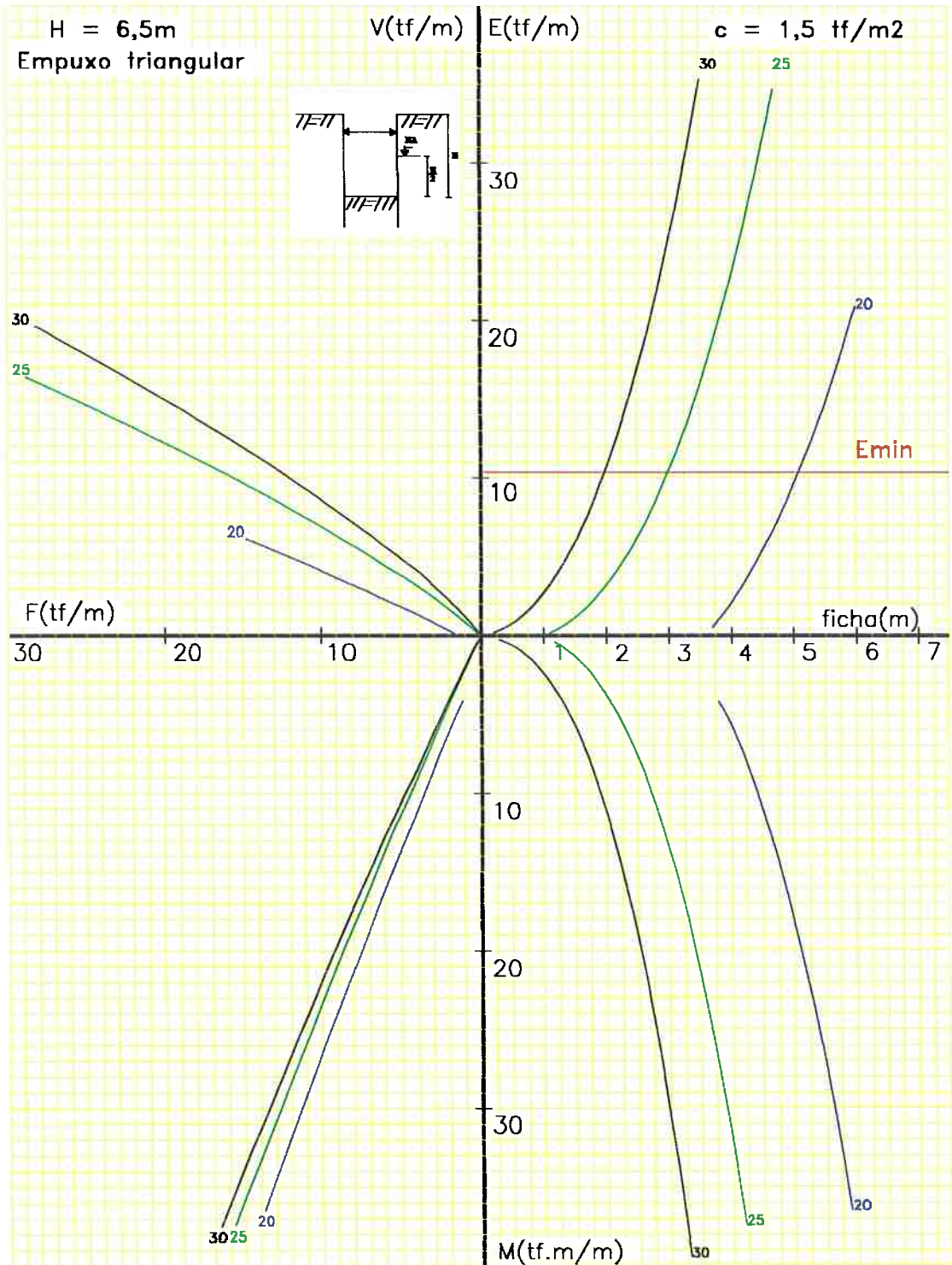


Fig. I.142- Ábaco tipo ES1

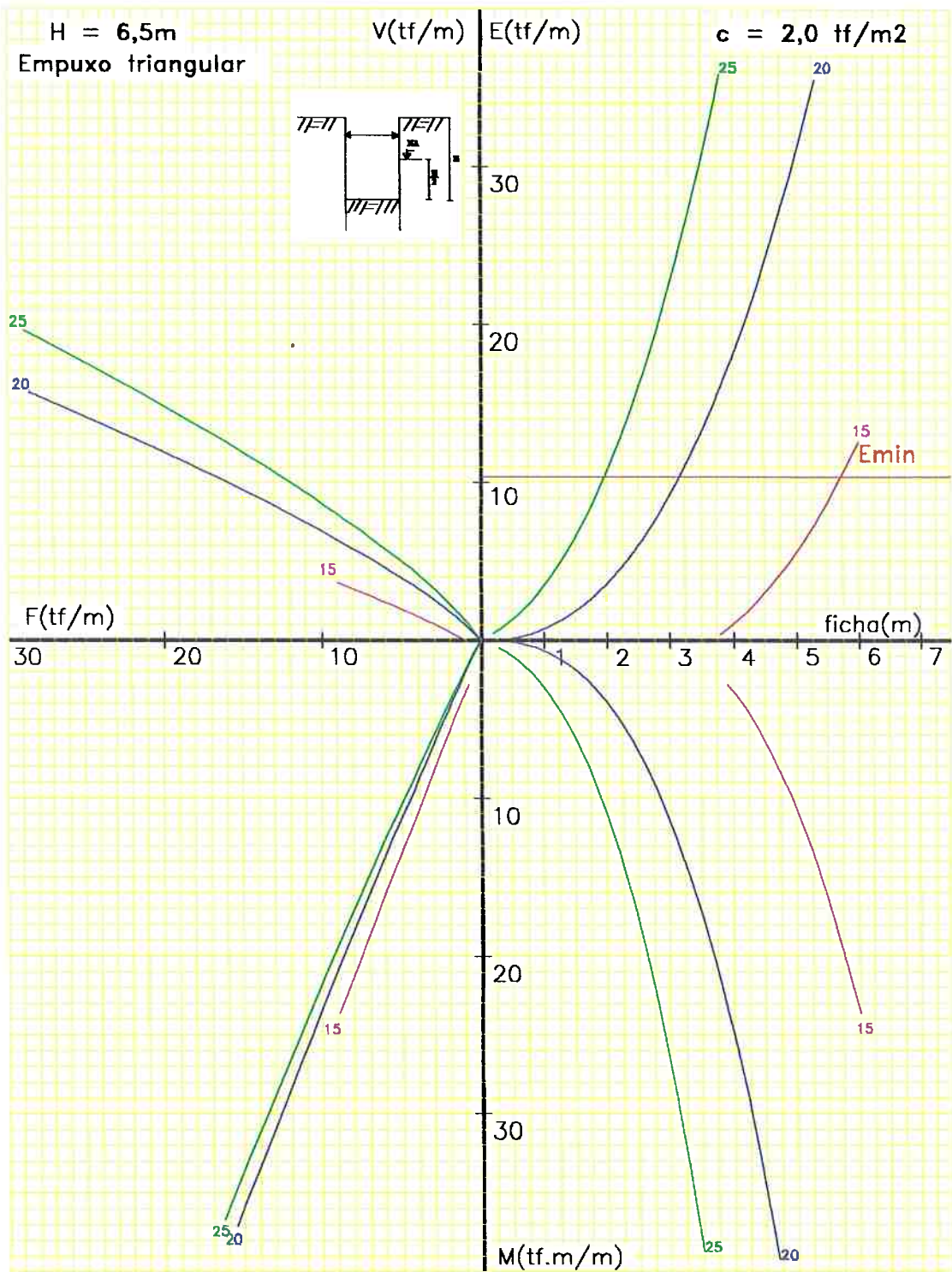


Fig. I.143- Ábaco tipo ES1

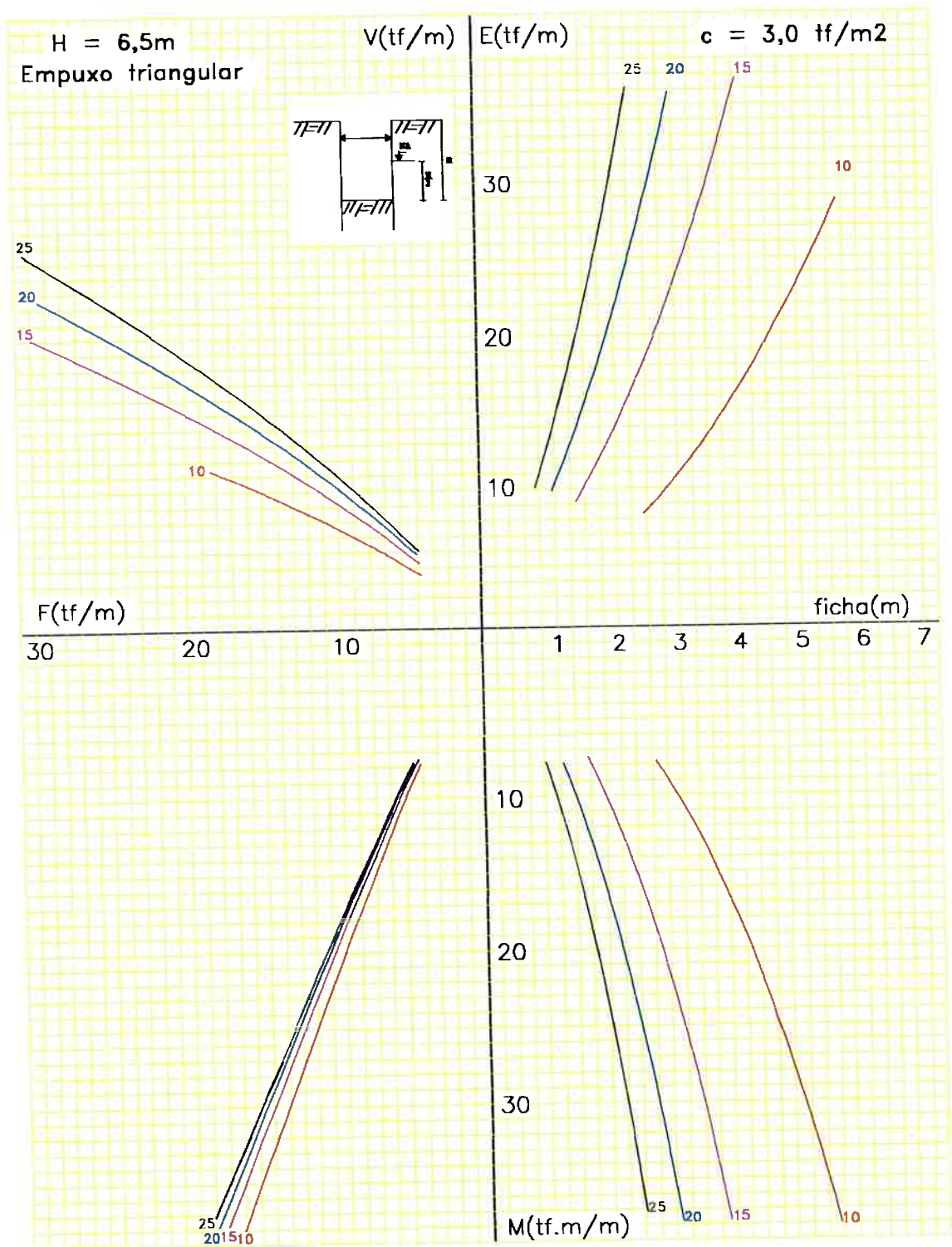


Fig. I.144- Ábaco tipo ES1

**NÍVEL DE ÁGUA
NO FUNDO DA ESCAVAÇÃO**

H = 3,5 m

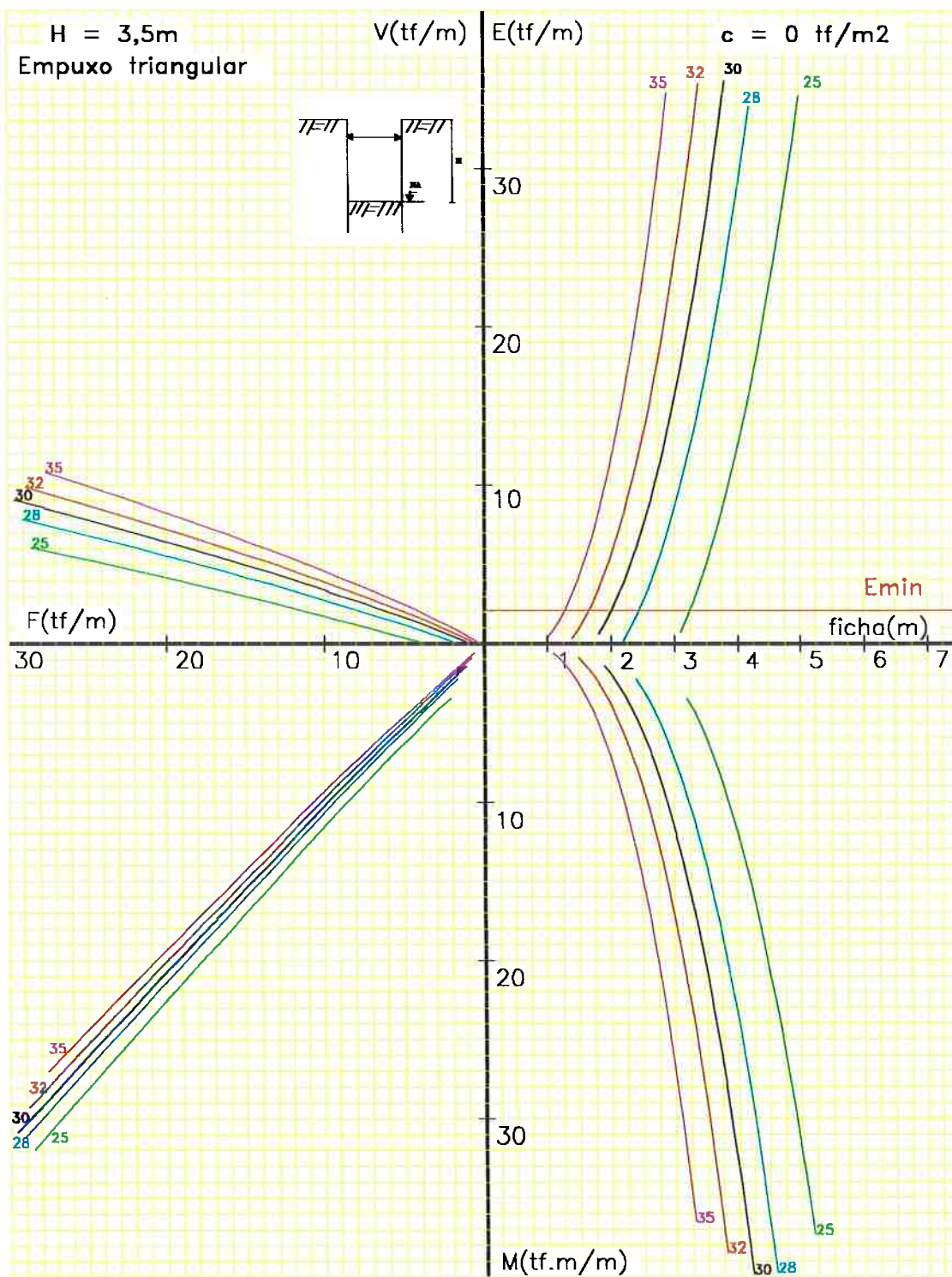


Fig. I.145- Ábaco tipo ES1

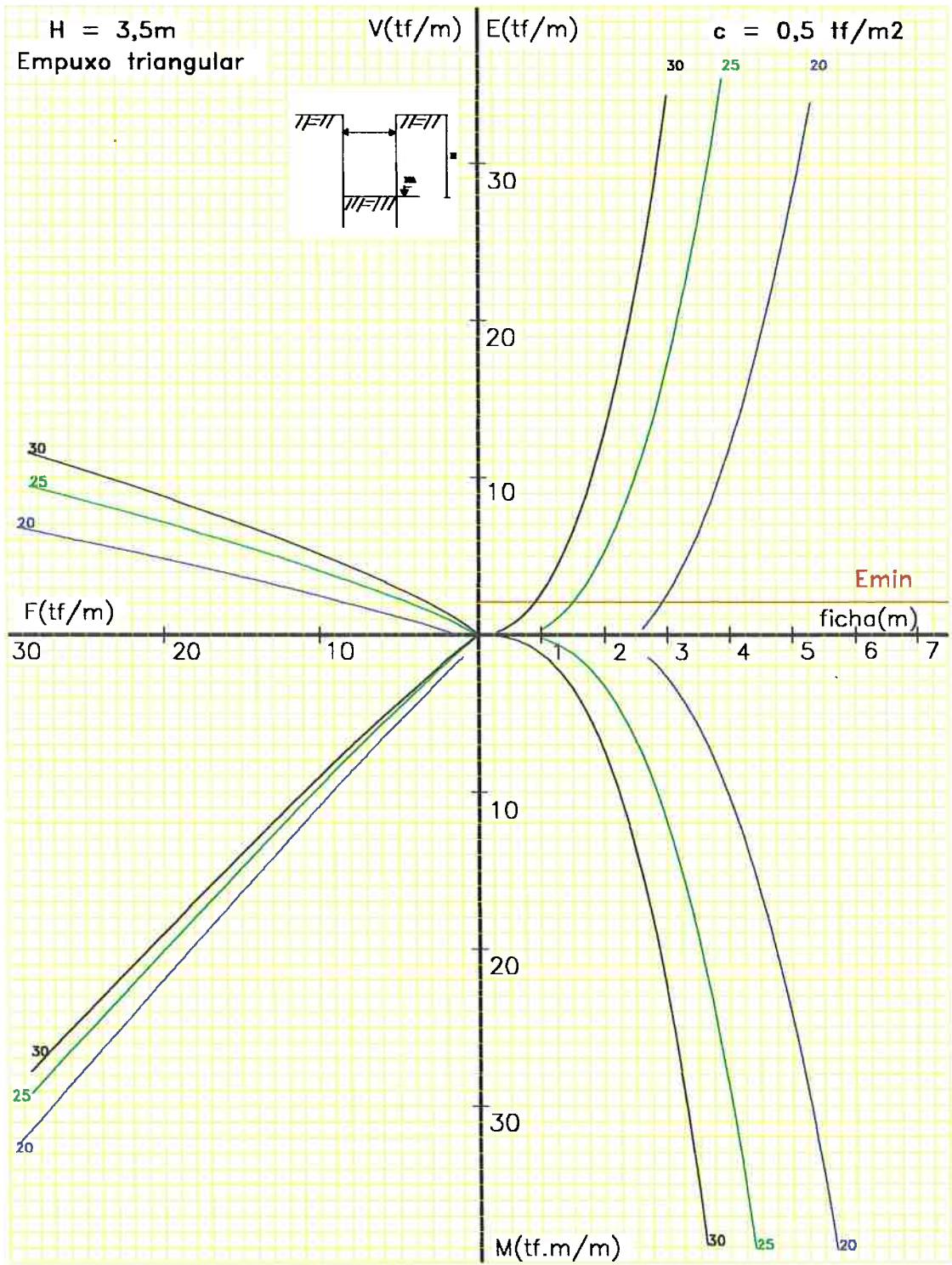


Fig. I.146- Ábaco tipo ES1

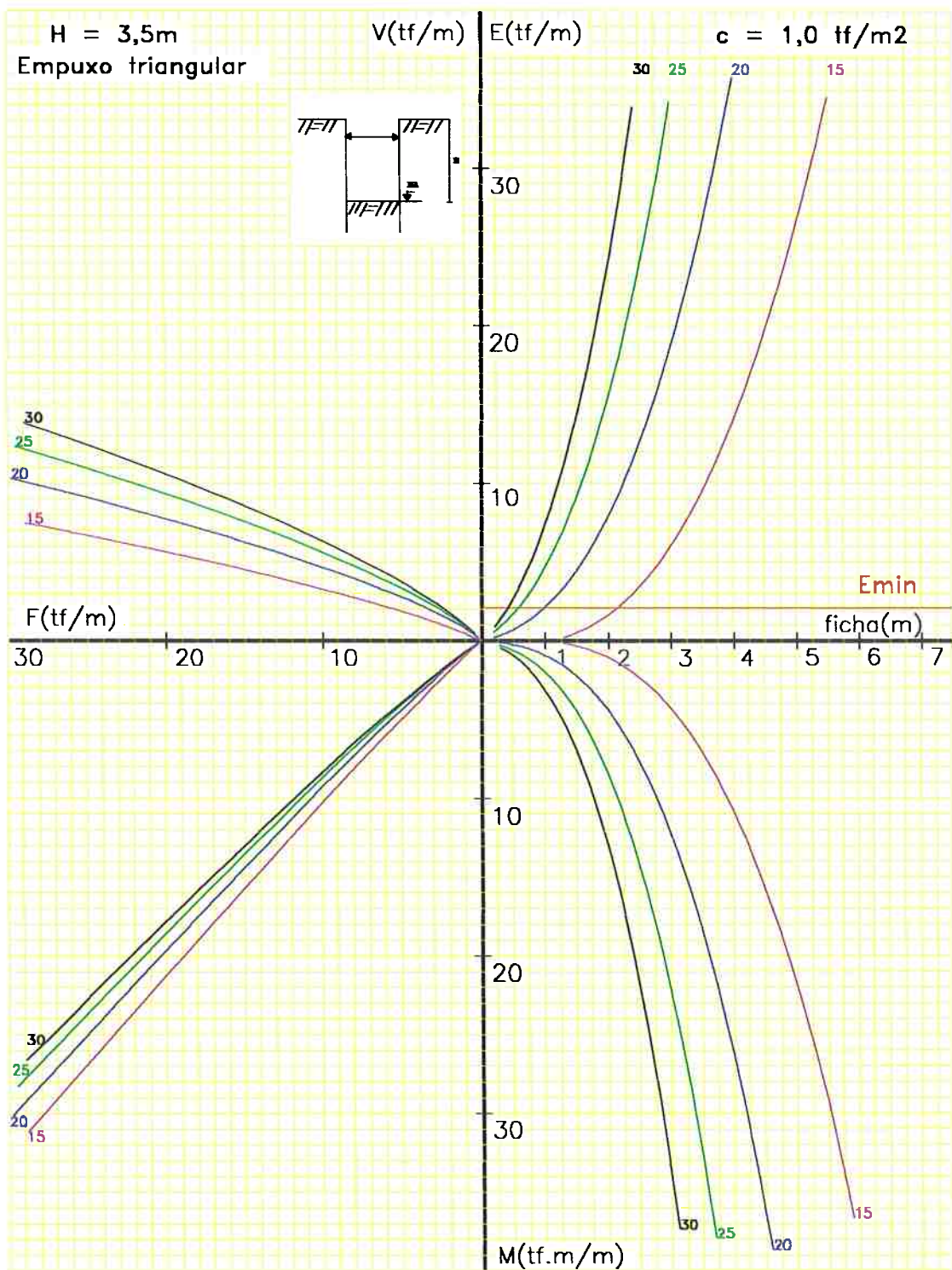


