



UNIVERSITAT POLITÈCNICA DE CATALUNYA  
ESCOLA TÈCNICA SUPERIOR D'ENGINYERS  
DE CAMINS, CANALS I PORTS DE BARCELONA



---

ESTUDIO EXPERIMENTAL  
DEL COMPORTAMIENTO DEL HORMIGÓN  
CONFINADO SOMETIDO A COMPRESIÓN

Tesis Doctoral de:  
Carlos Aire Untiveros

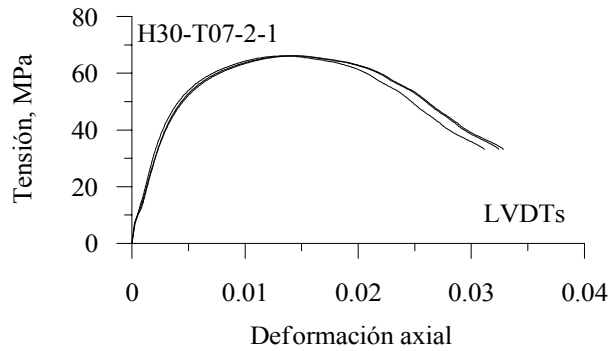
Dirigida por:  
Ravindra Gettu  
Joan Ramon Casas Rius

---

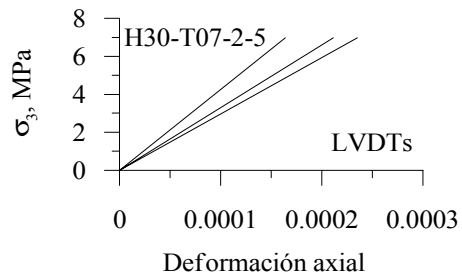
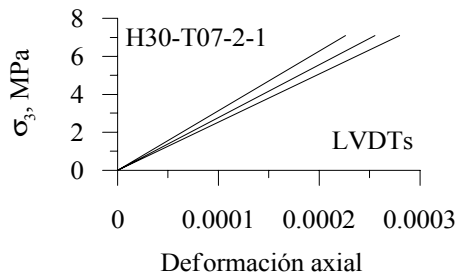
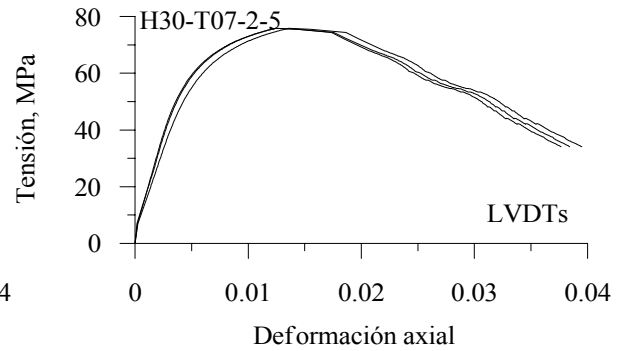
Barcelona, Septiembre 2002

**Figura C.1** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie H30- Presión de confinamiento hidrostática,  $\sigma_3$ : 7 MPa