Fig. I.147- Ábaco tipo ES1

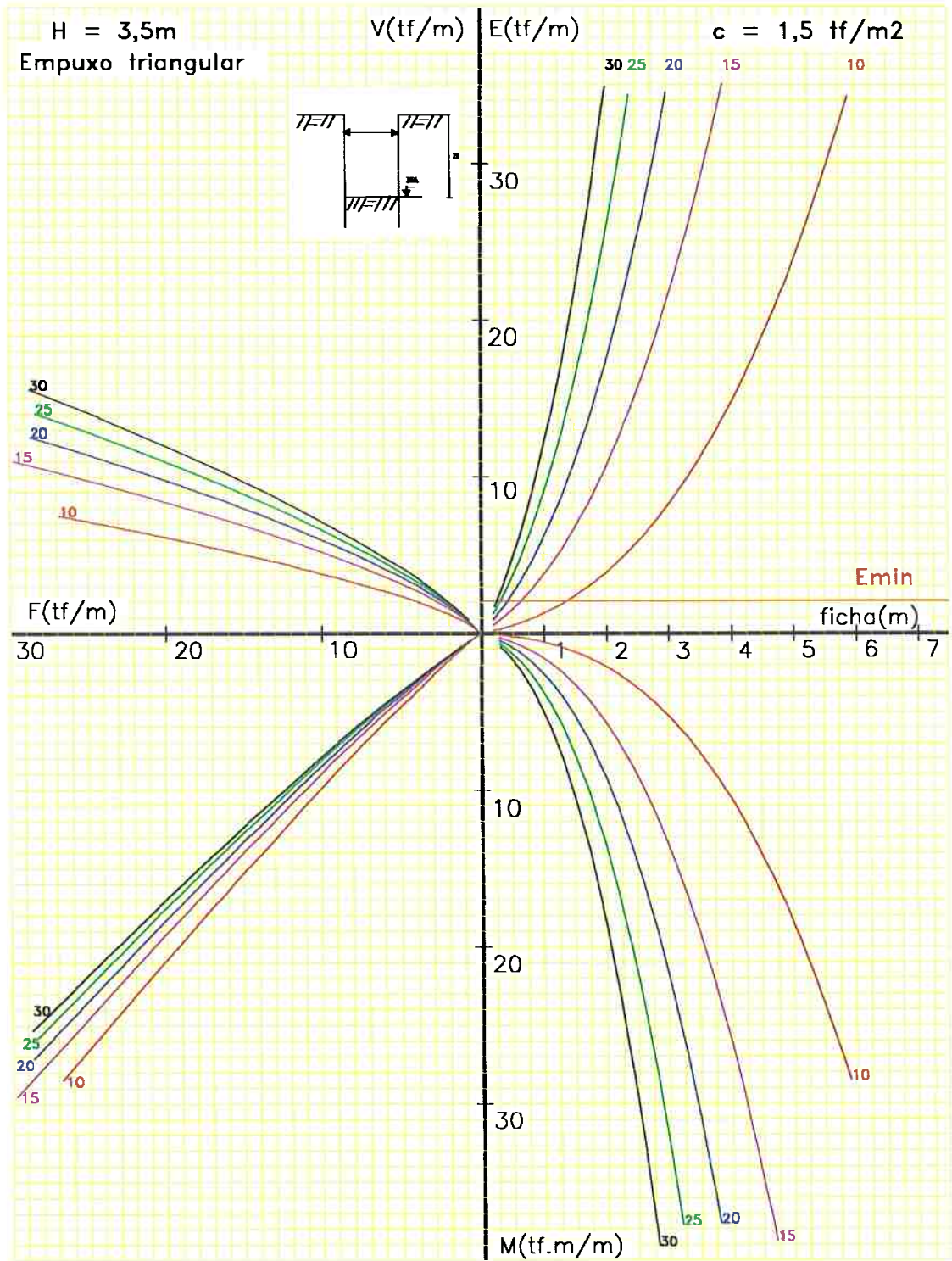


Fig. I.148- Ábaco tipo ES1

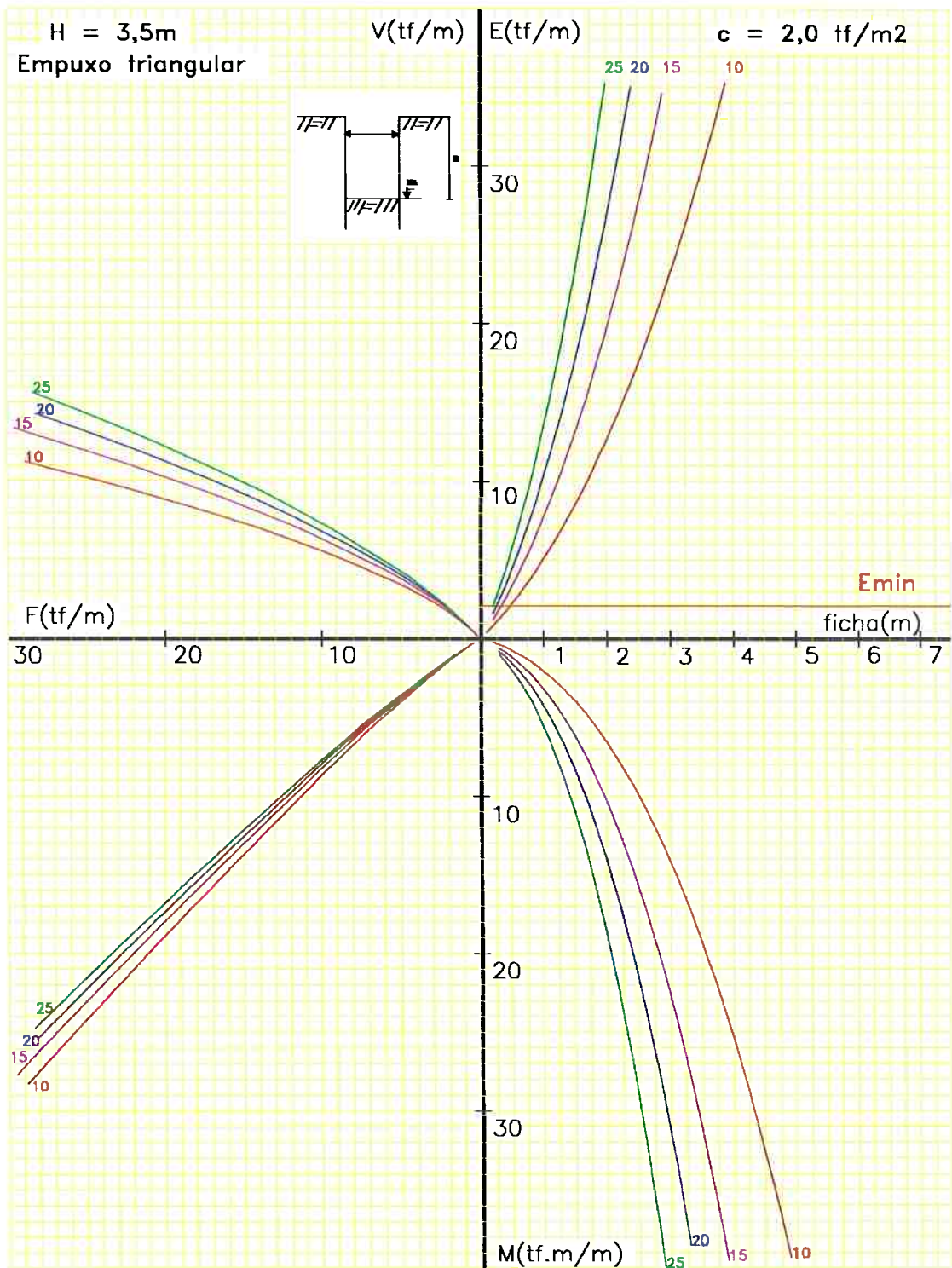


Fig. I.149- Ábaco tipo ES1

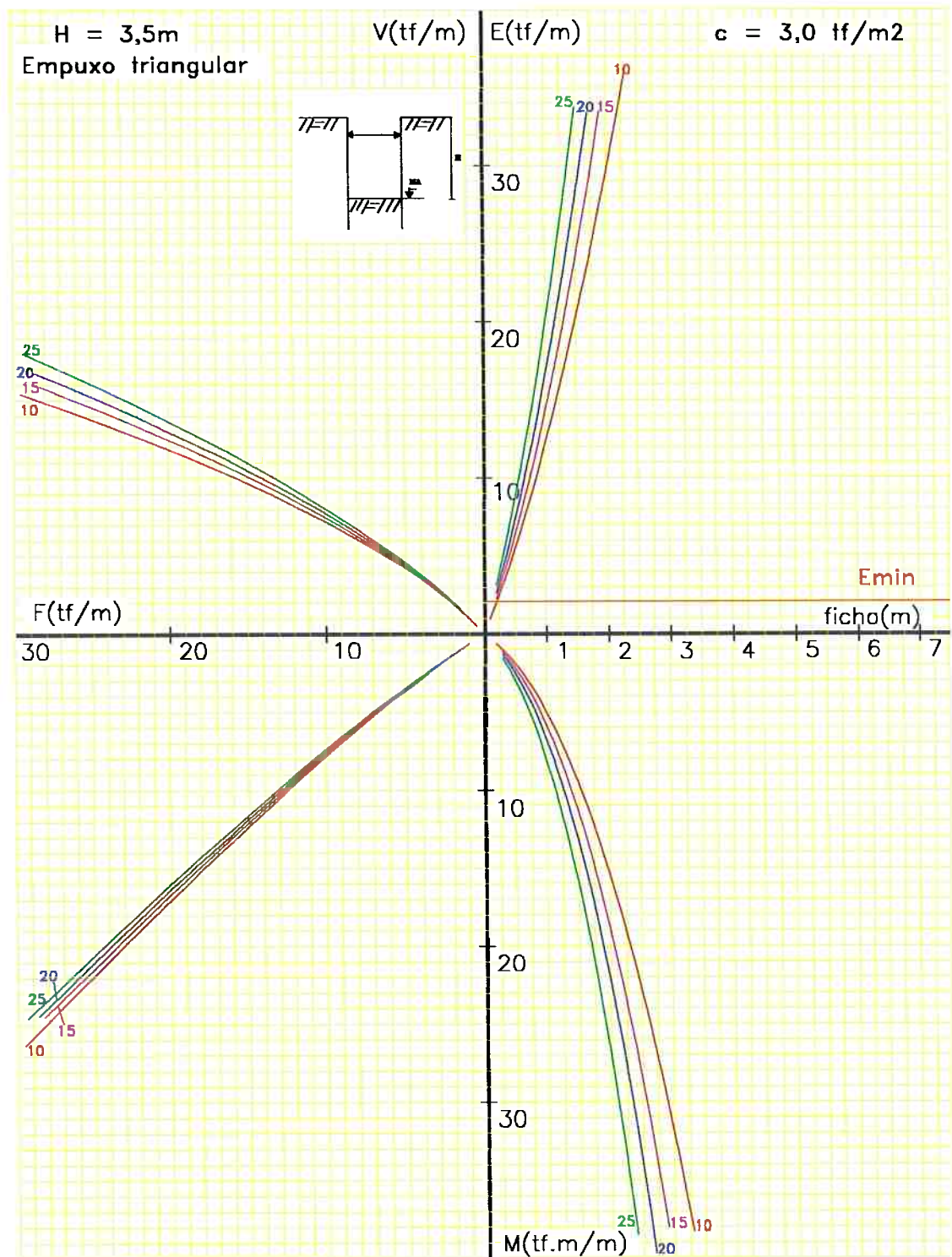


Fig. I.150- Ábaco tipo ES1

H = 4,5 m

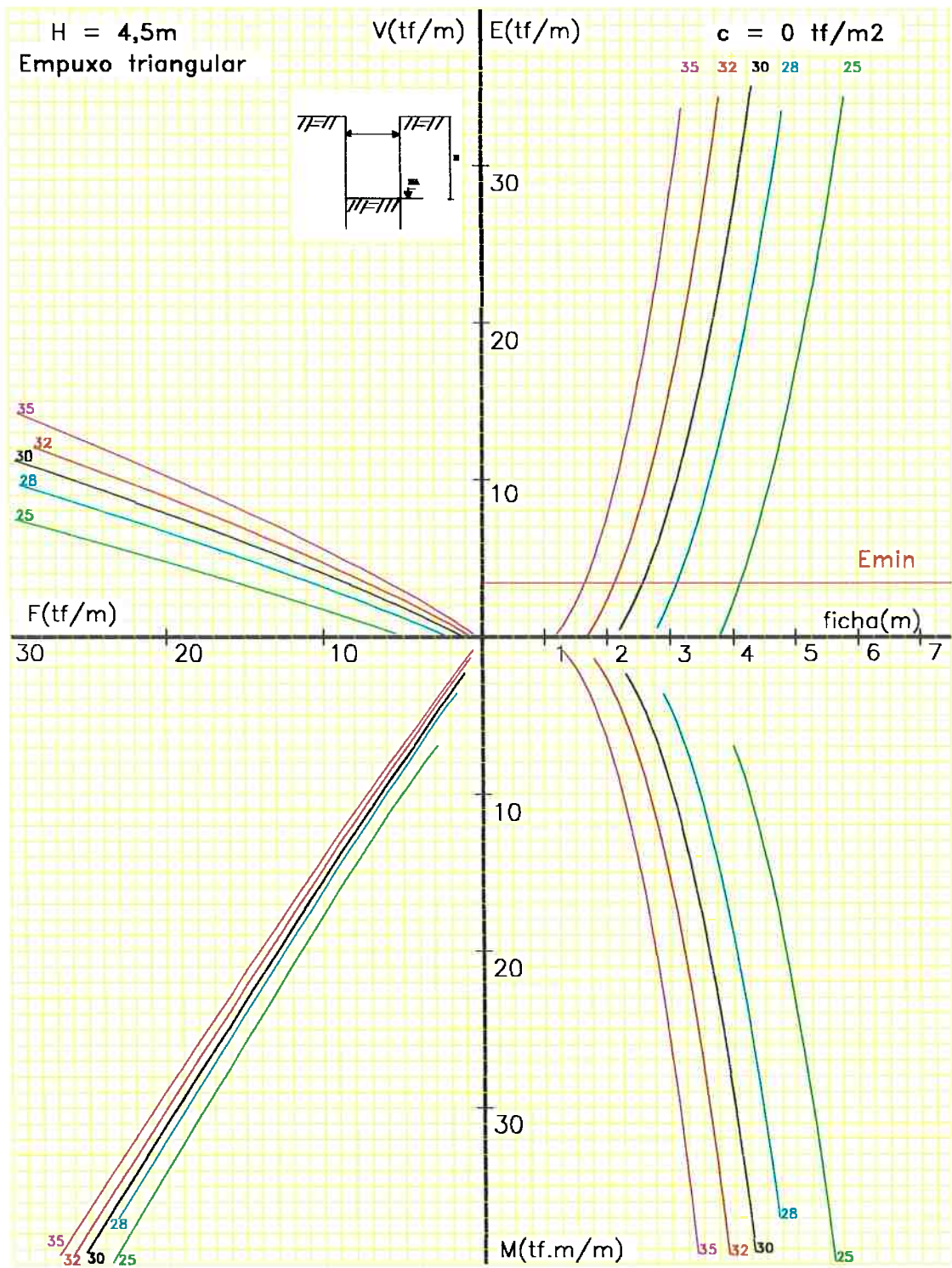


Fig. I.151- Ábaco tipo ES1

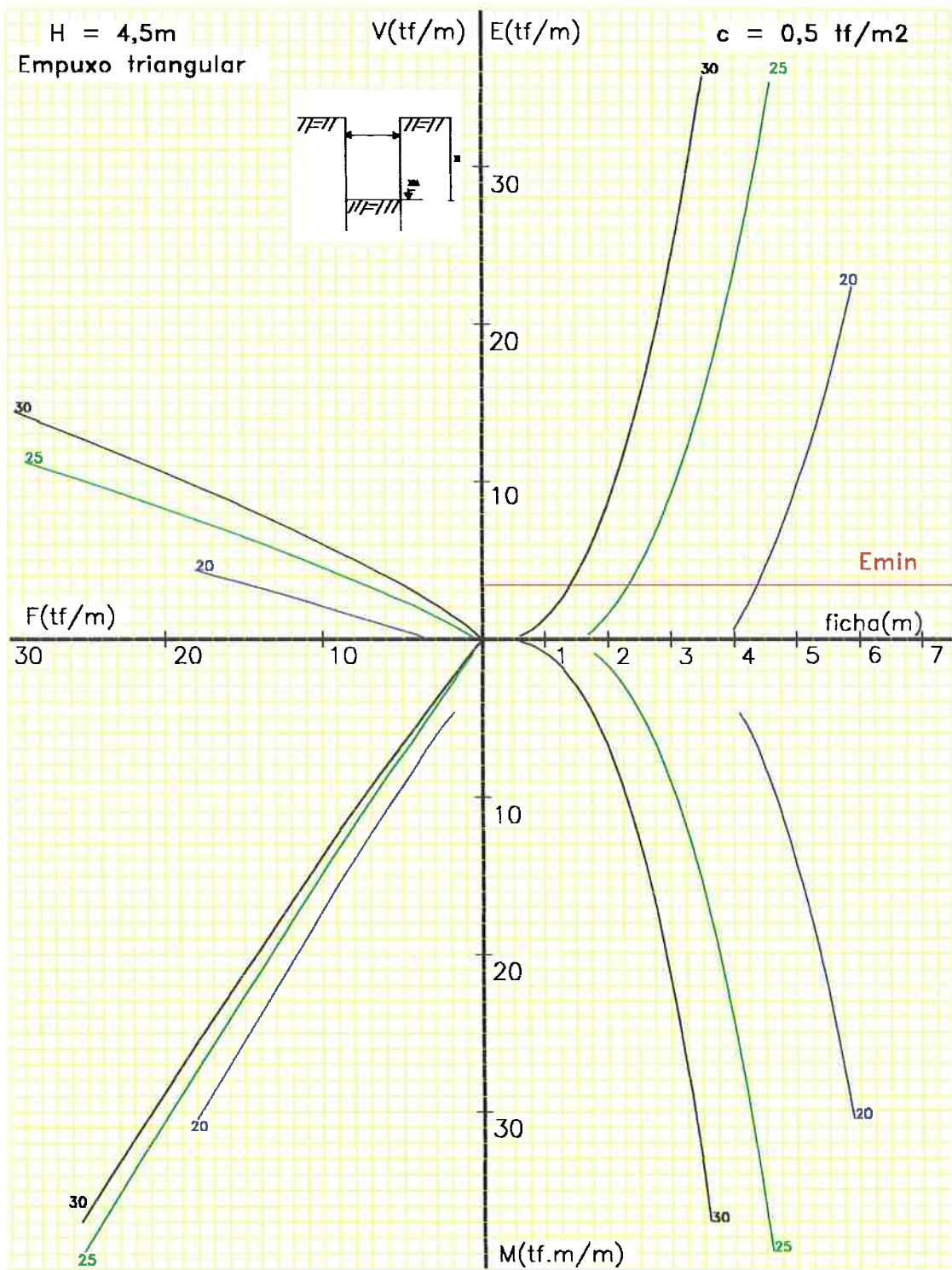


Fig. I.152- Ábaco tipo ES1

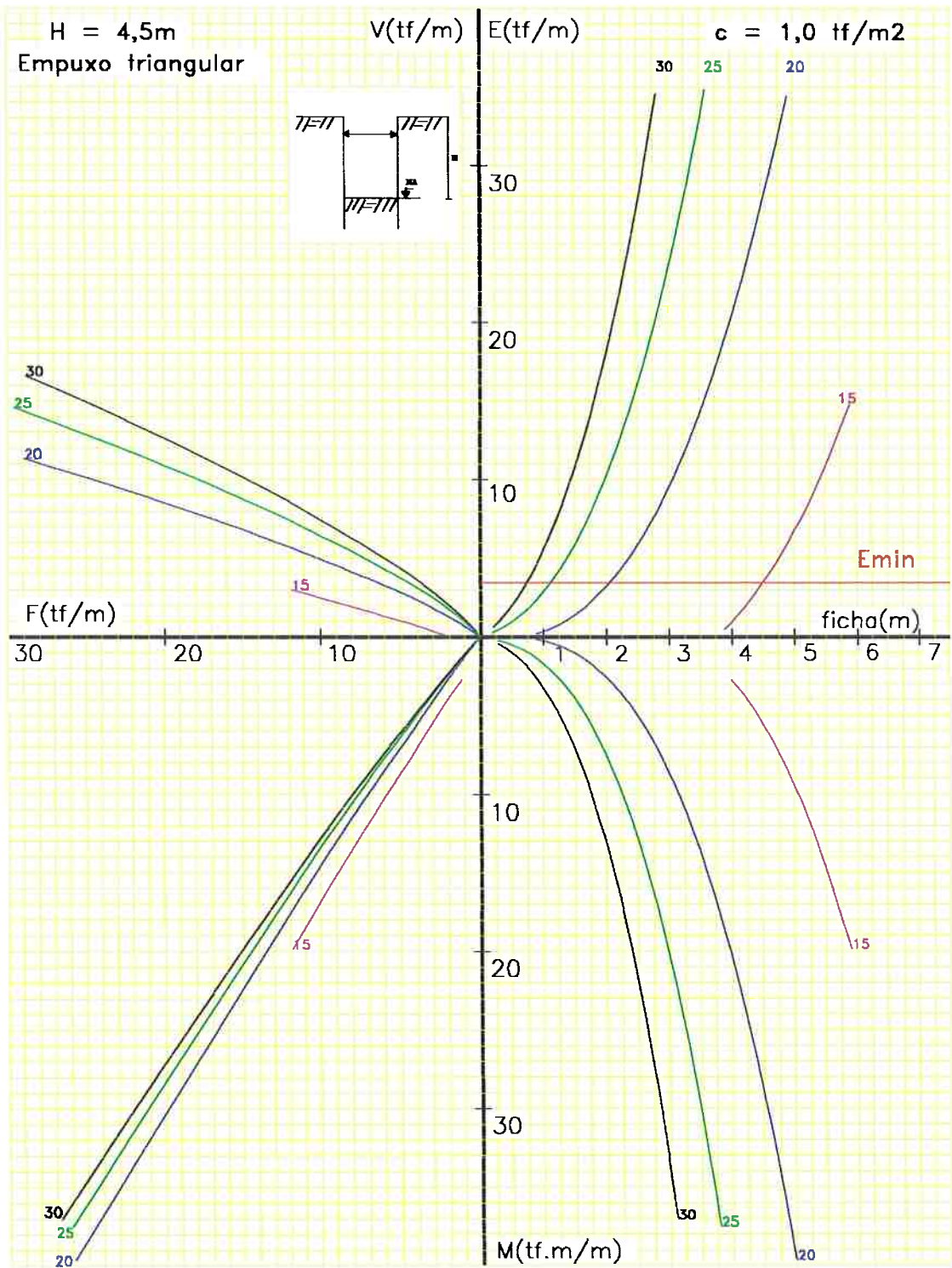


Fig. I.153- Ábaco tipo ES1

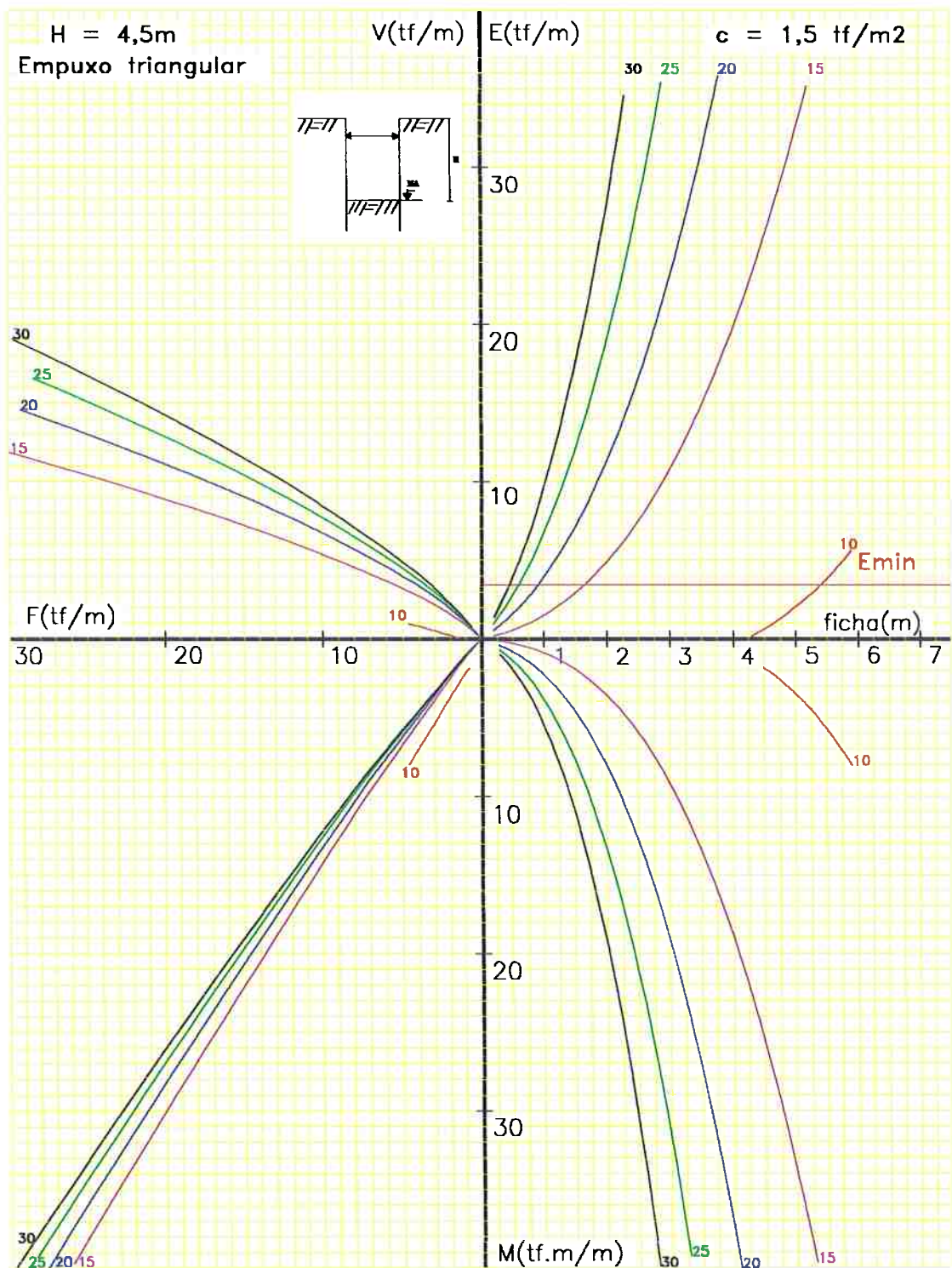


Fig. I.154- Ábaco tipo ES1

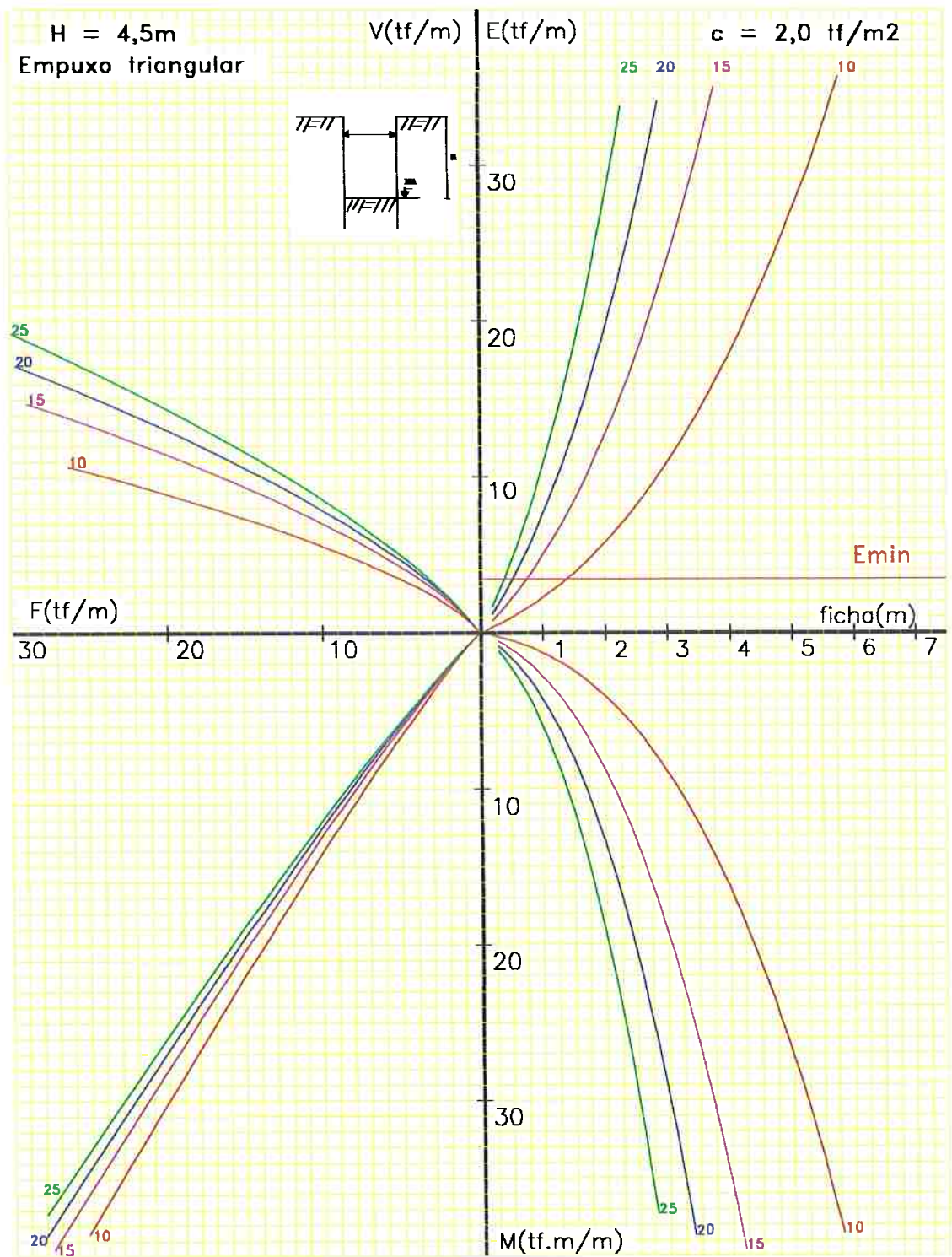


Fig. I.155- Ábaco tipo ES1

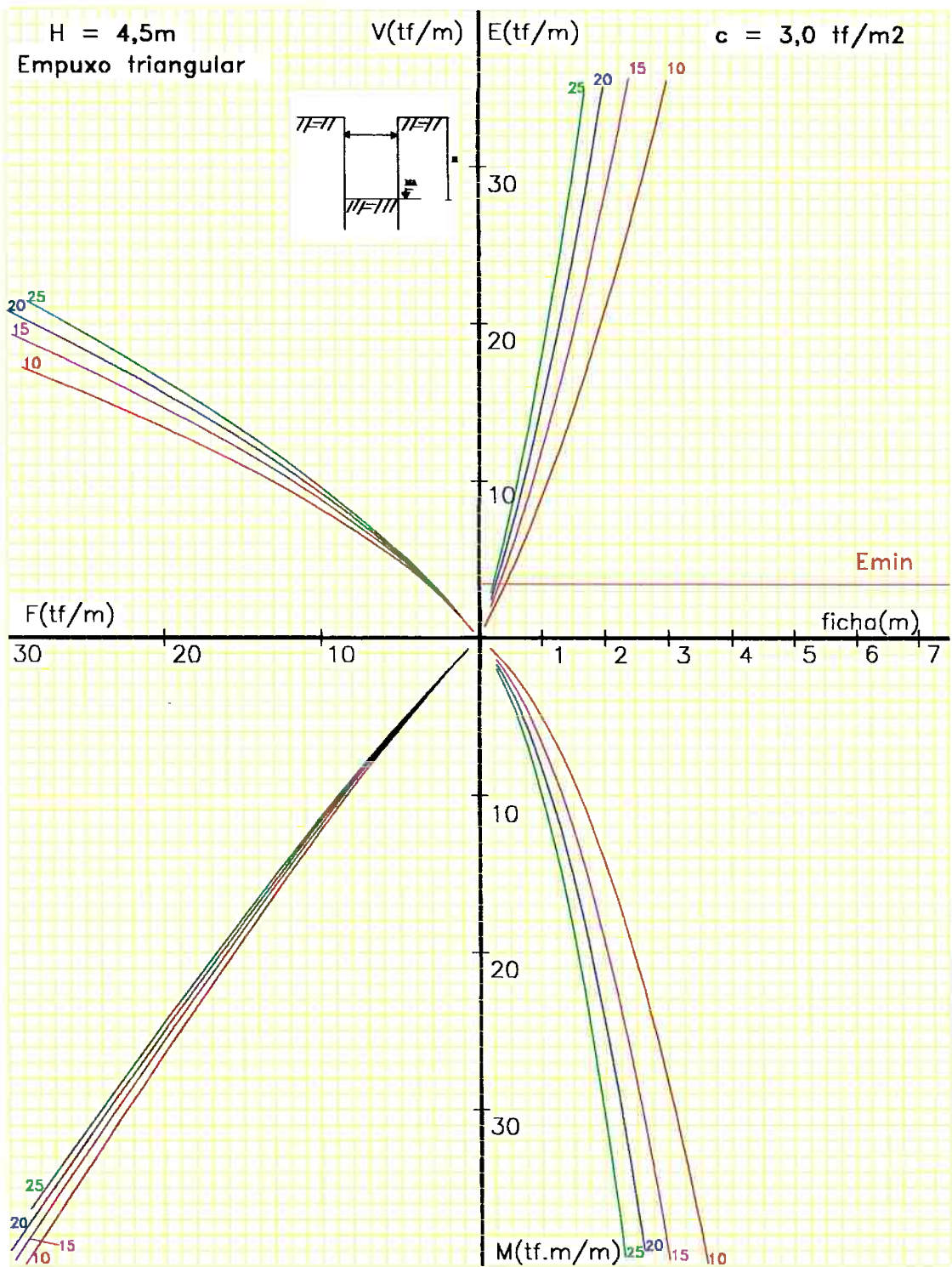


Fig. I.156- Ábaco tipo ES1

H = 5,5 m

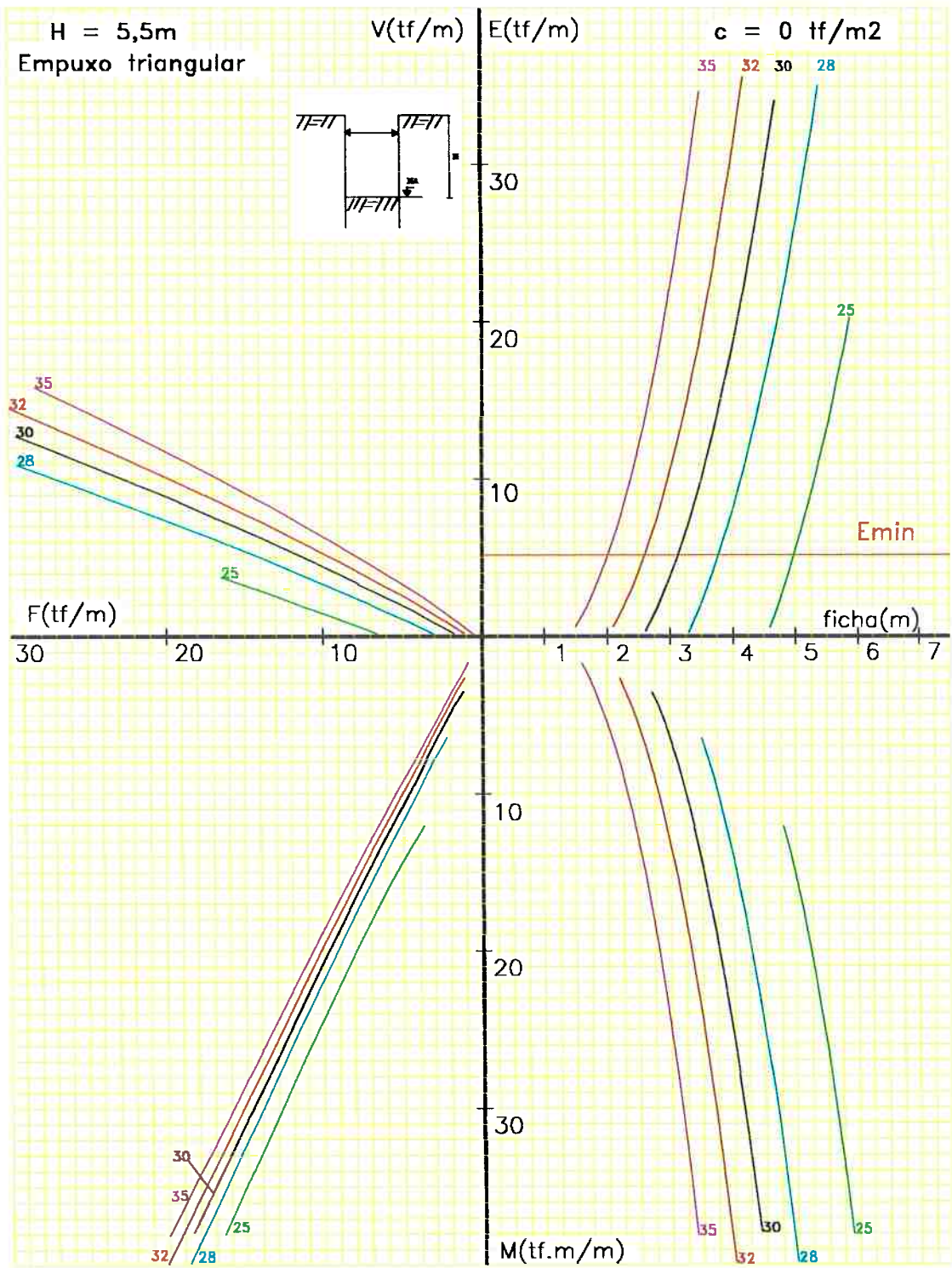


Fig. I.157- Ábaco tipo ES1

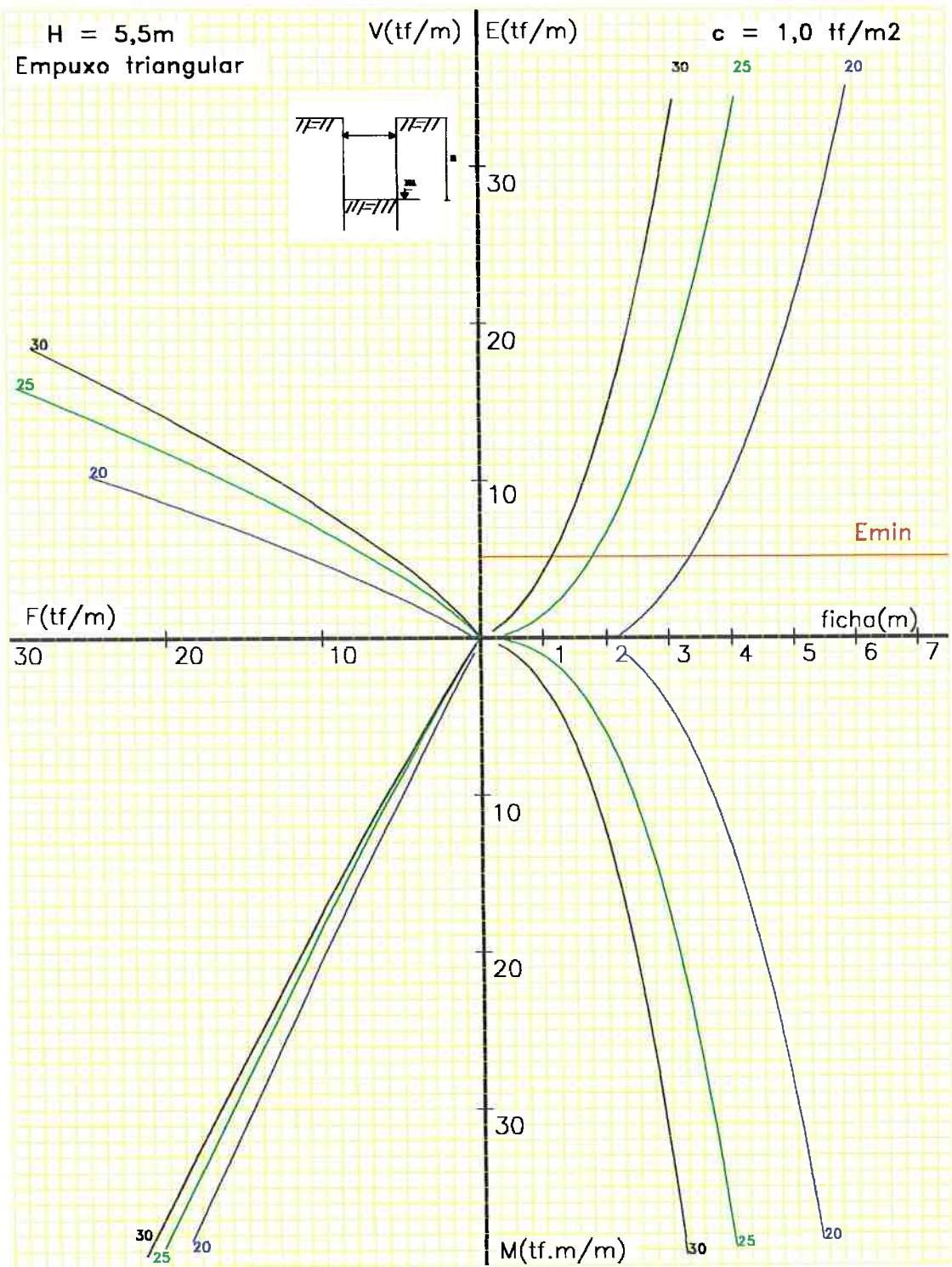


Fig. I.159- Ábaco tipo ES1

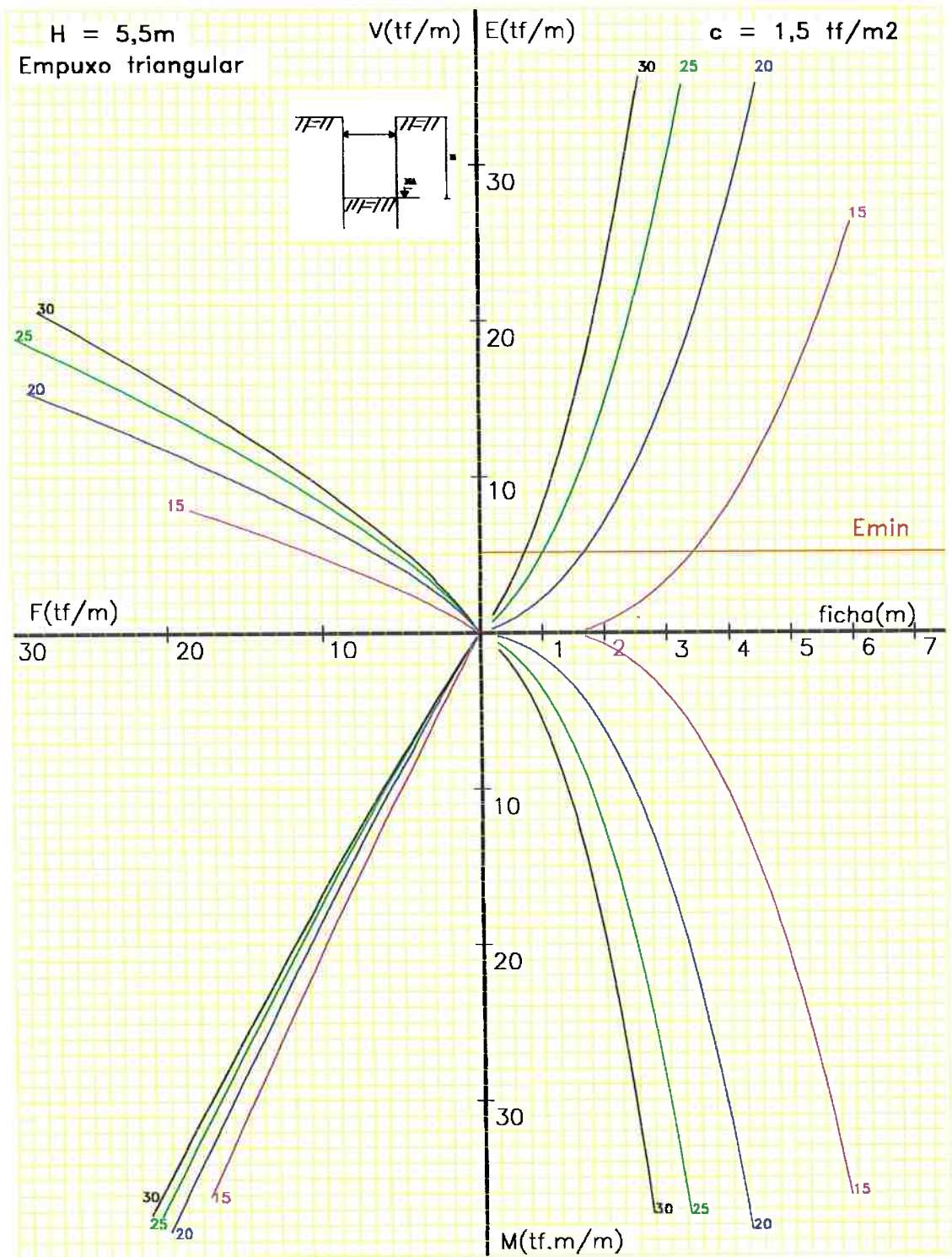


Fig. I.160- Ábaco tipo ES1