**Probeta H30-T07-2-1**



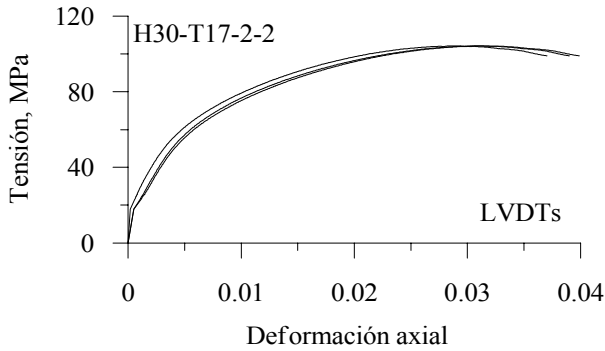
**Probeta H30-T07-2-5**



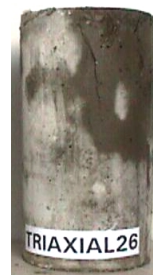
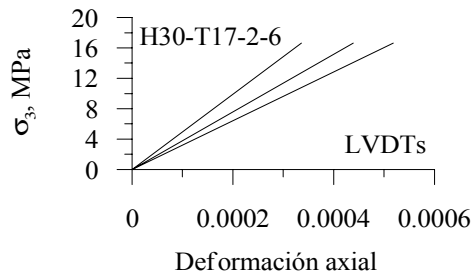
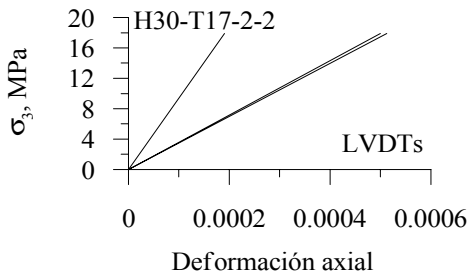
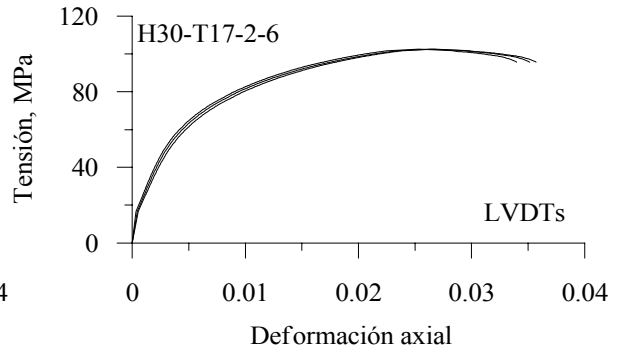
Probeta	Edad	$f_{max}$	$\epsilon_{max}$	$E_o$	$E_i$
Identificación	(días)	(MPa)	( $\mu\epsilon$ )	(GPa)	(GPa)
H30-T07-2-1	99	66.2	14047	27.9	14.9
H30-T07-2-5	188	75.9	12829	34.2	13.0

**Figura C.2** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie H30- Presión de confinamiento hidrostática,  $\sigma_3$ : 17 MPa

**Probeta H30-T17-2-2**



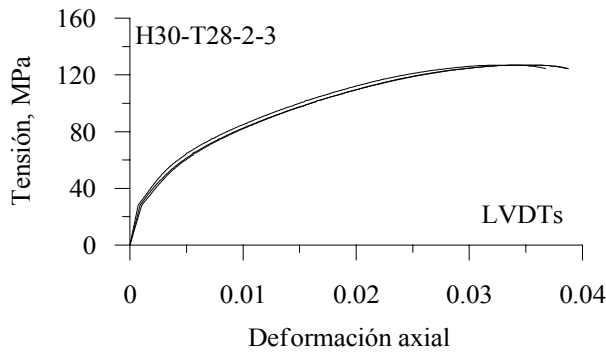
**Probeta H30-T17-2-6**



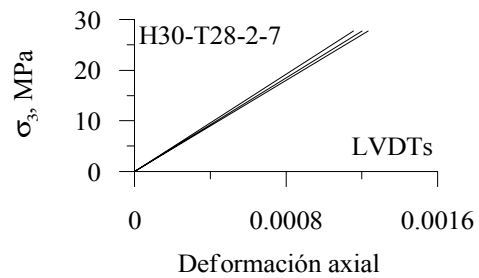
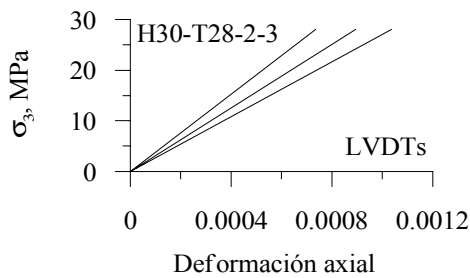
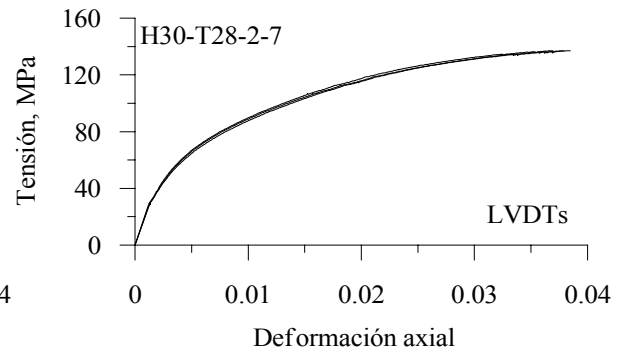
Probeta	Edad	$f_{max}$	$\epsilon_{max}$	$E_o$	$E_i$
Identificación	(días)	(MPa)	( $\mu\epsilon$ )	(GPa)	(GPa)
H30-T17-2-2	99	104.4	29988	44.7	10.2
H30-T17-2-6	188	102.6	26101	38.6	13.9

**Figura C.3** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie H30-Presión de confinamiento hidrostática,  $\sigma_3$ : 28 MPa

**Probeta H30-T28-2-3**



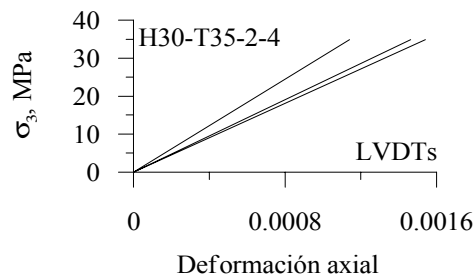
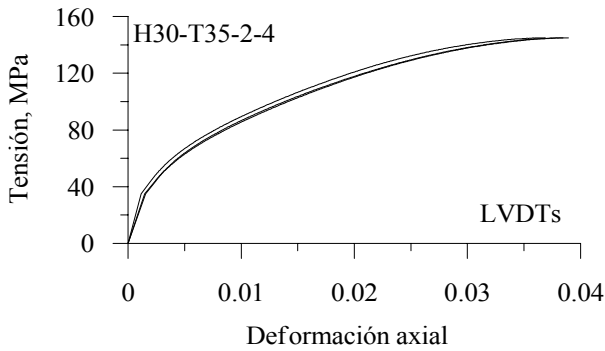
**Probeta H30-T28-2-7**