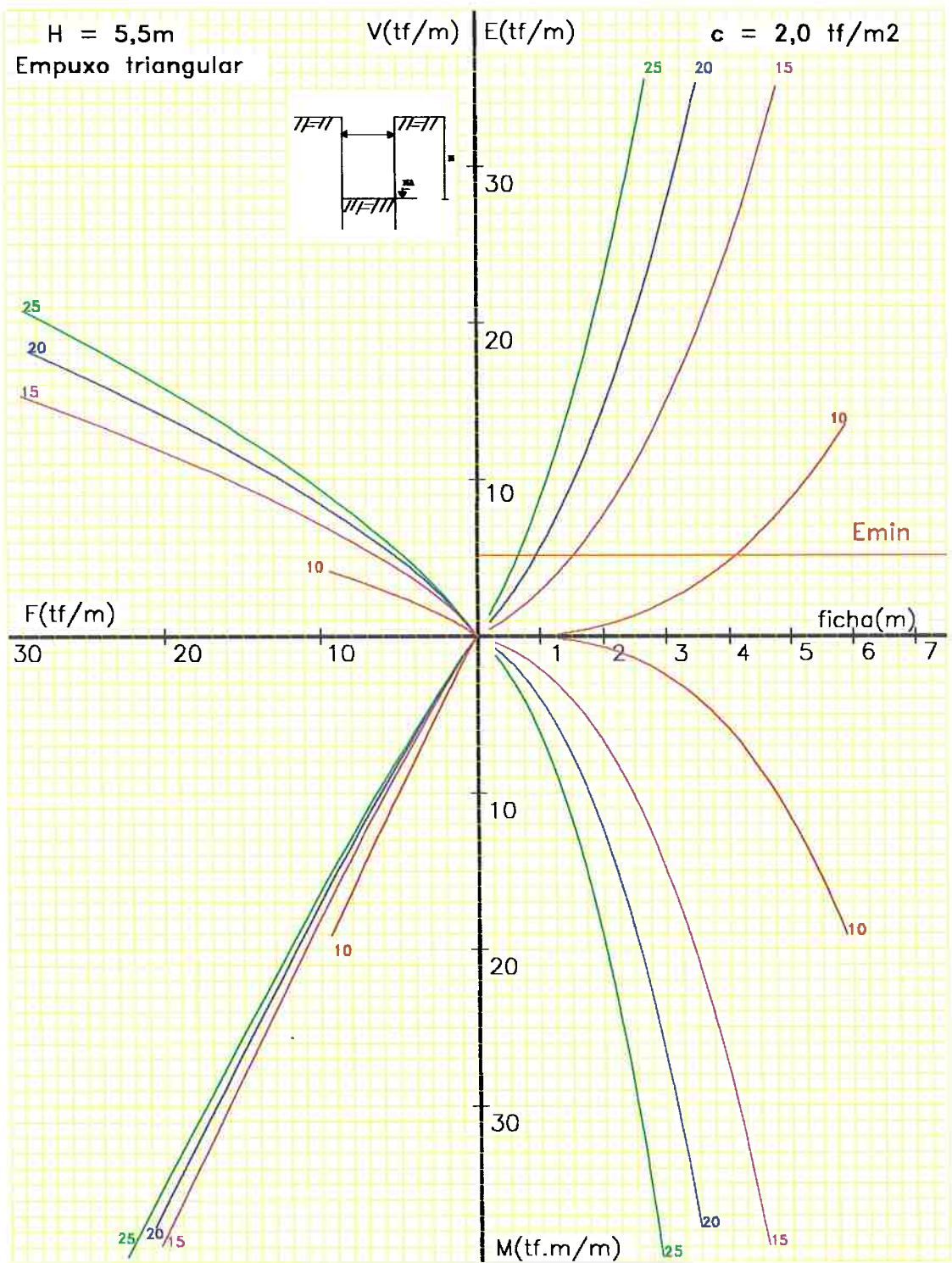


Fig. I.161- Ábaco tipo ES1

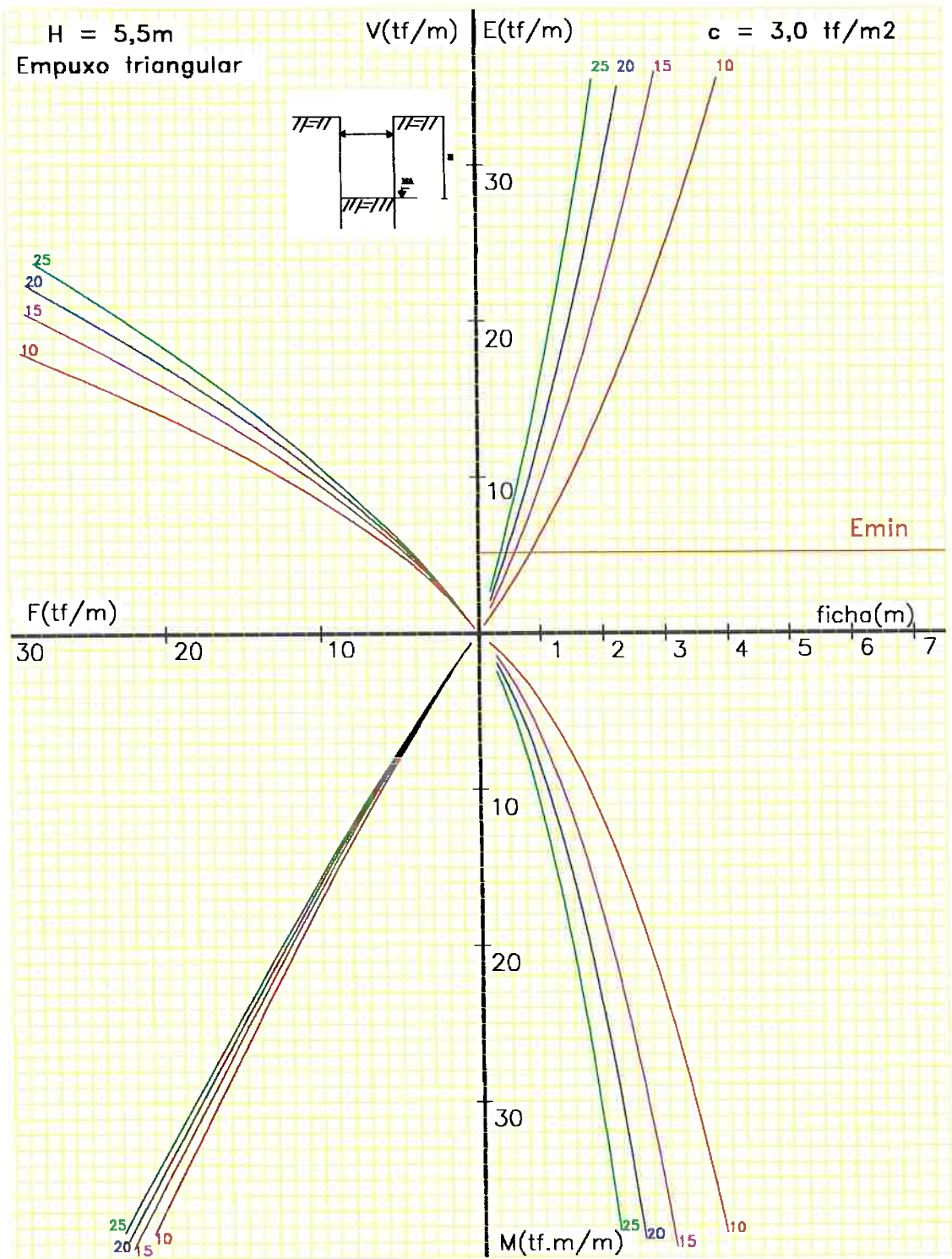


Fig. I.162- Ábaco tipo ES1

H = 6,5 m

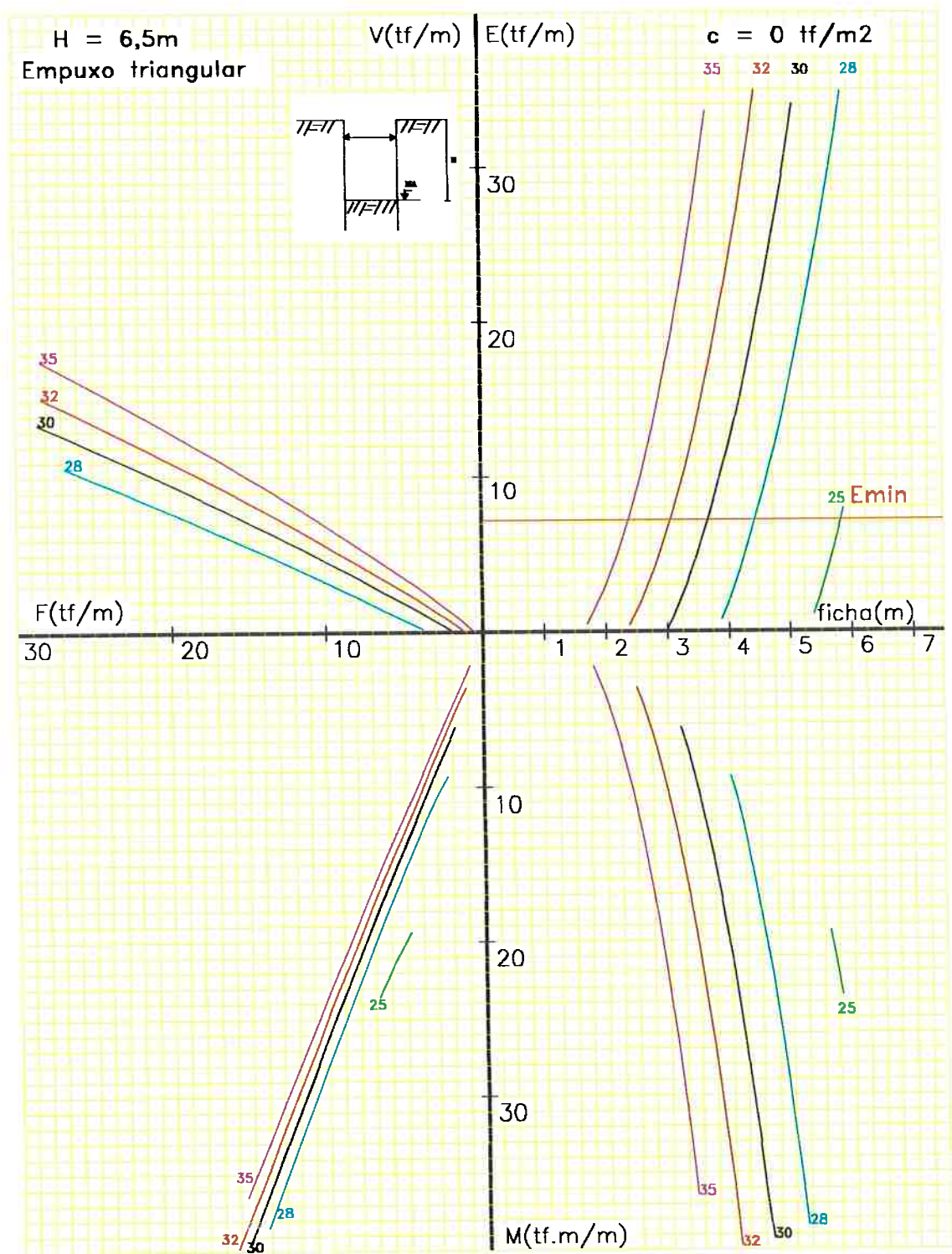


Fig. I.163- Ábaco tipo ES1

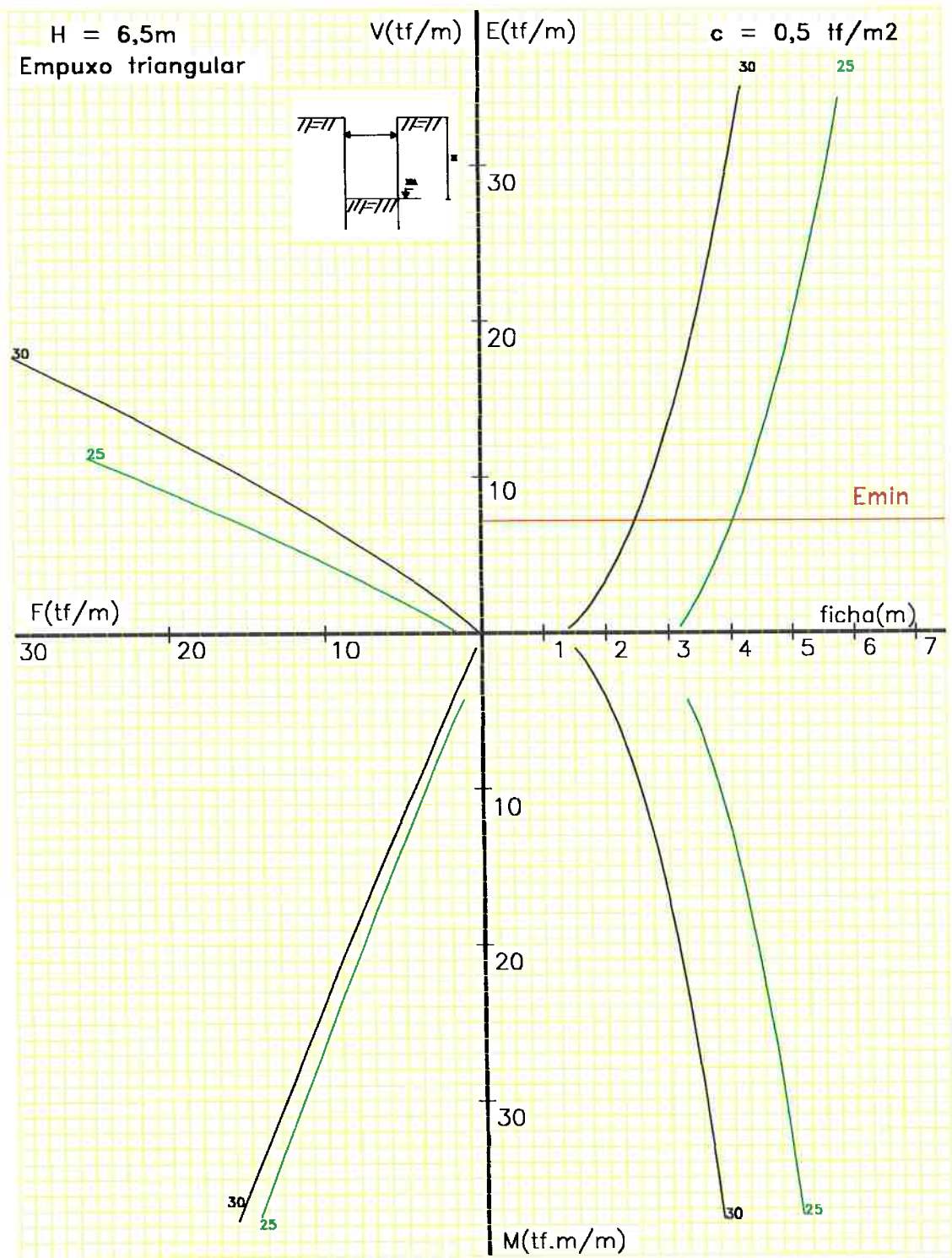


Fig. I.164- Ábaco tipo ES1

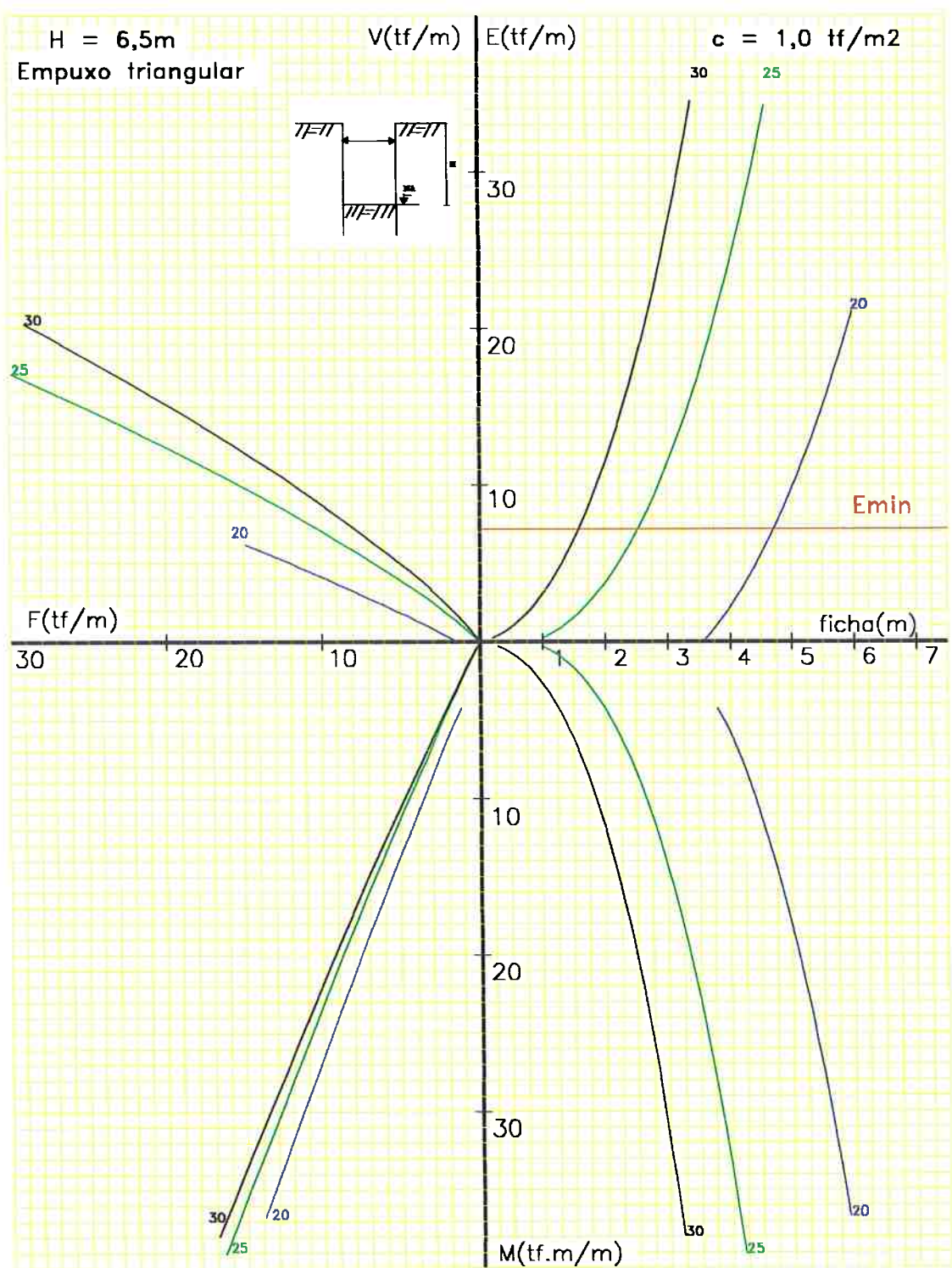


Fig. I.165- Ábaco tipo ES1

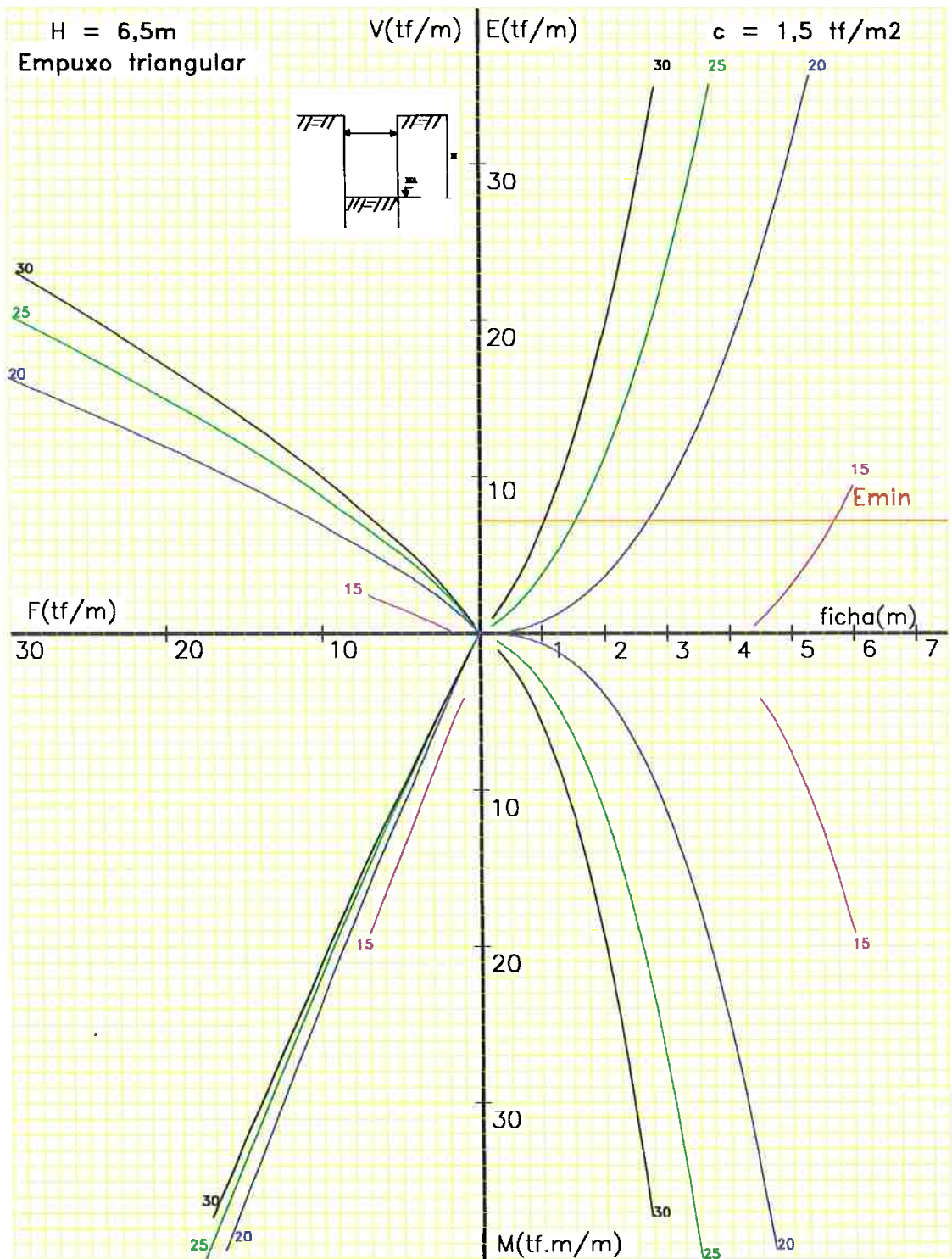


Fig. I.166- Ábaco tipo ES1

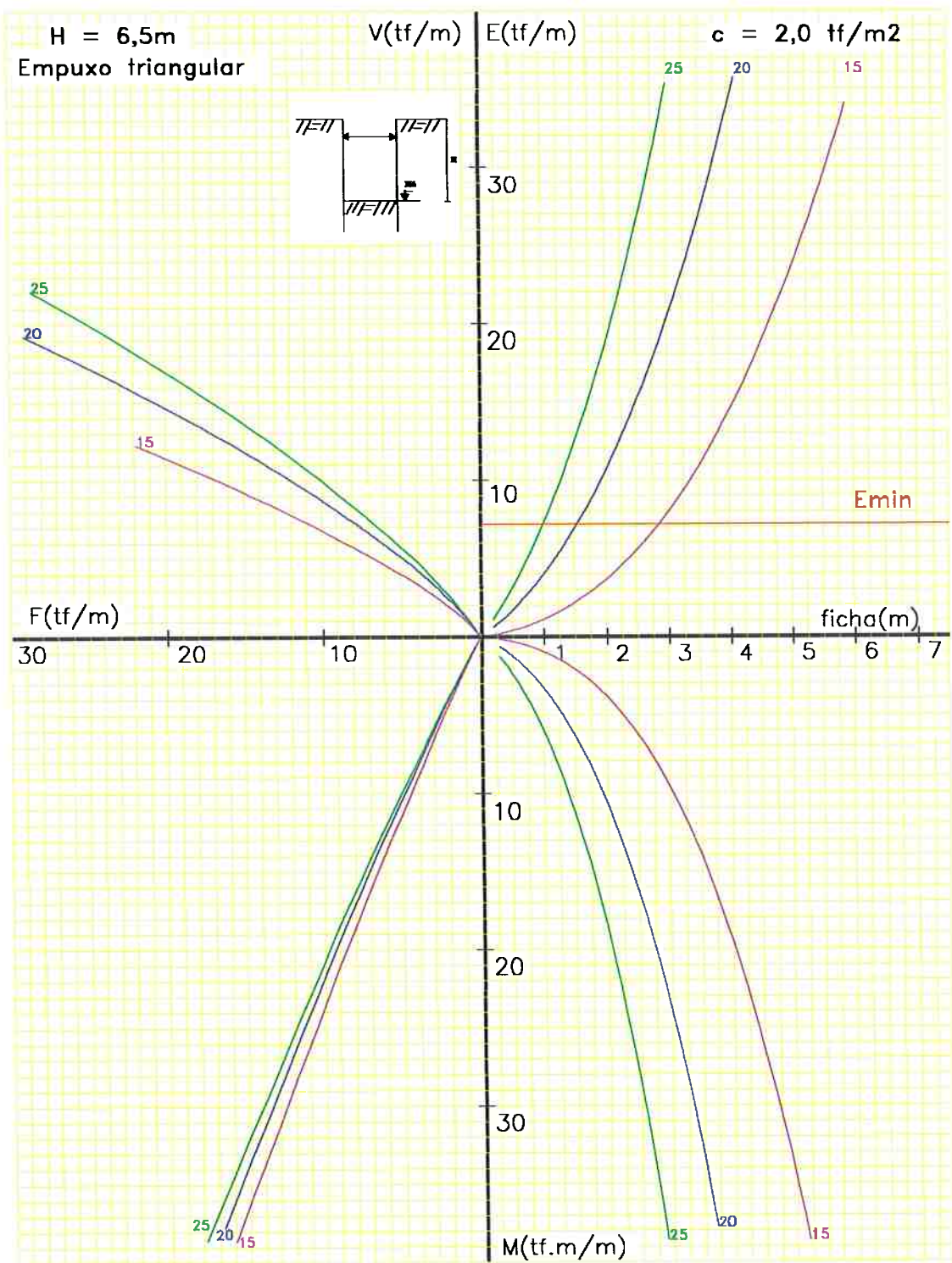


Fig. I.167- Ábaco tipo ES1

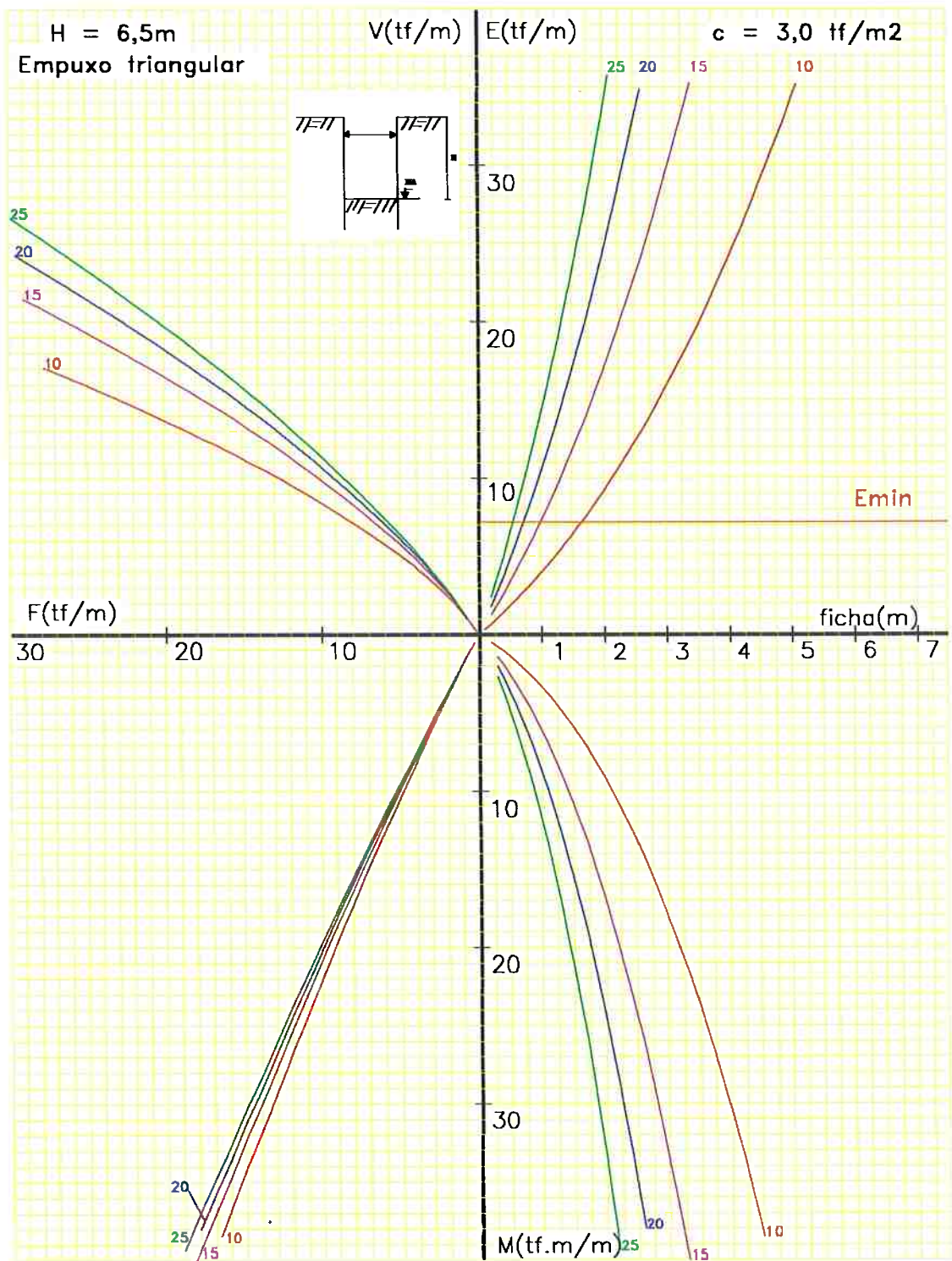


Fig. I.168- Ábaco tipo ES1

**NÍVEL DE ÁGUA
ABAIXO DA FICHA**

H = 3,5 m

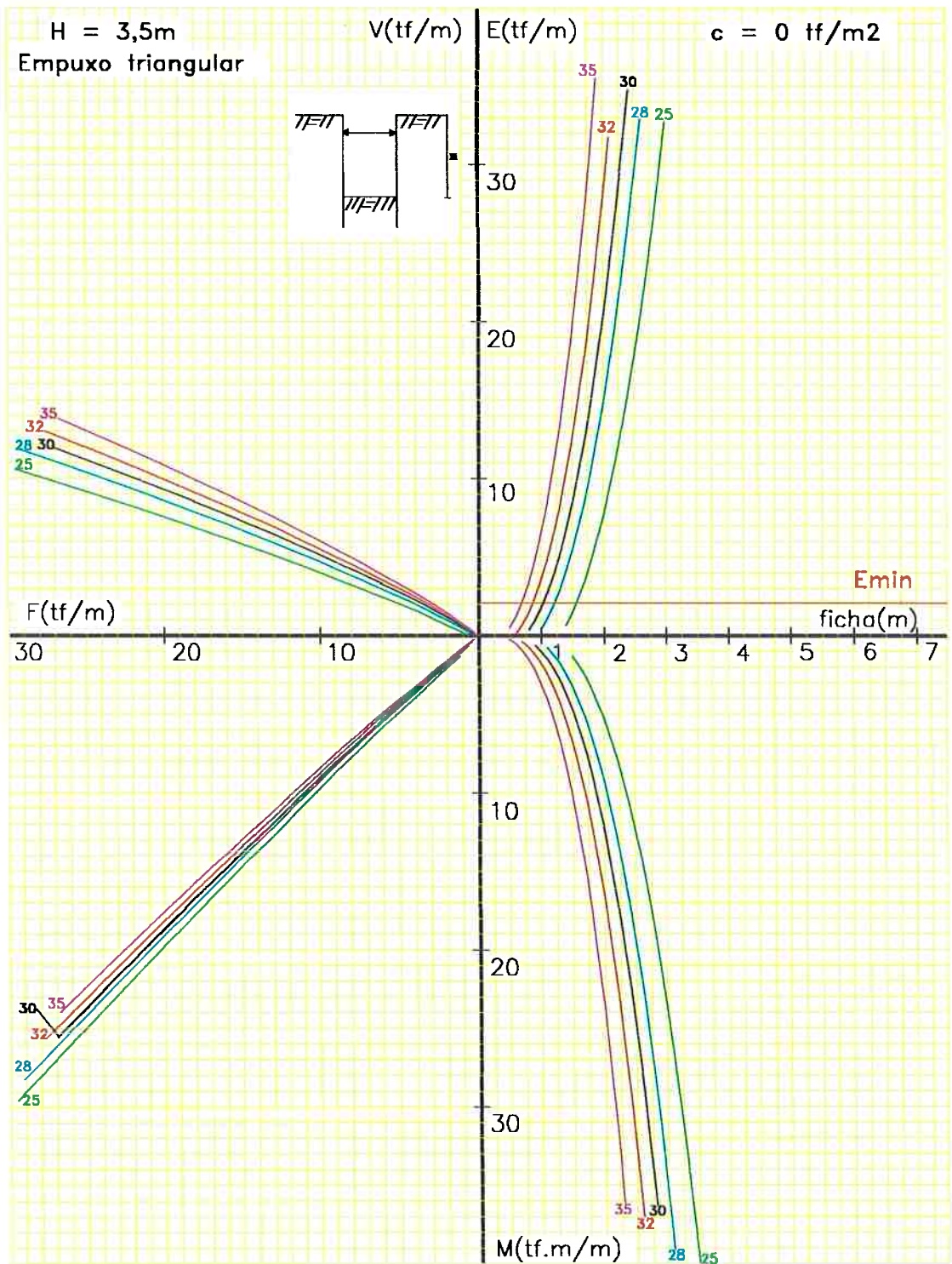


Fig. I.169- Ábaco tipo ES1

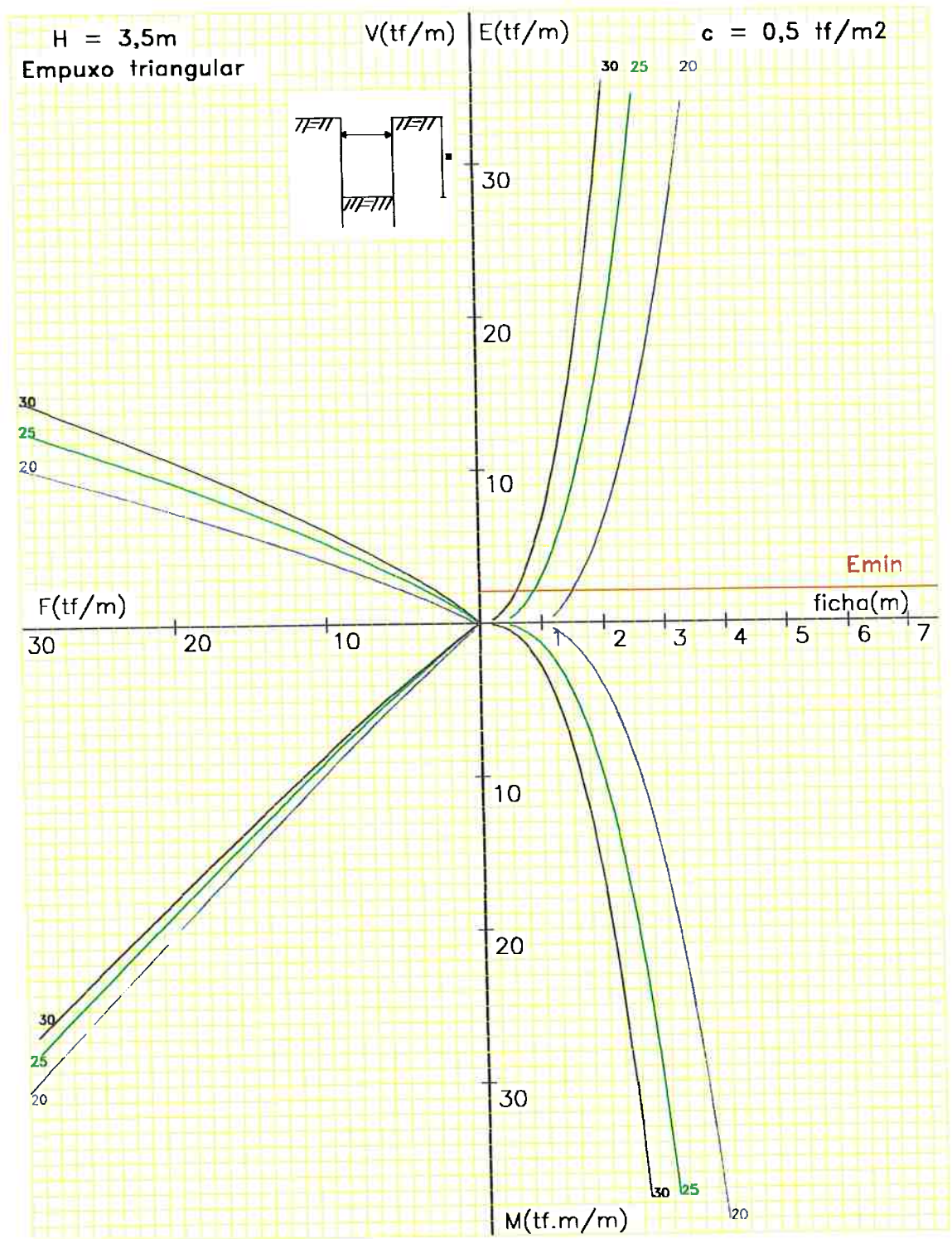


Fig. I.170- Ábaco tipo ES1

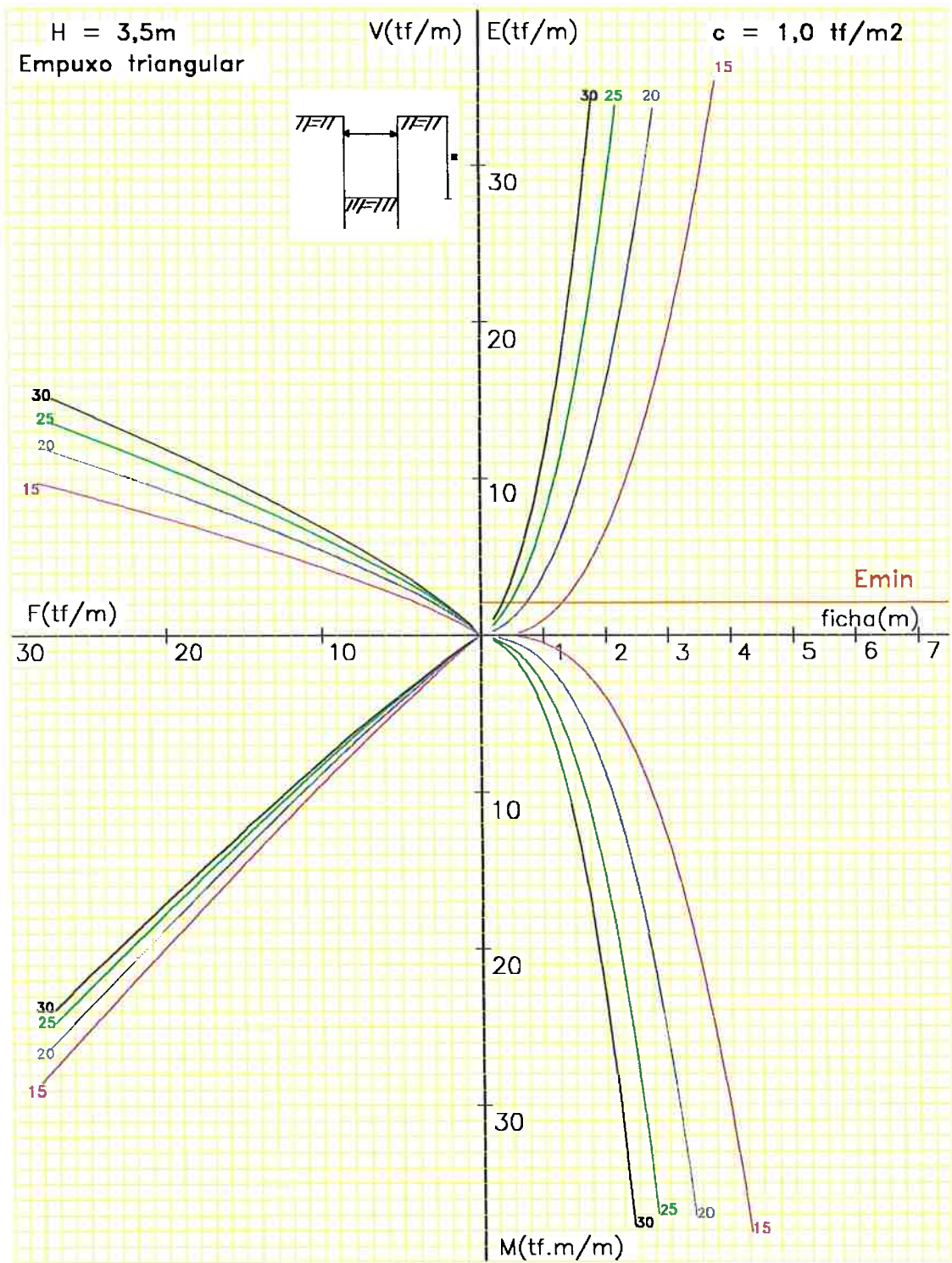


Fig. I.171- Ábaco tipo ES1

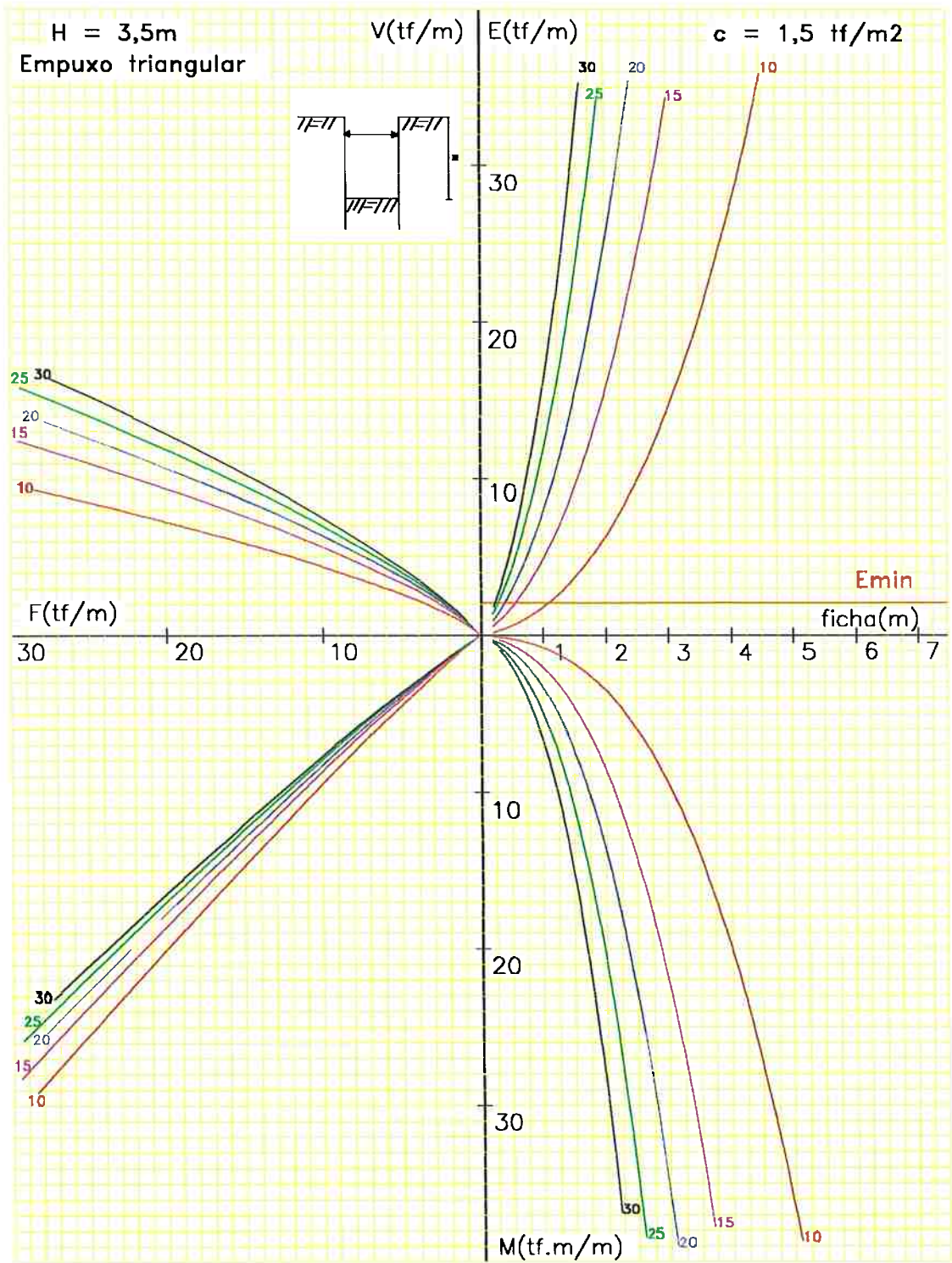