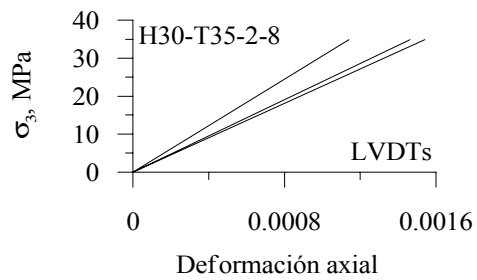
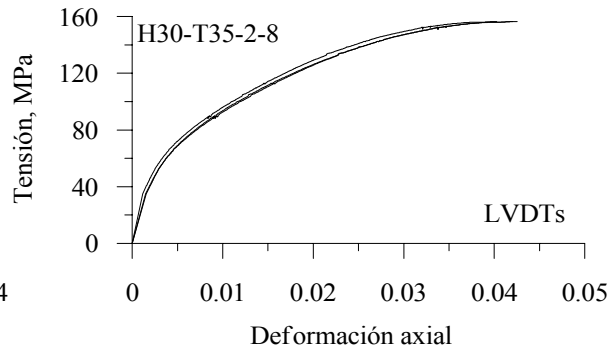
Probeta Identificación	Edad (días)	$f_{max}$ (MPa)	$\epsilon_{max}$ ( $\mu\epsilon$ )	$E_o$ (GPa)	$E_i$ (GPa)
H30-T28-2-3	102	126.9	33486	31.5	9.2
H30-T28-2-7	190	137.1	37764	23.2	12.4

**Figura C.4** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie H30- Presión de confinamiento hidrostática,  $\sigma_3$ : 35 MPa

**Probeta H30-T35-2-4**



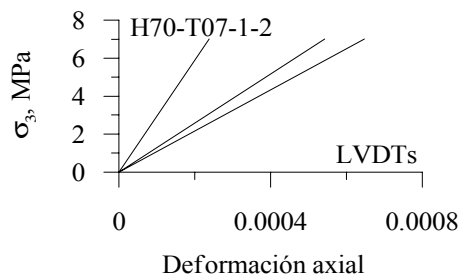
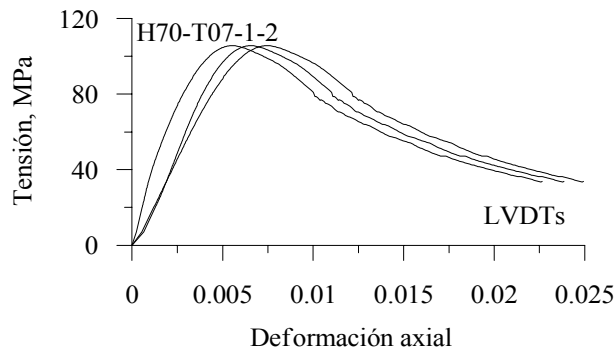
**Probeta H30-T35-2-8**



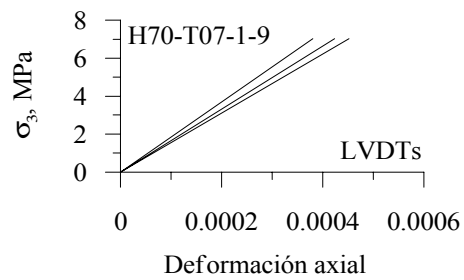
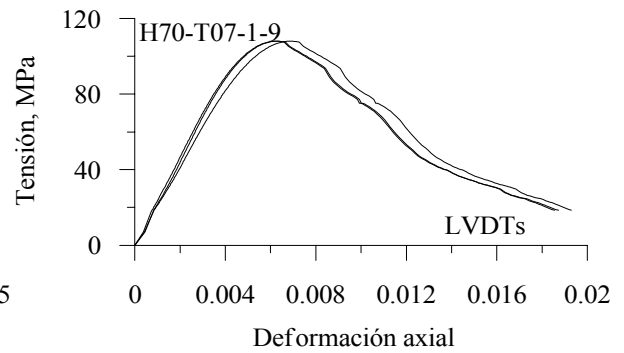
Probeta	Edad	$f_{max}$	$\epsilon_{max}$	$E_o$	$E_i$
Identificación	(días)	(MPa)	( $\mu\epsilon$ )	(GPa)	(GPa)
H30-T35-2-4	106	144.9	37635	25.3	10.1
H30-T35-2-8	193	156.5	41611	25.3	13.0