Fig. I.172- Ábaco tipo ES1

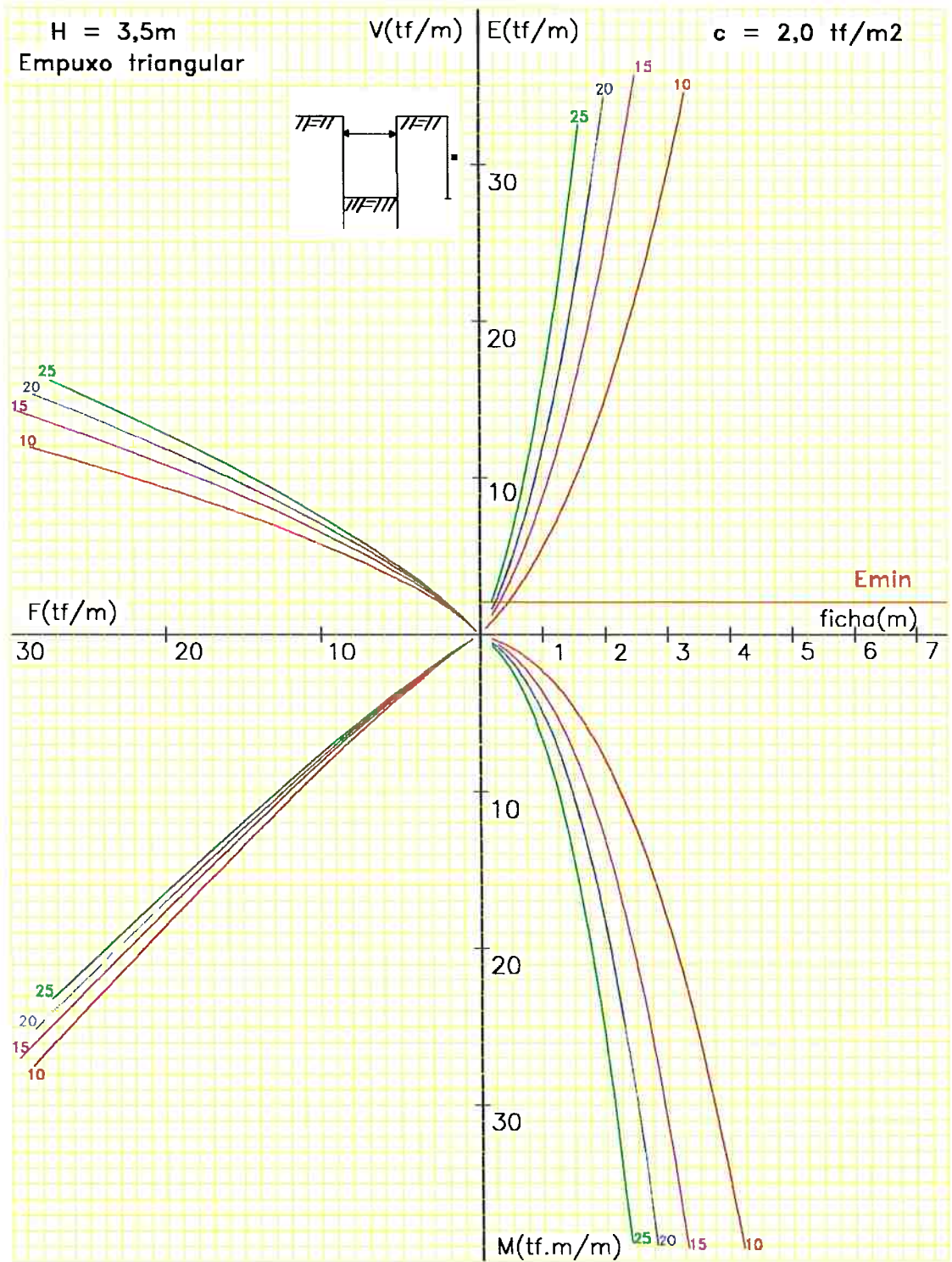


Fig. I.173- Ábaco tipo ES1

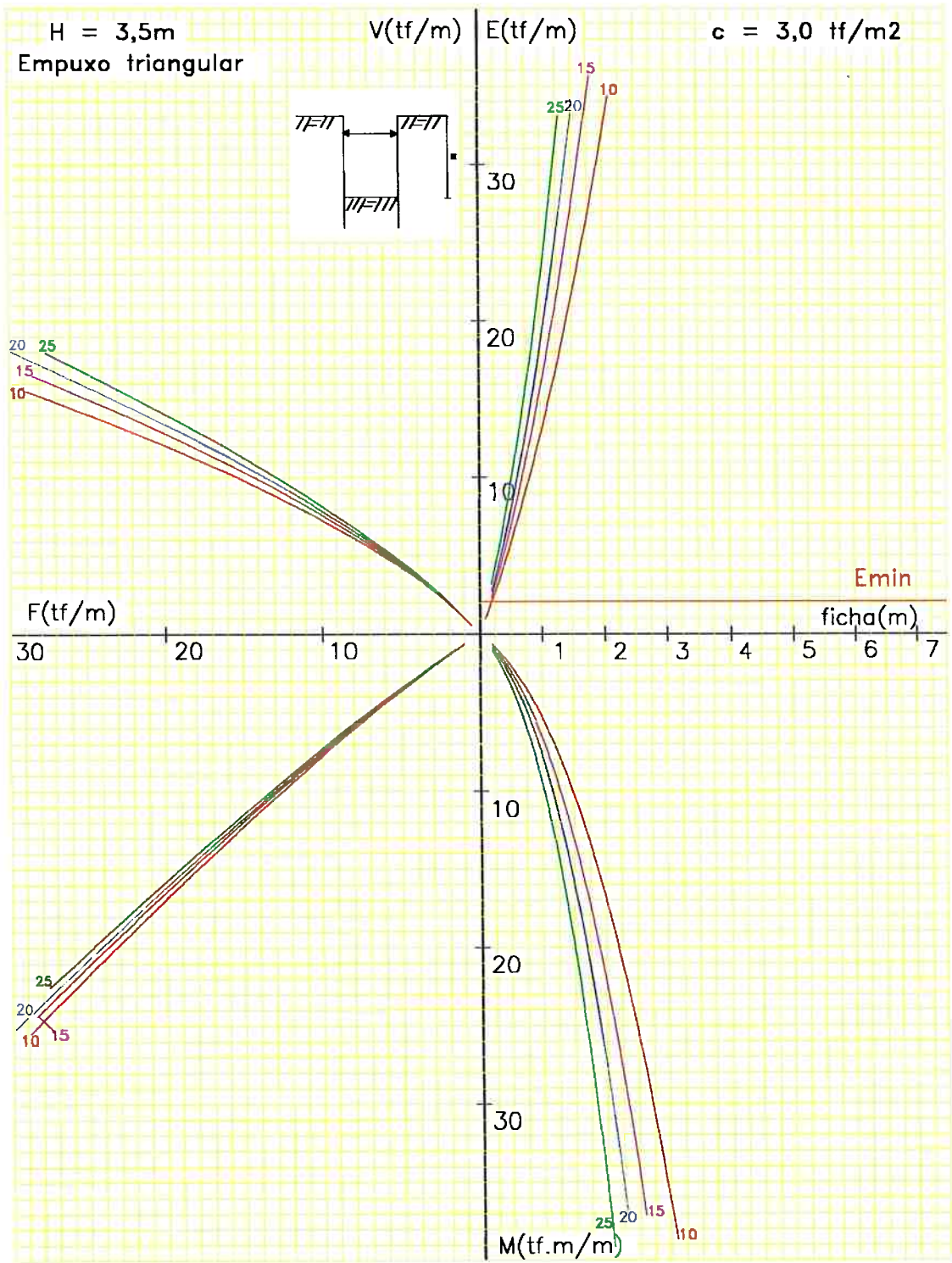


Fig. I.174- Ábaco tipo ES1

H = 4,5 m

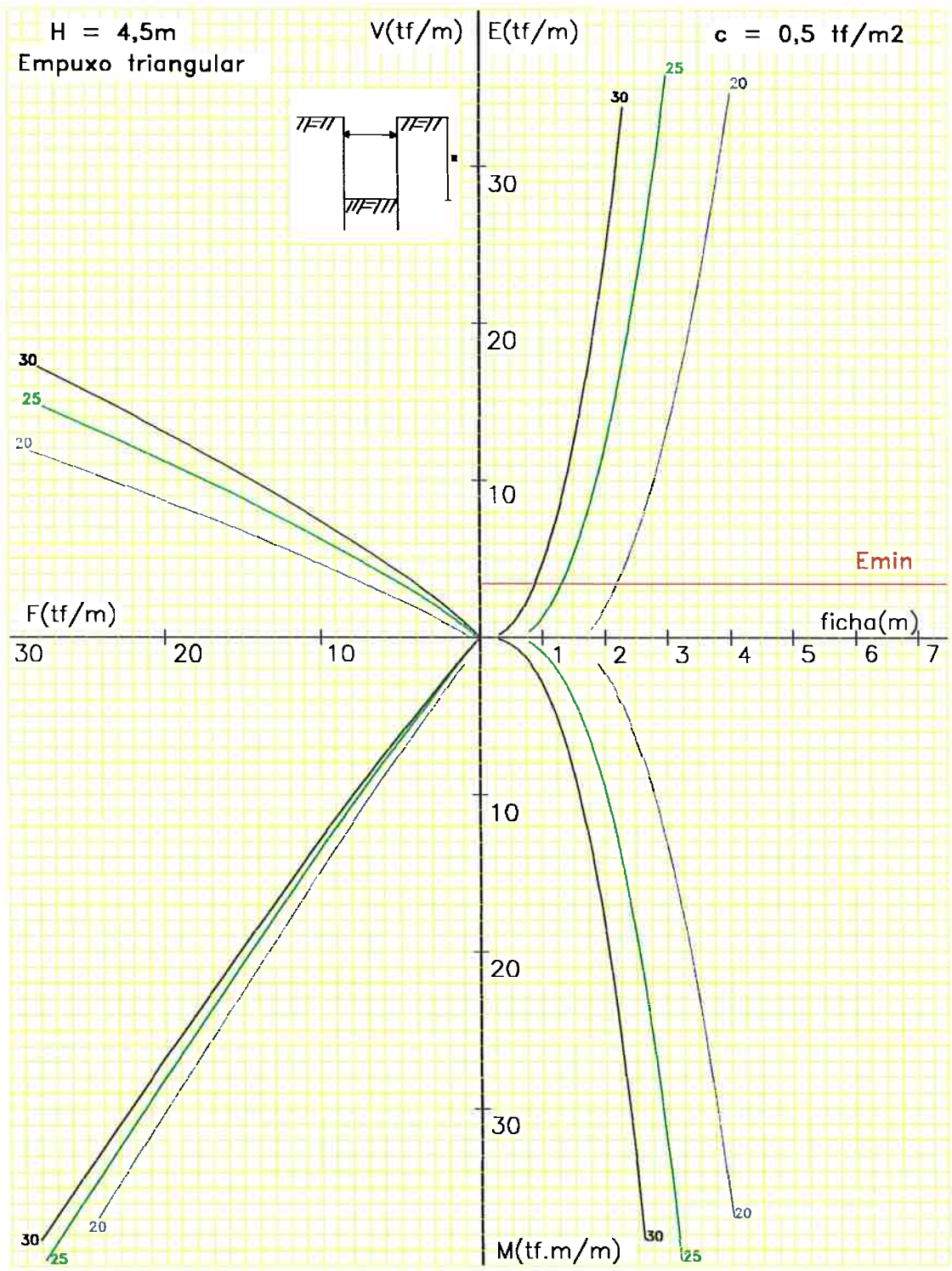


Fig. I.176- Ábaco tipo ES1

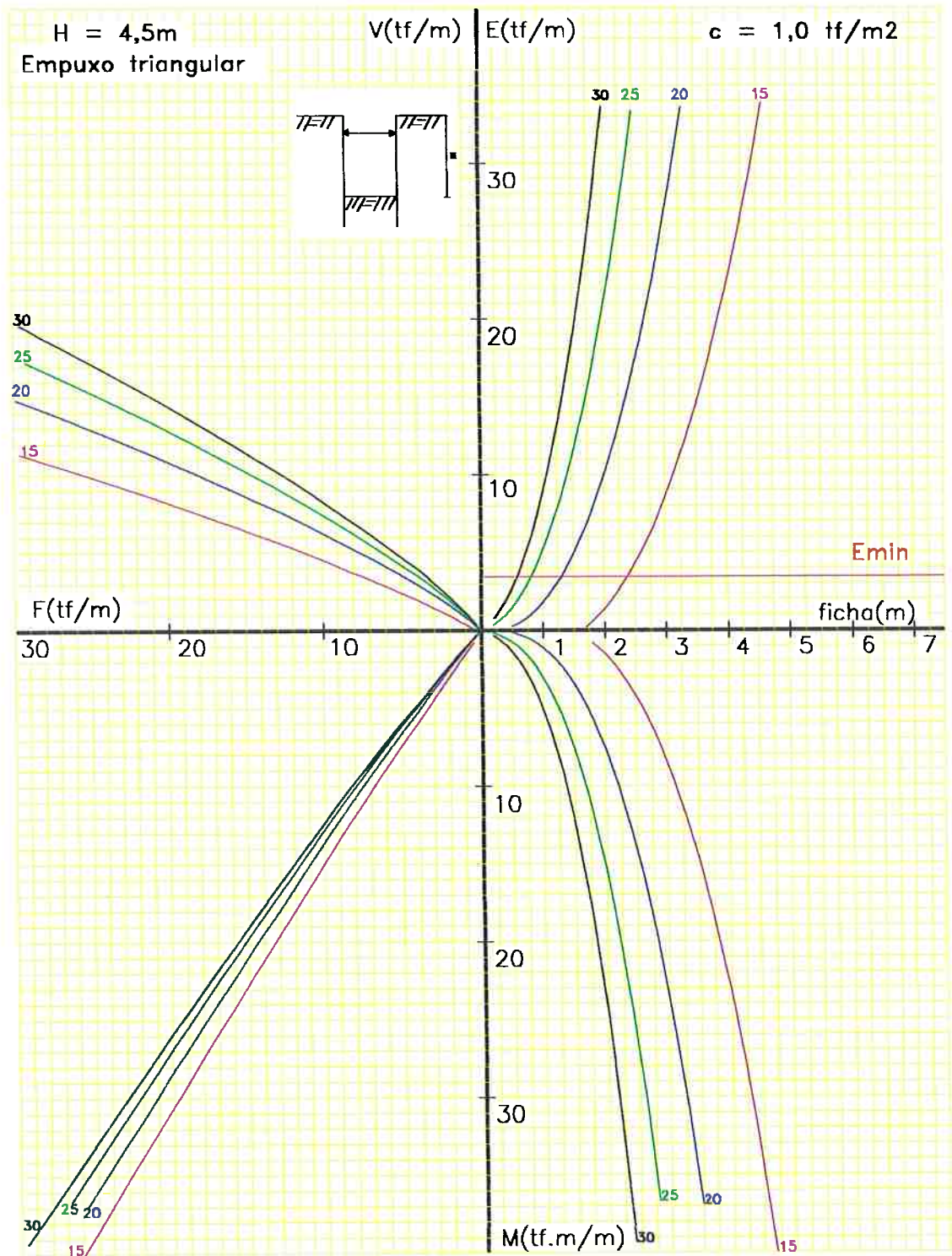


Fig. I.177- Ábaco tipo ES1

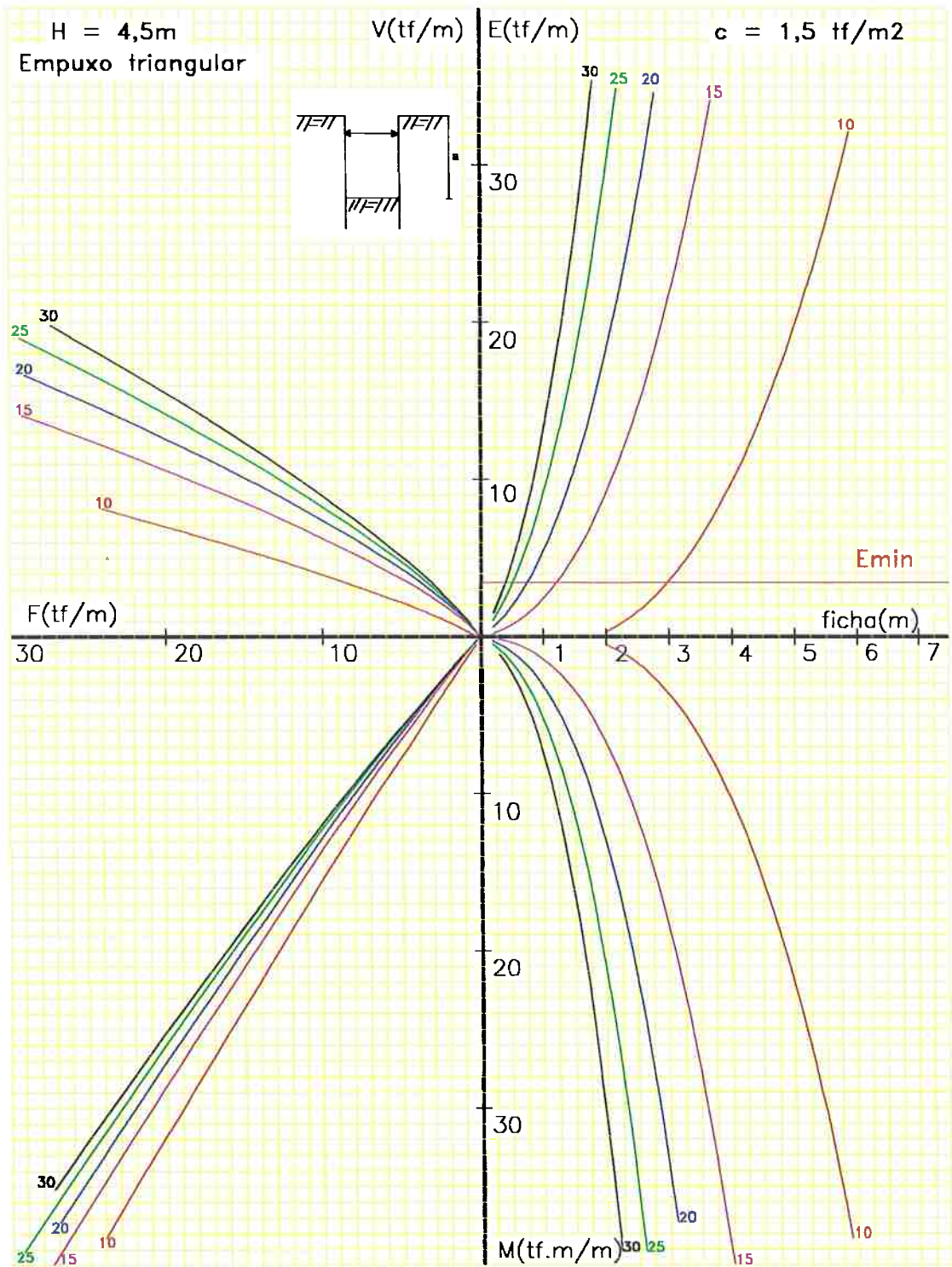


Fig. I.178- Ábaco tipo ES1

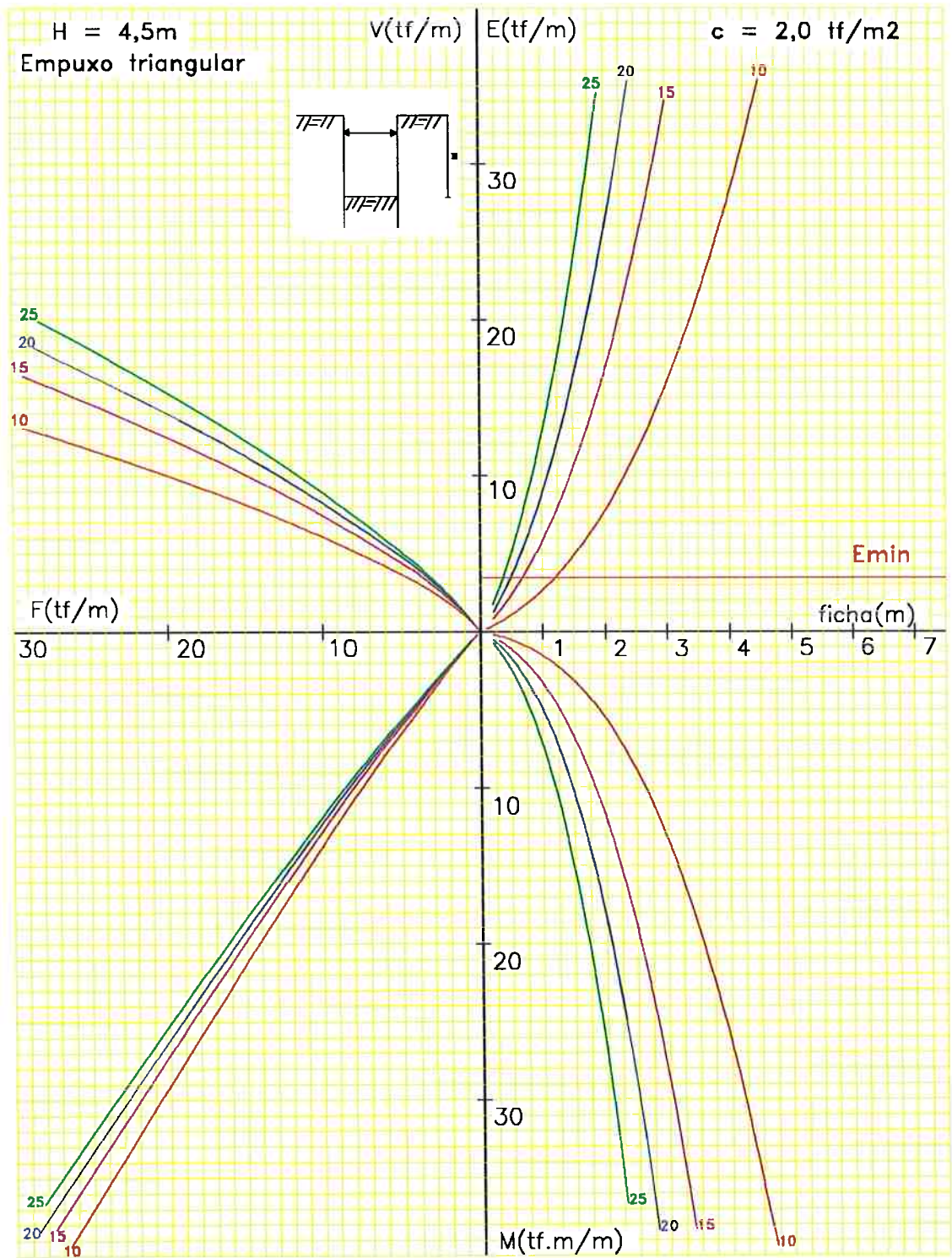


Fig. I.179- Ábaco tipo ES1

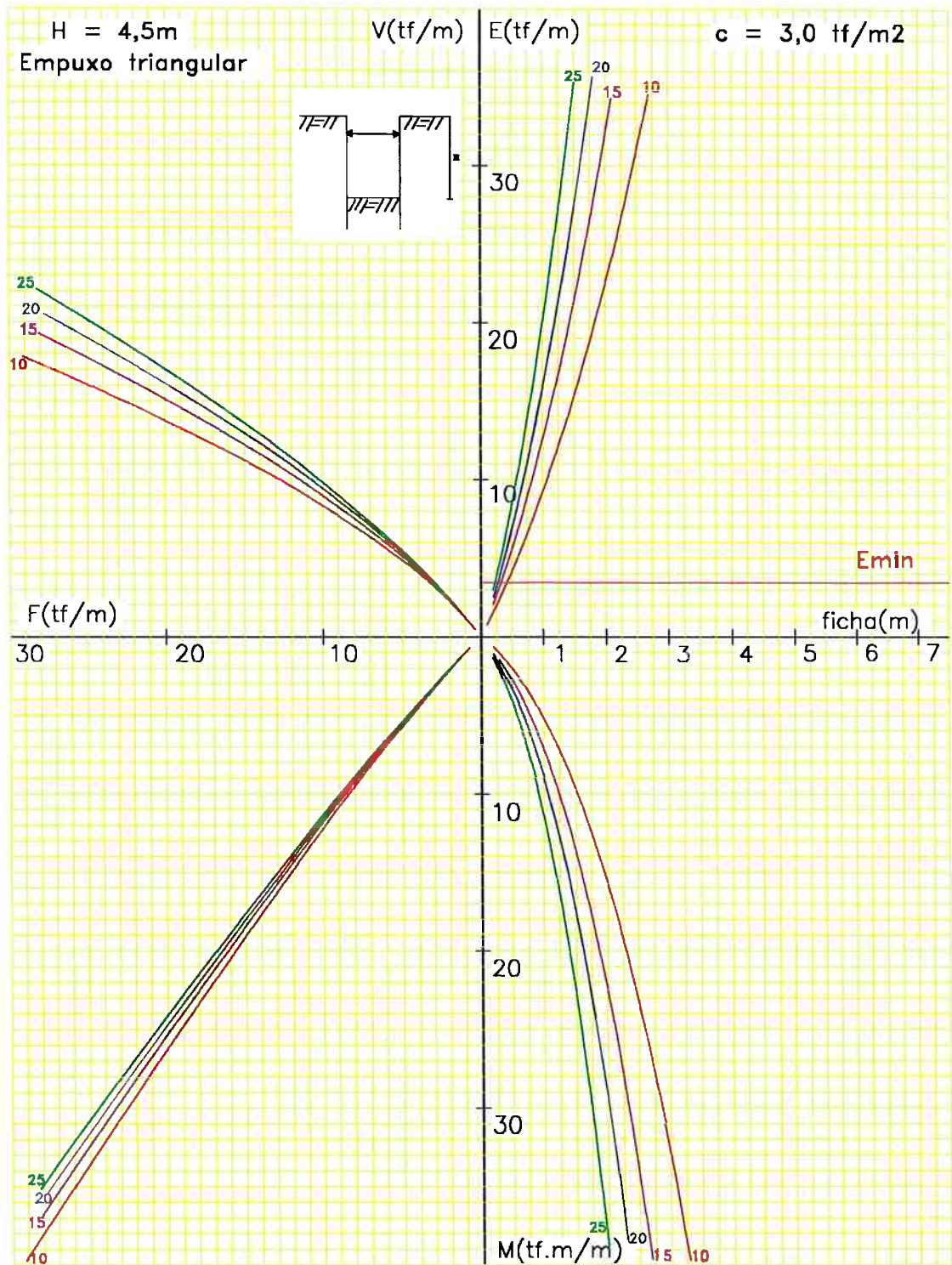


Fig. I.180- Ábaco tipo ES1

H = 5,5 m

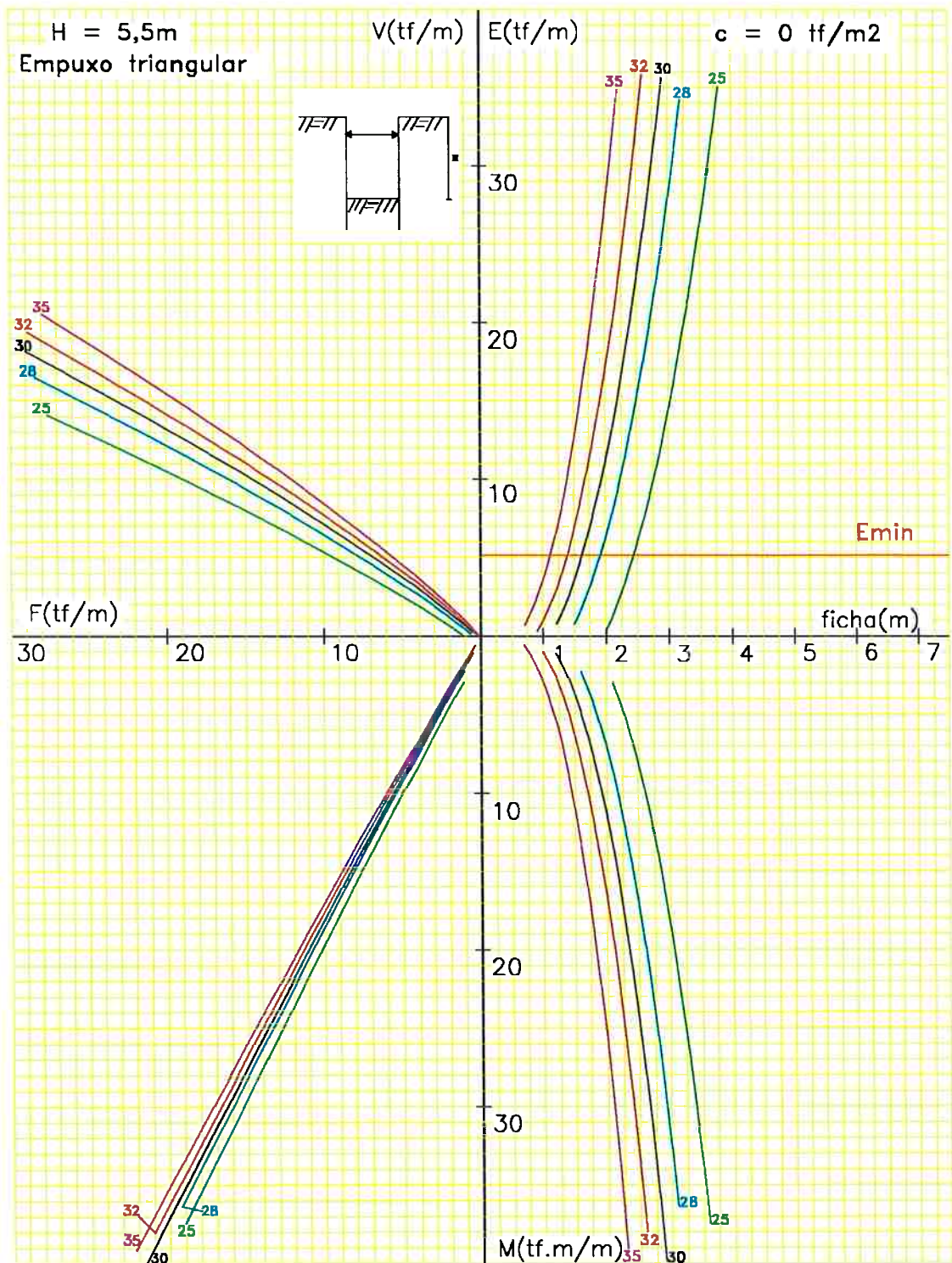


Fig. I.181- Ábaco tipo ES1

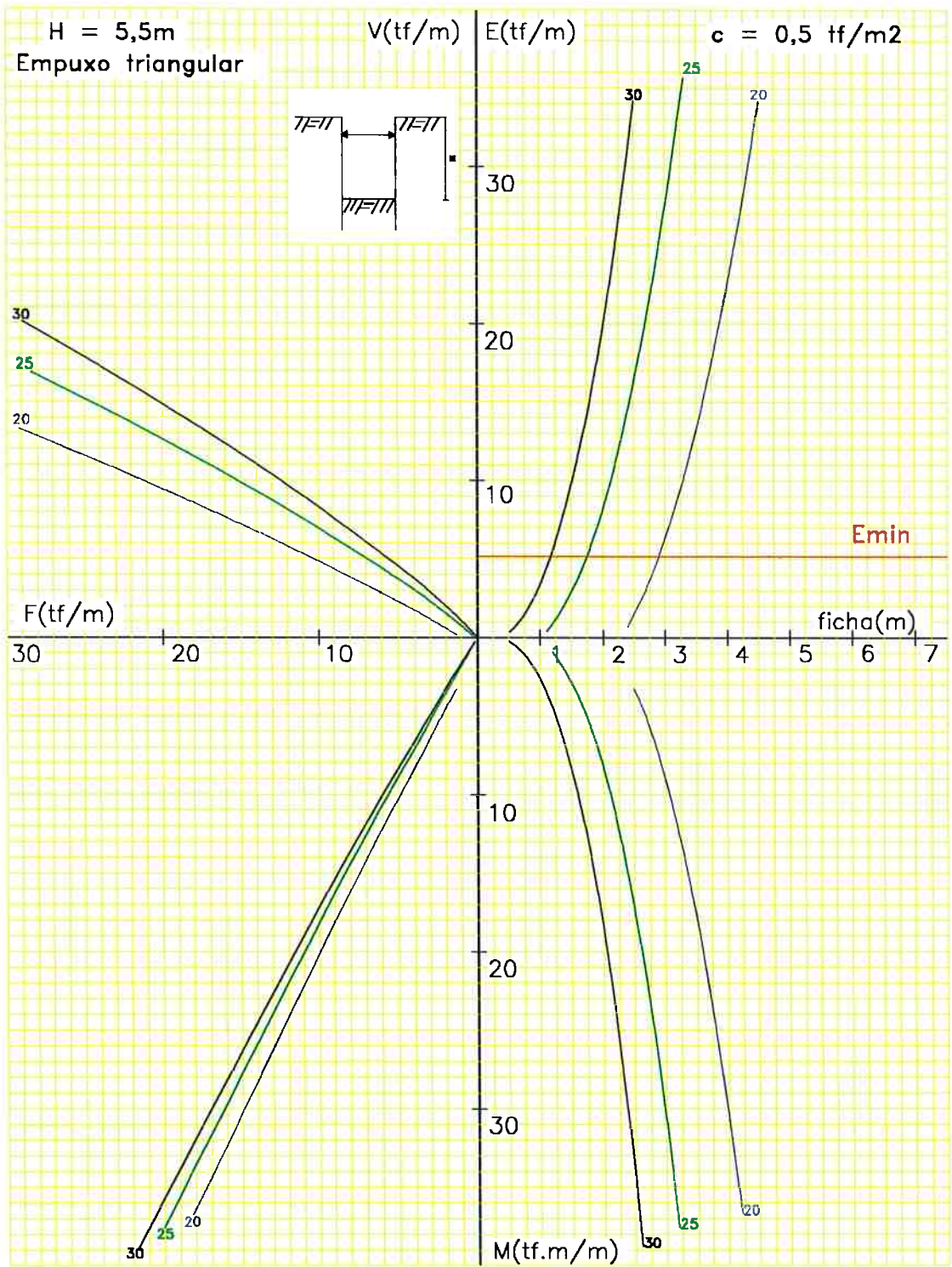


Fig. I.182- Ábaco tipo ES1

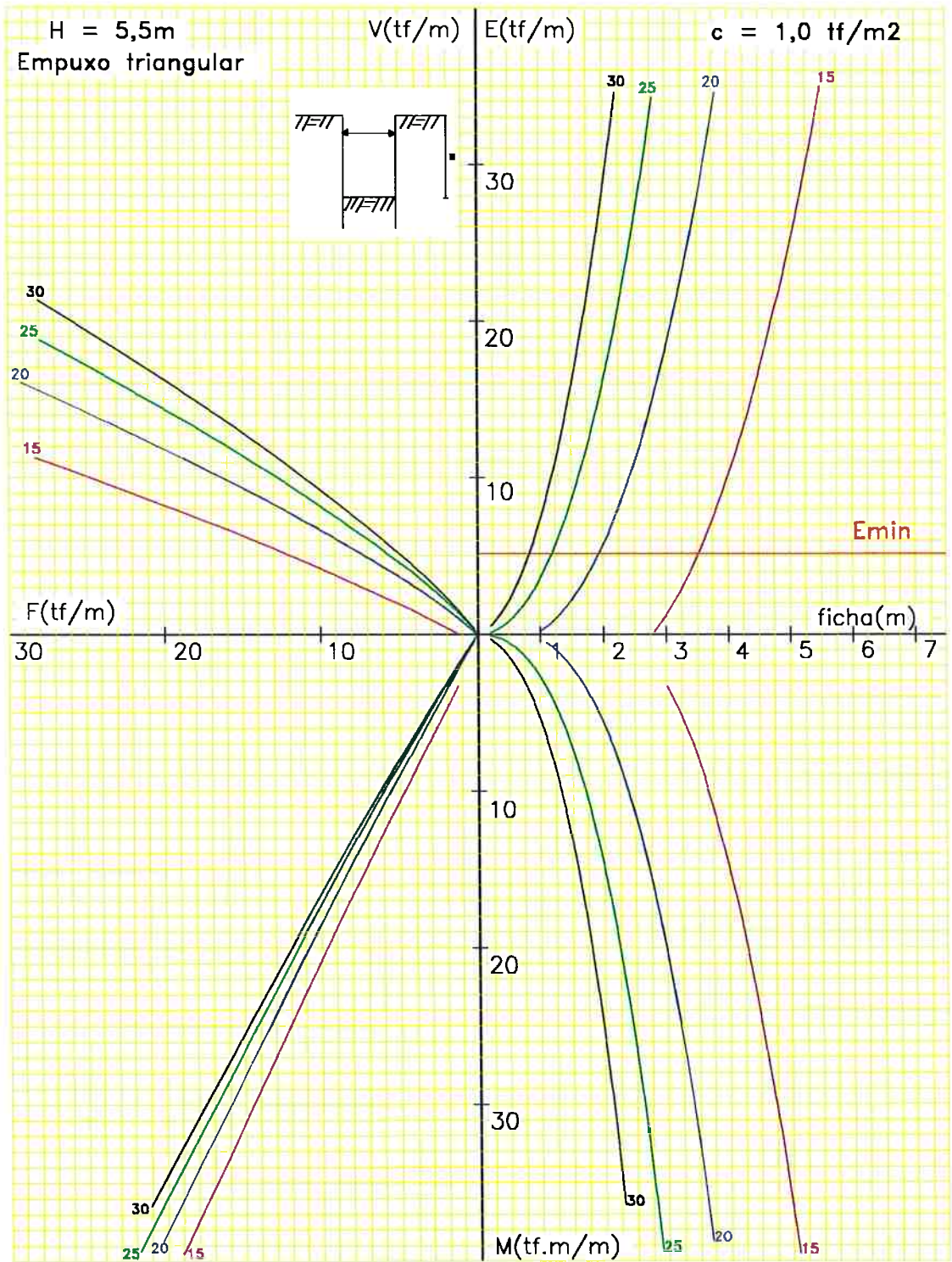


Fig. I.183- Ábaco tipo ES1

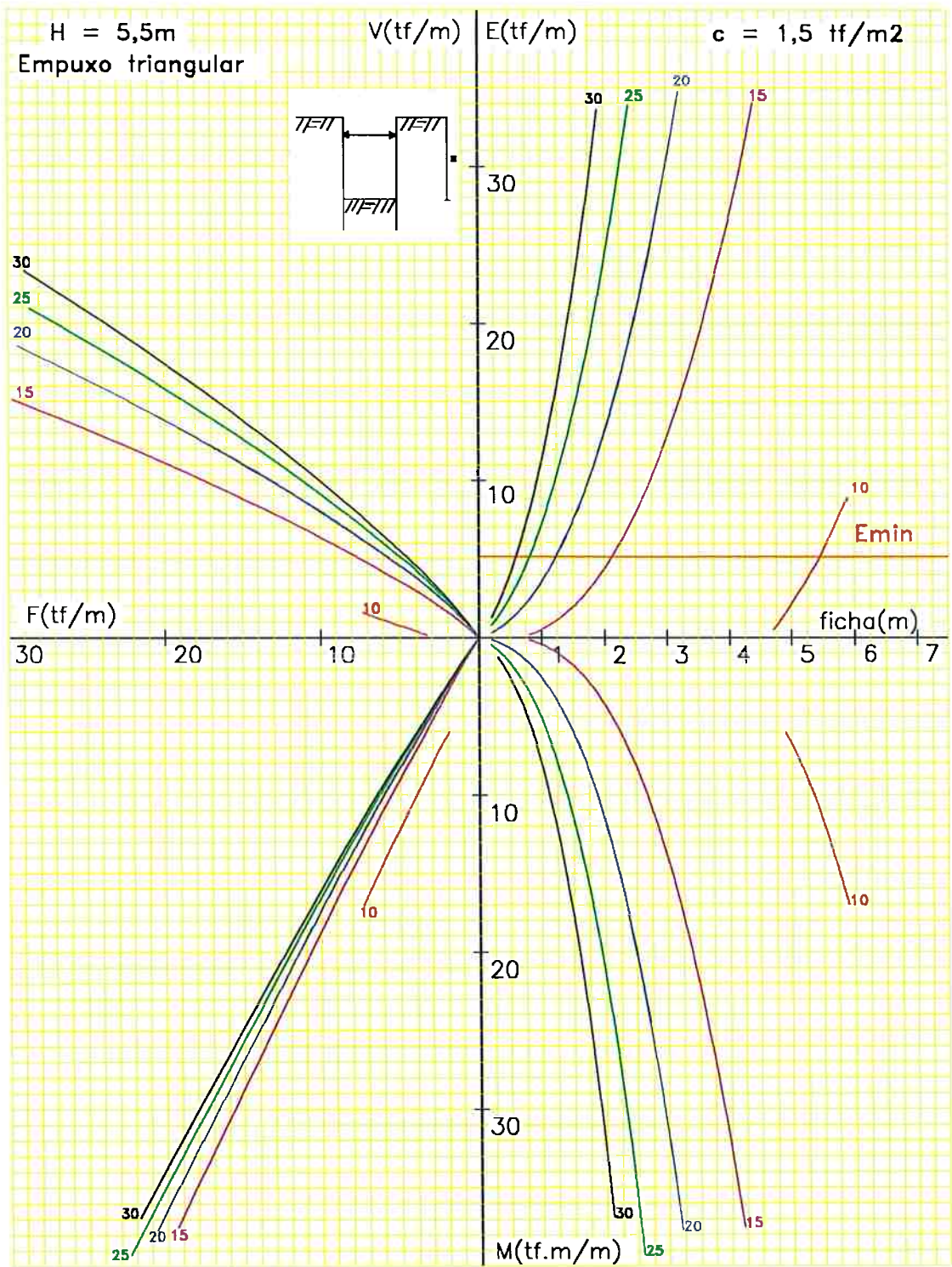


Fig. I.184- Ábaco tipo ES1

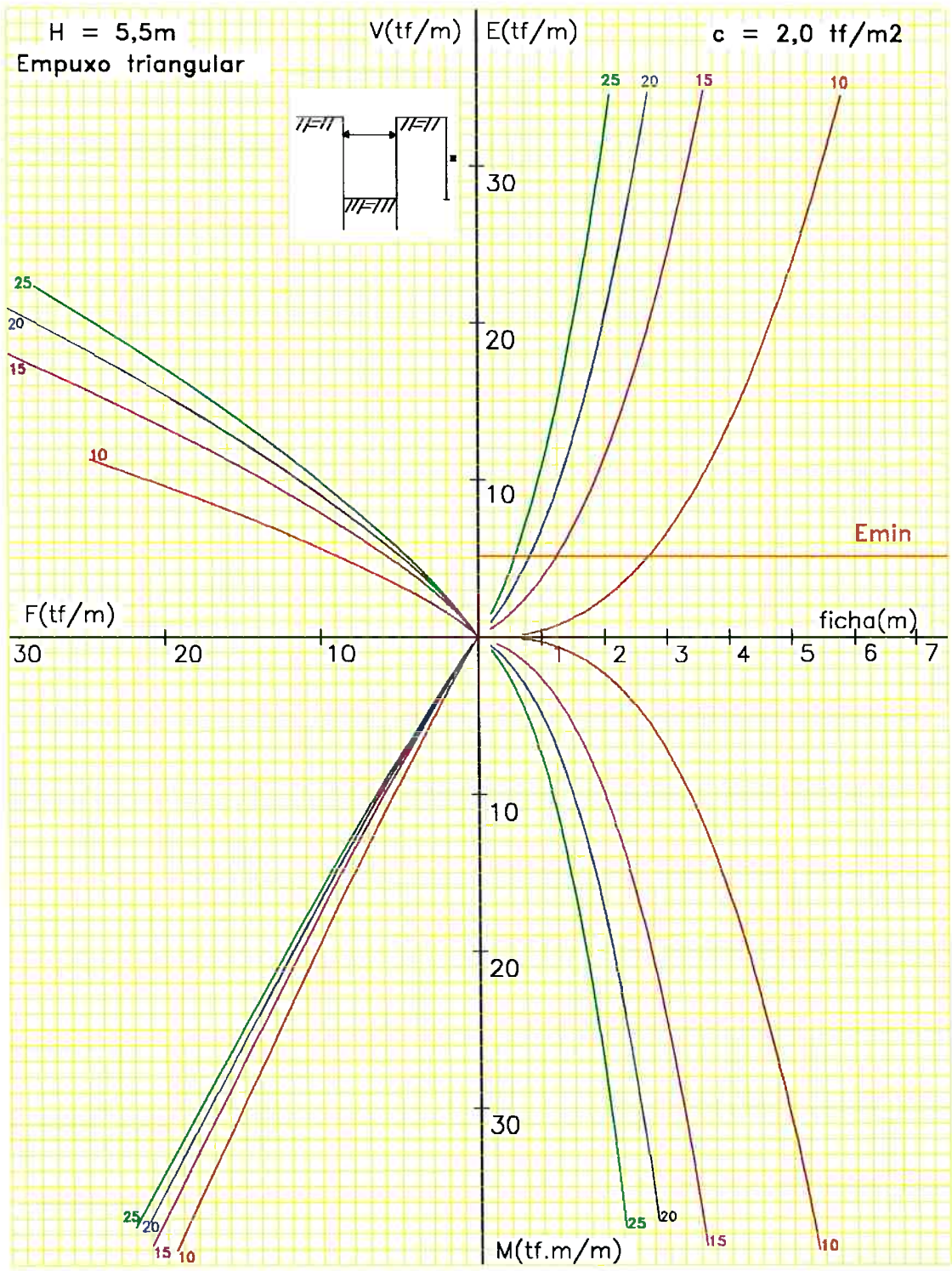


Fig. I.185- Ábaco tipo ES1