**Figura C.5** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie H70- Presión de confinamiento hidrostática,  $\sigma_3$ : 7 MPa

**Probeta H70-T07-1-2**



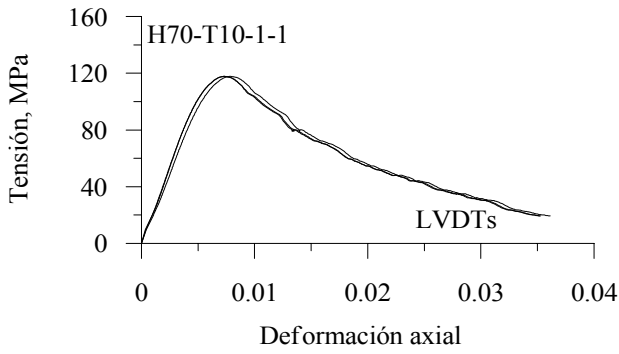
**Probeta H70-T07-1-9**



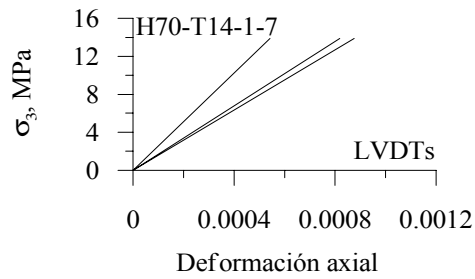
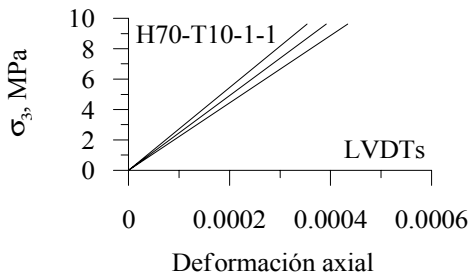
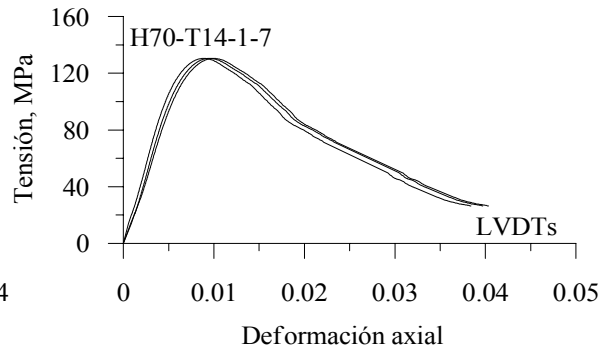
Probeta Identificación	Edad (días)	$f_{max}$ (MPa)	$\epsilon_{max}$ ( $\mu\epsilon$ )	$E_o$ (GPa)	$E_i$ (GPa)
H70-T07-1-2	82	105.6	6946	14.7	23.8
H70-T07-1-9	126	108.0	6329	16.8	22.1

**Figura C.6** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie H70- Presión de confinamiento hidrostática,  $\sigma_3$ : 10 MPa – 14 MPa

**Probeta H70-T10-1-1**



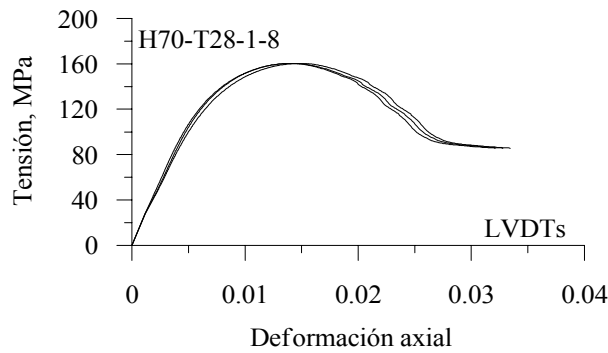
**Probeta H70-T14-1-7**



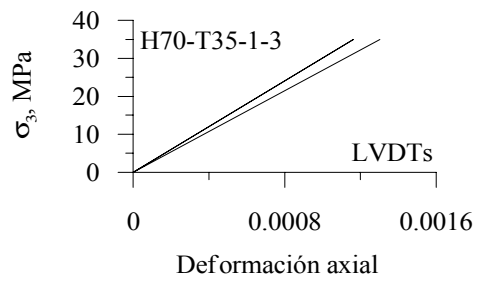
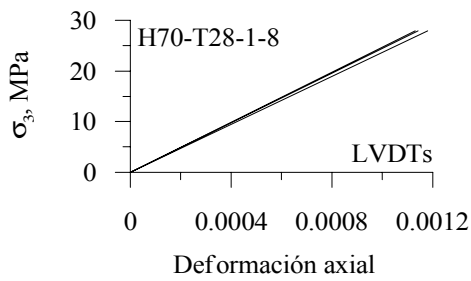
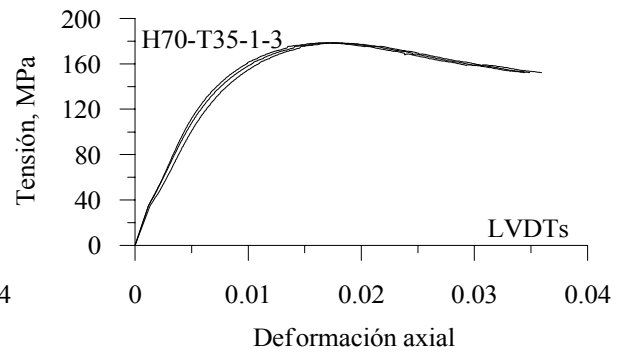
Probeta	Edad	$f_{max}$	$\epsilon_{max}$	$E_o$	$E_i$
Identificación	(días)	(MPa)	( $\mu\epsilon$ )	(GPa)	(GPa)
H70-T10-1-1	78	117.7	7488	24.5	22.2
H70-T14-1-7	109	130.5	9426	18.6	20.9

**Figura C.7** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie H70- Presión de confinamiento hidrostática,  $\sigma_3$ : 28 MPa – 35 MPa

**Probeta H70-T28-1-8**



**Probeta H70-T35-1-3**

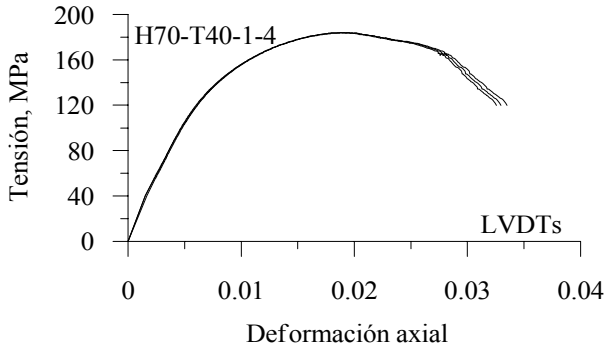


Probeta	Edad	$f_{max}$	$\epsilon_{max}$	$E_o$	$E_i$
Identificación	(días)	(MPa)	( $\mu\epsilon$ )	(GPa)	(GPa)
H70-T28-1-8	126	160.3	13941	24.2	21.0
H70-T35-1-3	83	178.5	17130	28.9	20.0

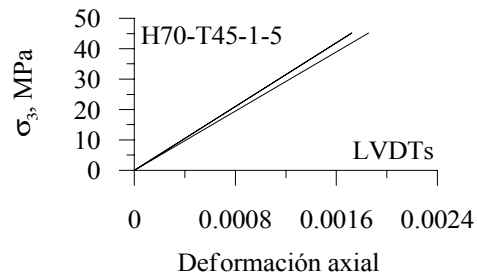
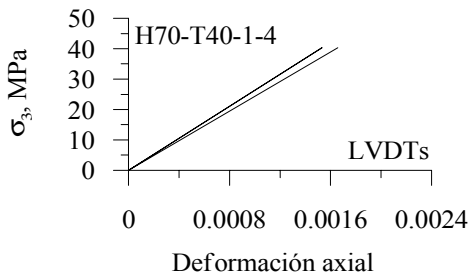
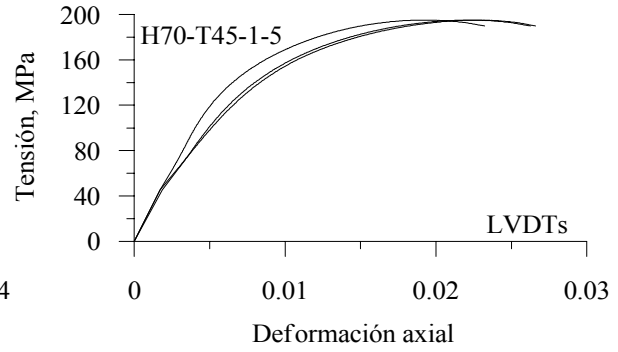


**Figura C.8** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie H70- Presión de confinamiento hidrostática,  $\sigma_3$ : 40 MPa – 45 MPa