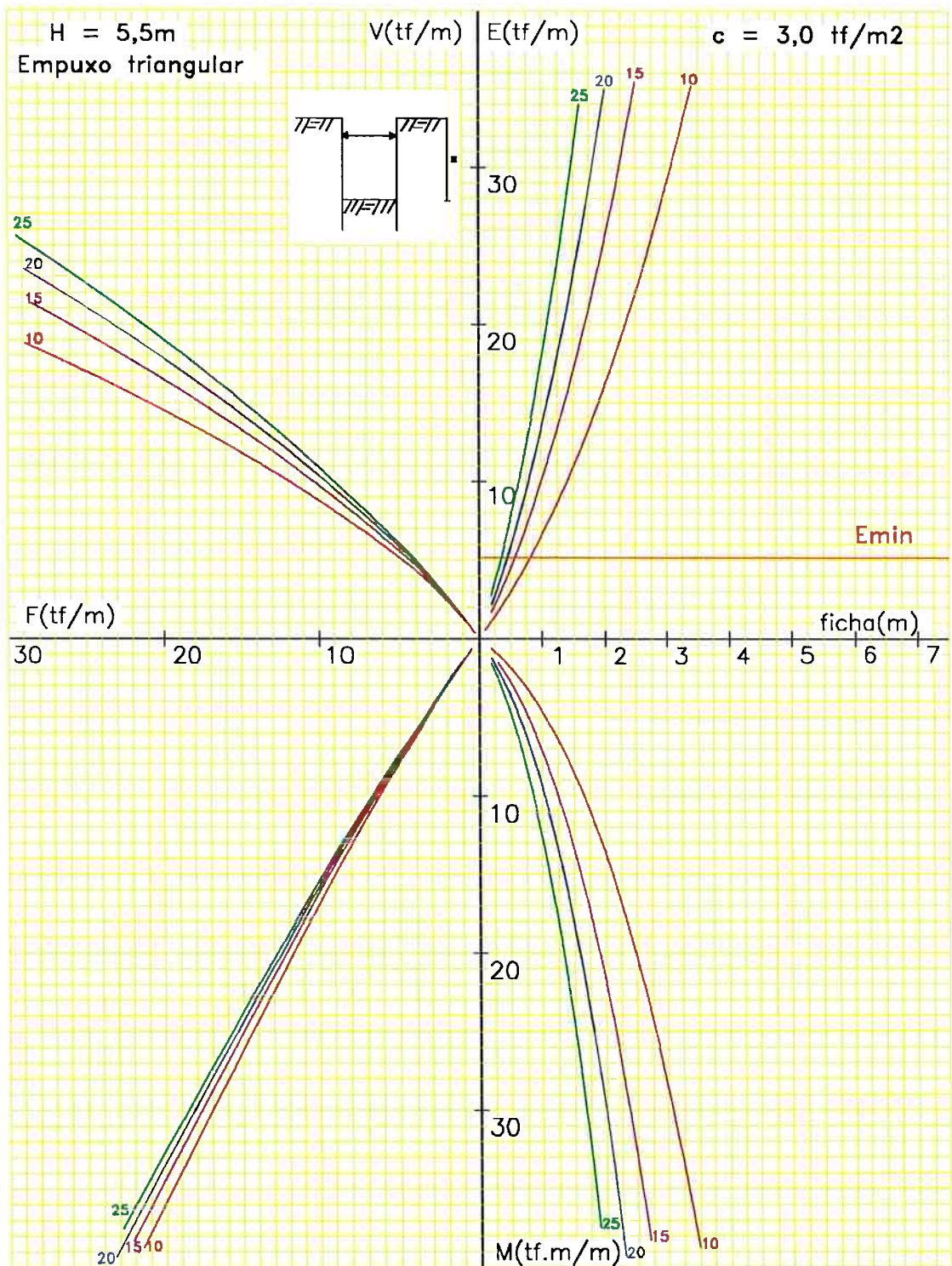


Fig. I.186- Ábaco tipo ES1

H = 6,5 m

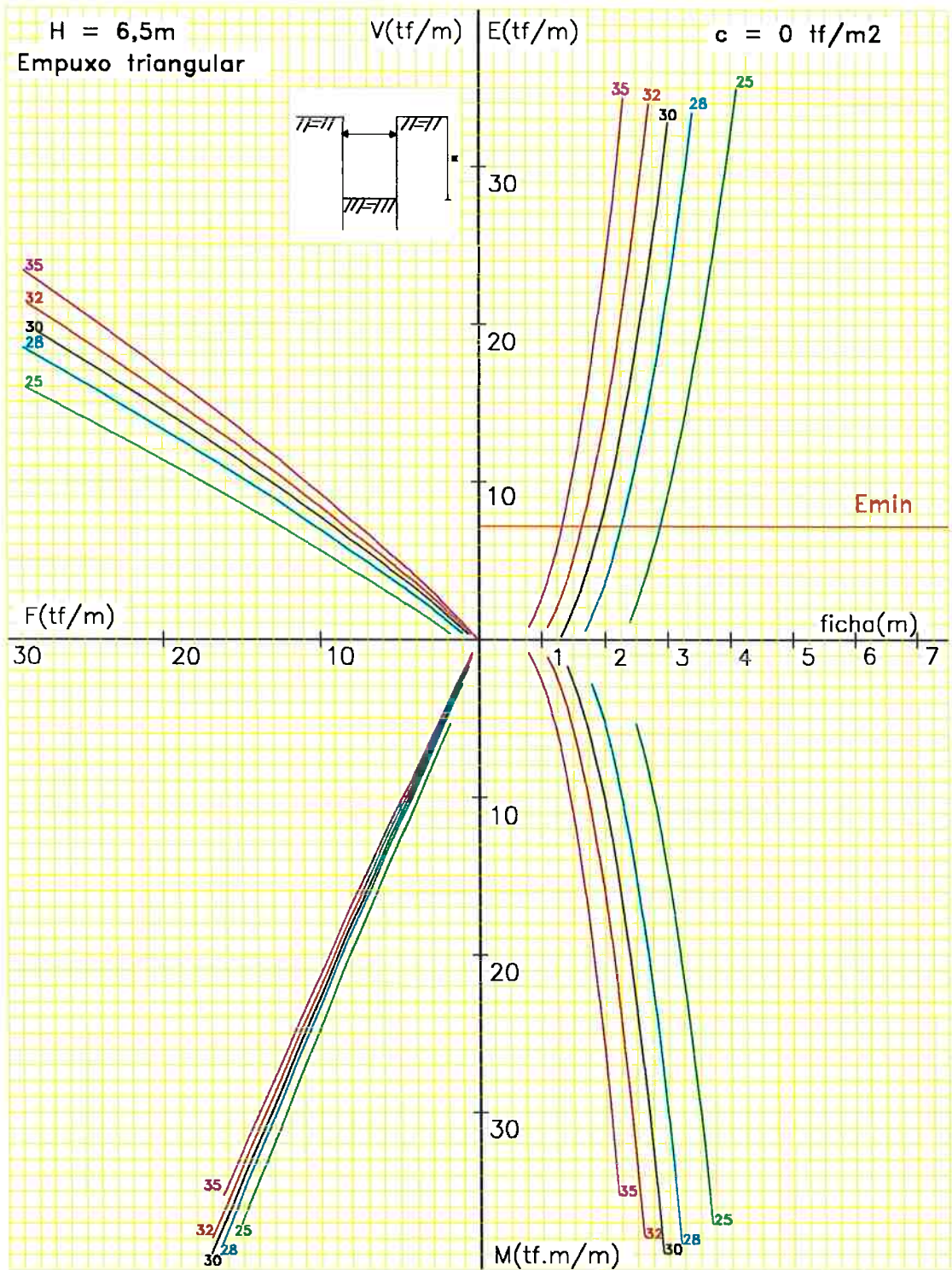


Fig. I.187- Ábaco tipo ES1

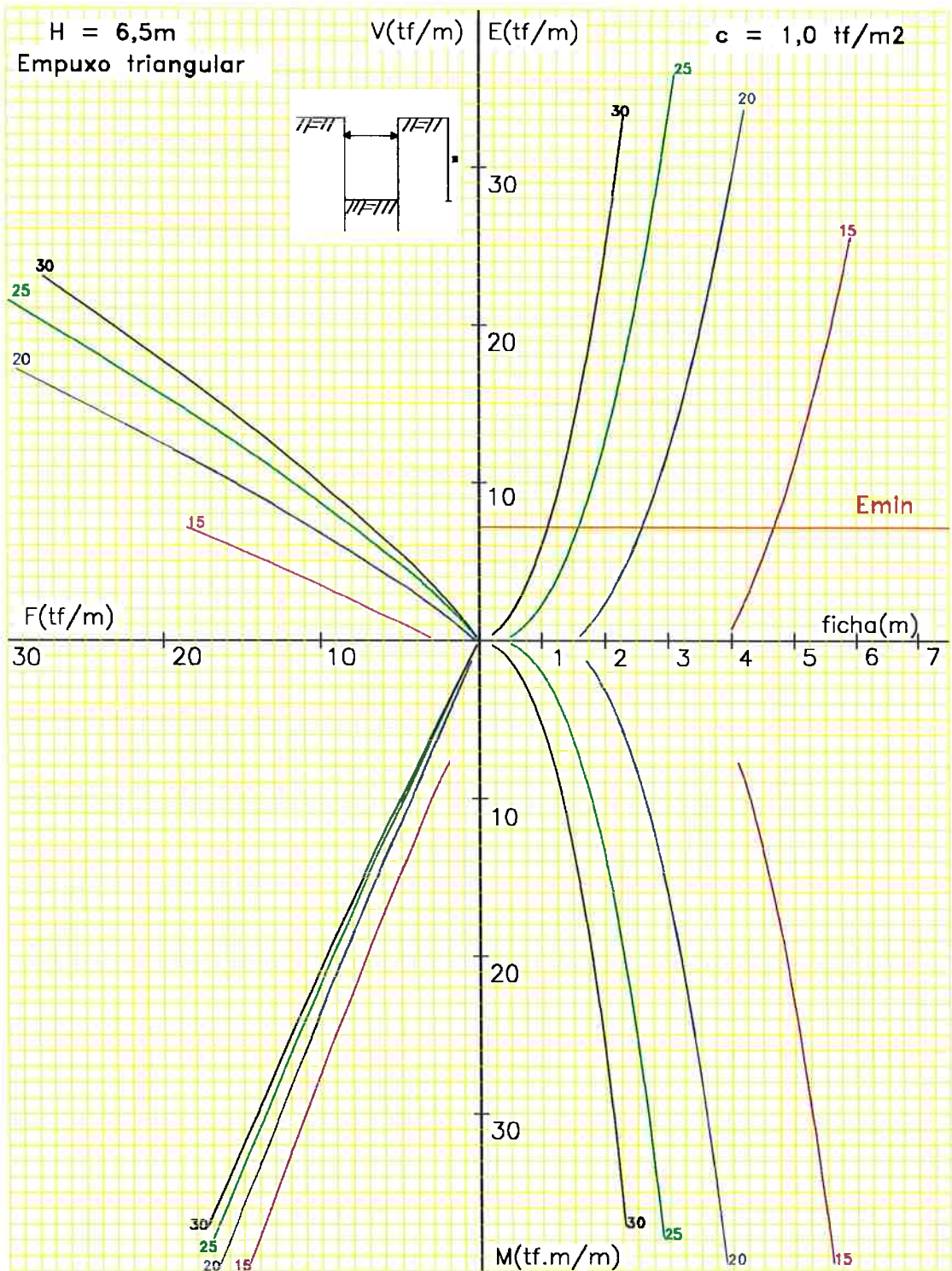


Fig. I.189- Ábaco tipo ES1

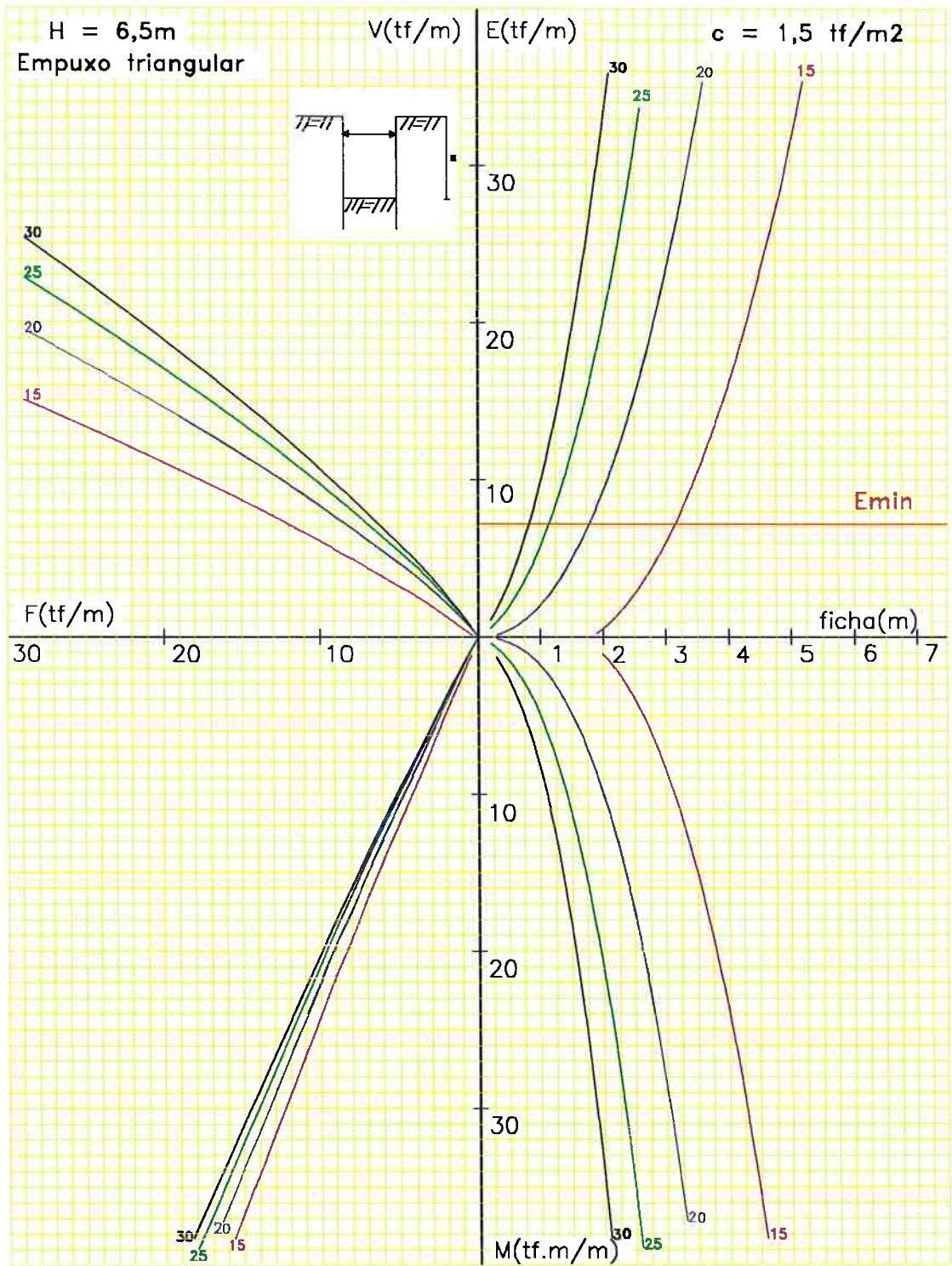


Fig. I.190- Ábaco tipo ES1

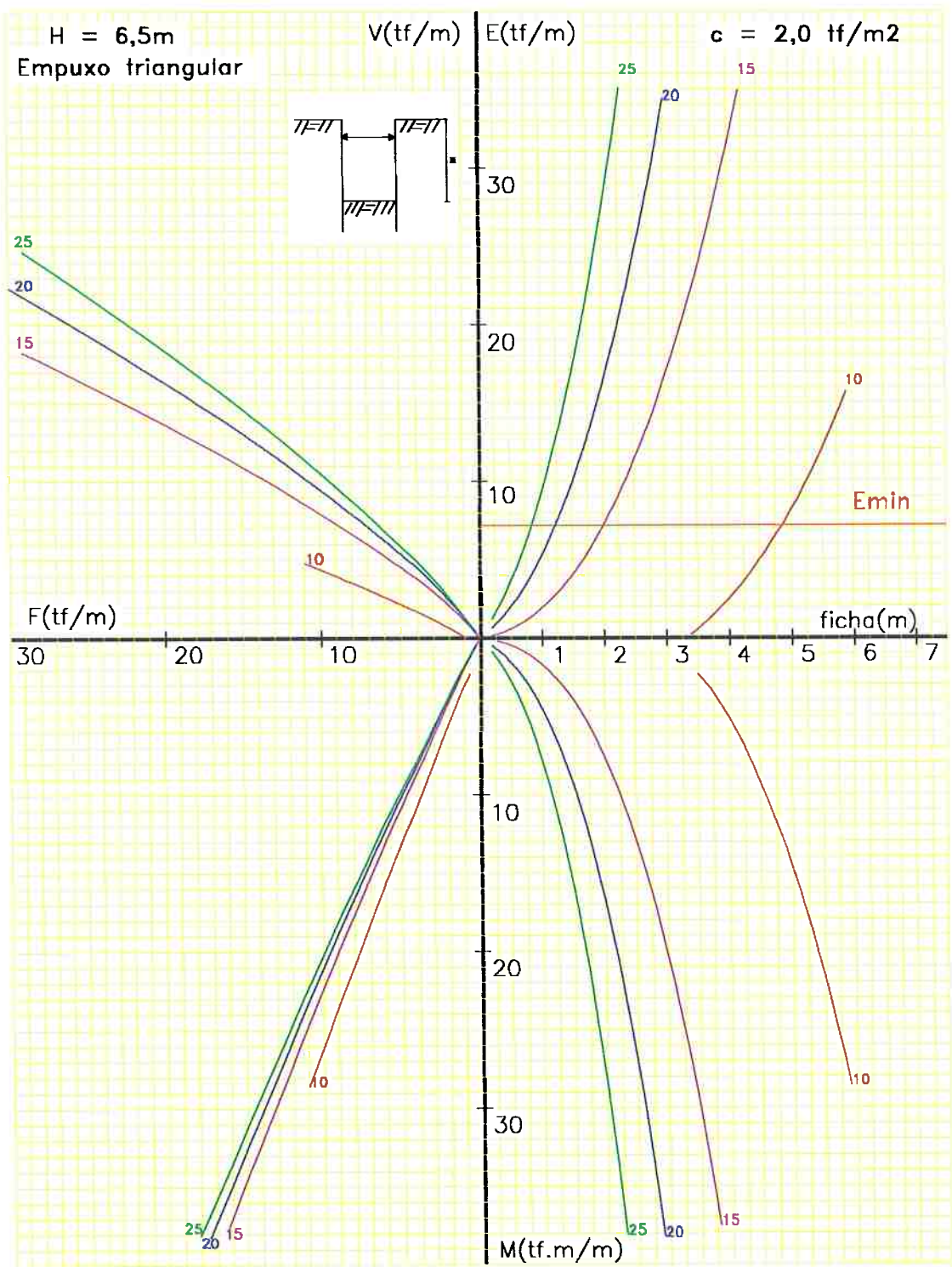


Fig. I.191- Ábaco tipo ES1

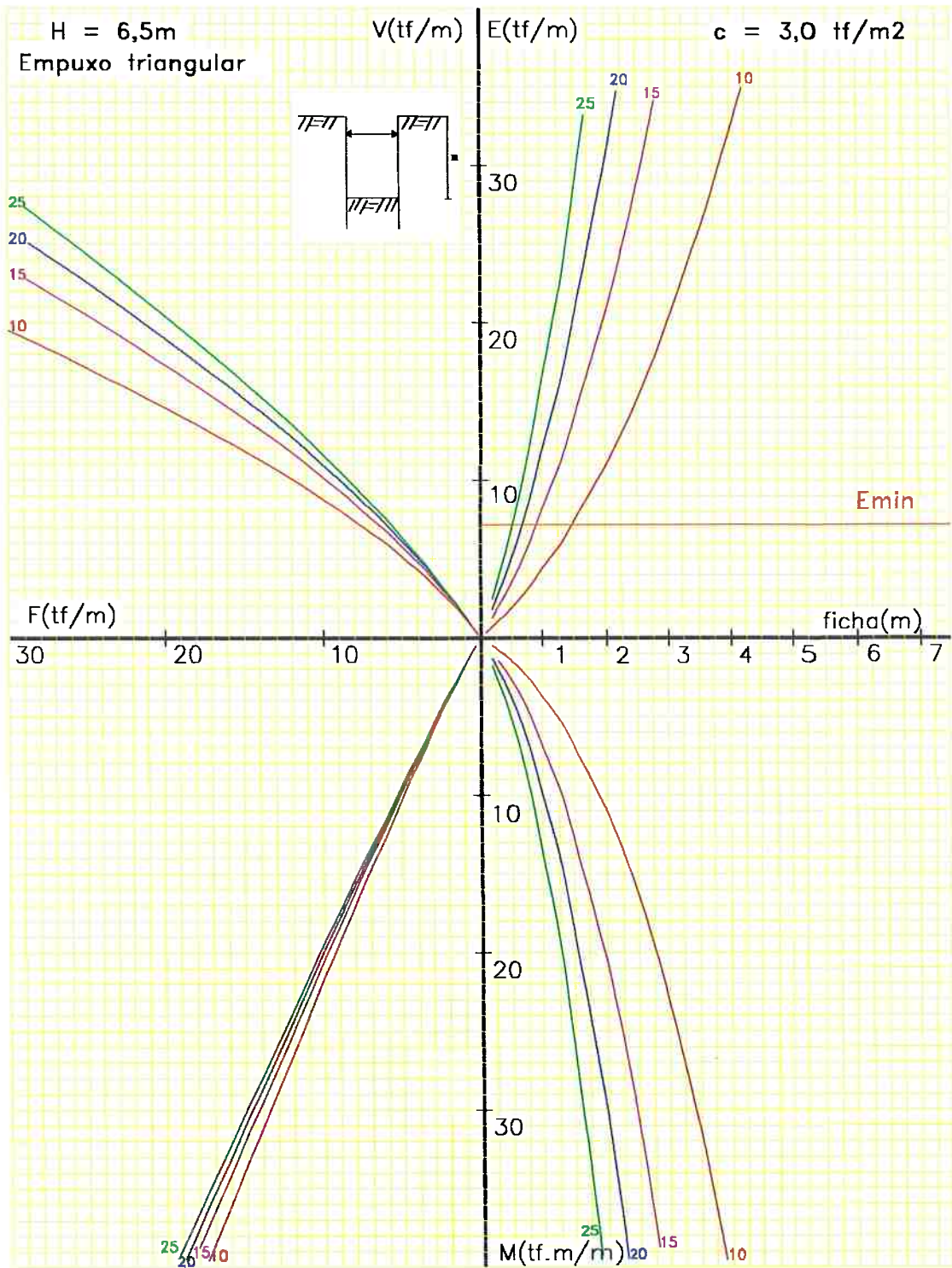


Fig. I.192- Ábaco tipo ES1