**Probeta H70-T40-1-4**



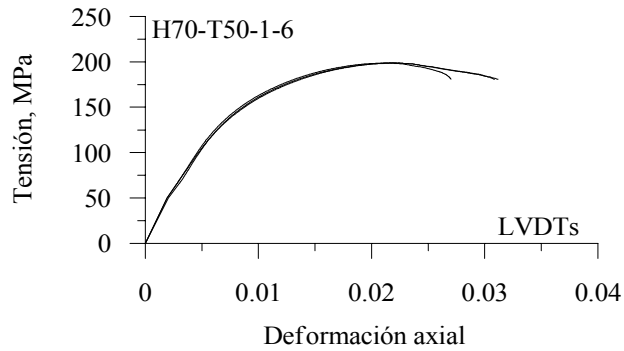
**Probeta H70-T45-1-5**



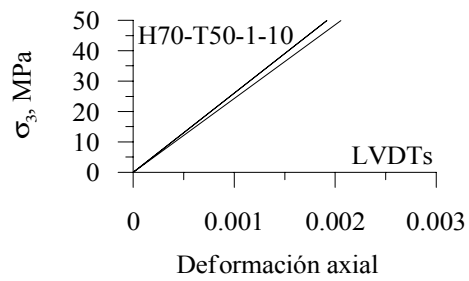
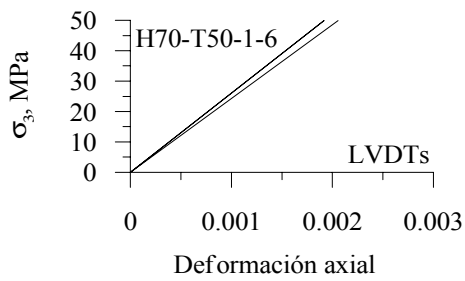
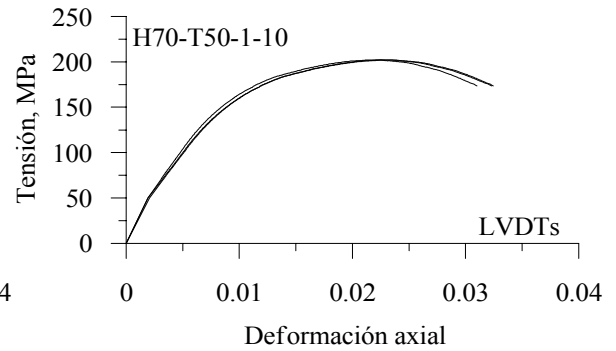
Probeta Identificación	Edad (días)	$f_{max}$ (MPa)	$\epsilon_{max}$ ( $\mu\epsilon$ )	$E_o$ (GPa)	$E_i$ (GPa)
H70-T40-1-4	85	184.1	19255	25.6	19.2
H70-T45-1-5	95	195.2	21027	25.6	18.9

**Figura C.9** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie H70- Presión de confinamiento hidrostática,  $\sigma_3$ : 50 MPa

**Probeta H70-T50-1-6**



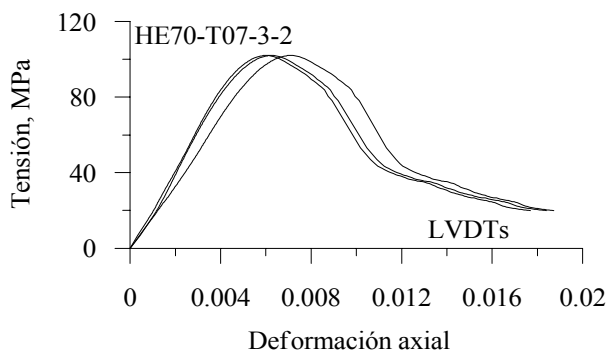
**Probeta H70-T50-1-10**



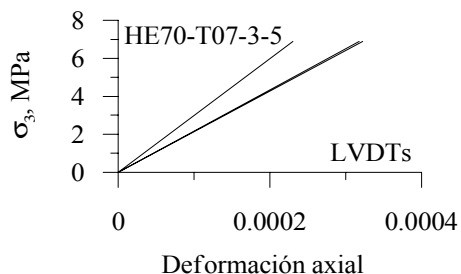
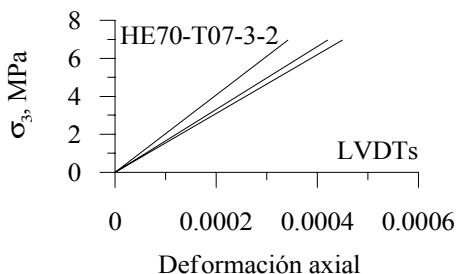
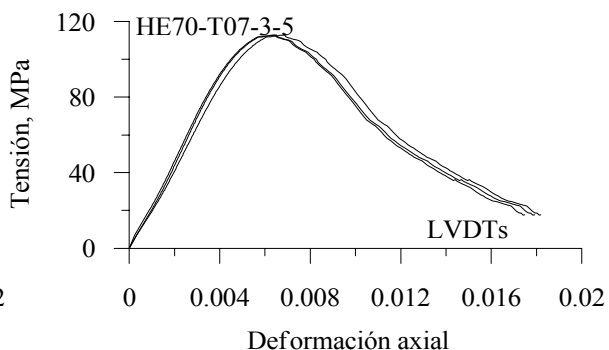
Probeta Identificación	Edad (días)	$f_{max}$ (MPa)	$\epsilon_{max}$ ( $\mu\epsilon$ )	$E_o$ (GPa)	$E_i$ (GPa)
H70-T50-1-6	95	198.0	21689	25.5	18.3
H70-T50-1-10	125	202.1	22922	25.5	16.6

**Figura C.10** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie **HE70**-Presión de confinamiento hidrostática,  $\sigma_3$ : 7 MPa

**Probeta HE70-T07-3-2**



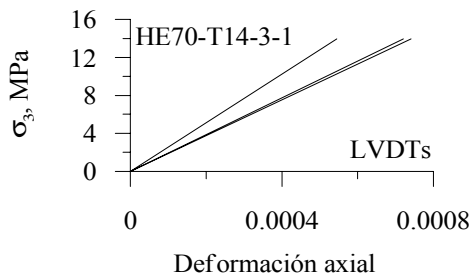
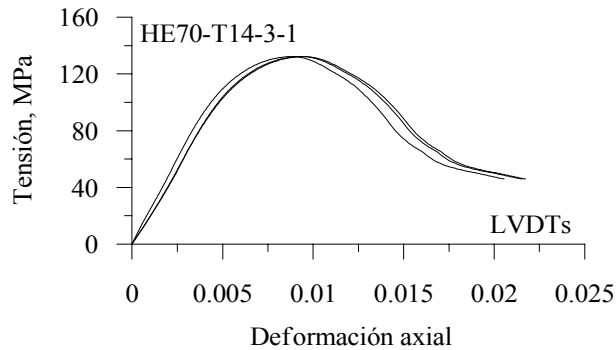
**Probeta HE70-T07-3-5**



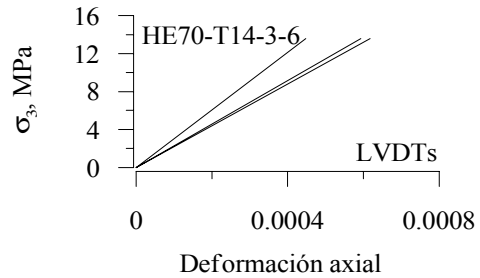
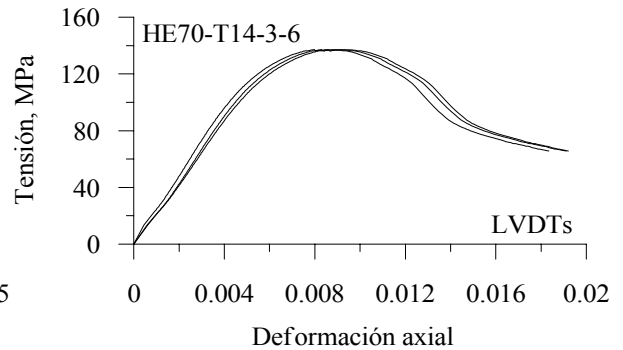
Probeta	Edad	$f_{max}$	$\epsilon_{max}$	$E_o$	$E_i$
Identificación	(días)	(MPa)	( $\mu\epsilon$ )	(GPa)	(GPa)
HE70-T07-3-2	94	102.1	6430	17.2	20.7
HE70-T07-3-5	188	112.9	6597	23.7	24.3

**Figura C.11** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie HE70-Presión de confinamiento hidrostática,  $\sigma_3$ : 14 MPa

**Probeta HE70-T14-3-1**



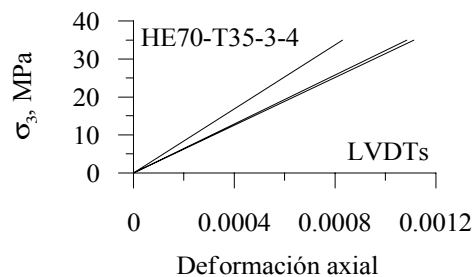
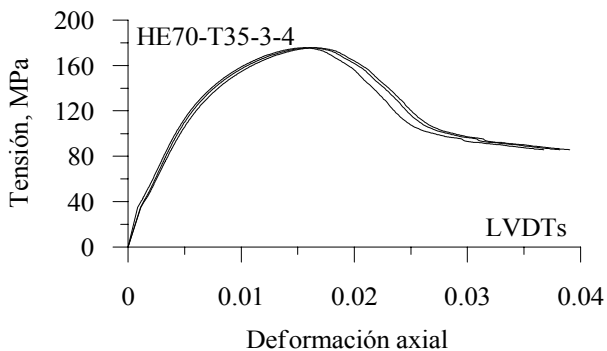
**Probeta HE70-T14-3-6**



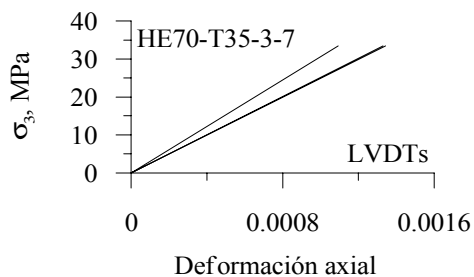
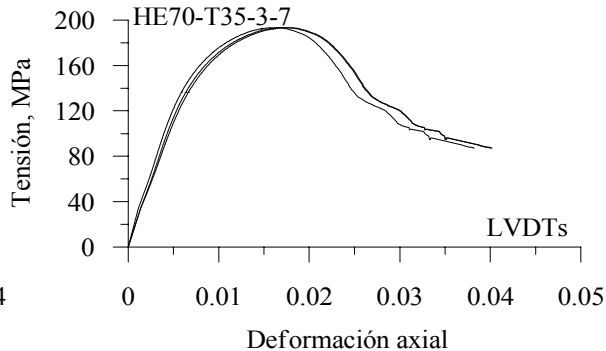
Probeta Identificación	Edad (días)	$f_{max}$ (MPa)	$\epsilon_{max}$ ( $\mu\epsilon$ )	$E_o$ (GPa)	$E_i$ (GPa)
HE70-T14-3-1	93	132.3	9209	20.8	23.3
HE70-T14-3-6	188	137.3	8278	24.5	24.4

**Figura C.12** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie HE70- Presión de confinamiento hidrostática,  $\sigma_3$ : 35 MPa

**Probeta HE70-T35-3-4**



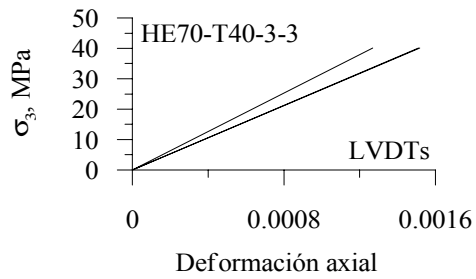
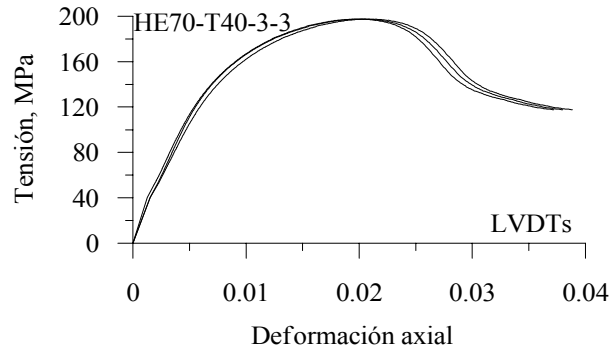
**Probeta HE70-T35-3-7**



Probeta Identificación	Edad (días)	$f_{max}$ (MPa)	$\epsilon_{max}$ ( $\mu\epsilon$ )	$E_o$ (GPa)	$E_i$ (GPa)
HE70-T35-3-4	94	175.8	15966	34.6	20.5
HE70-T35-3-7	189	193.4	17031	26.6	23.2

**Figura C.13** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie HE70-Presión de confinamiento hidrostática,  $\sigma_3$ : 40 MPa

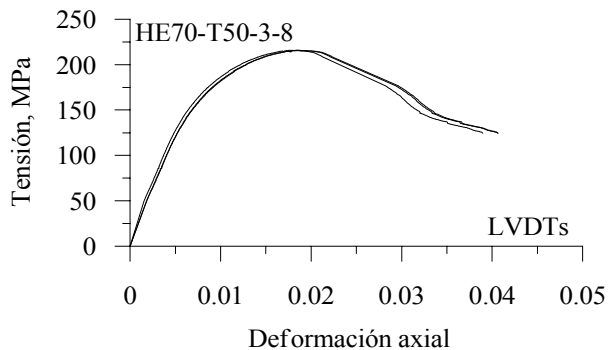
**Probeta HE70-T40-3-3**



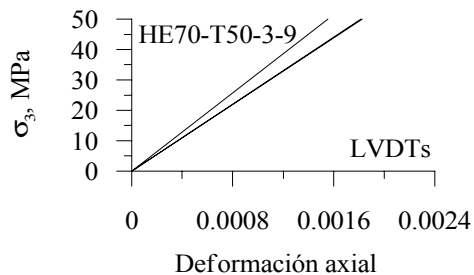
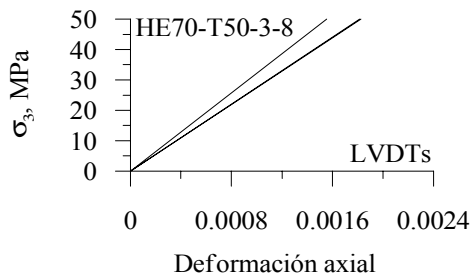
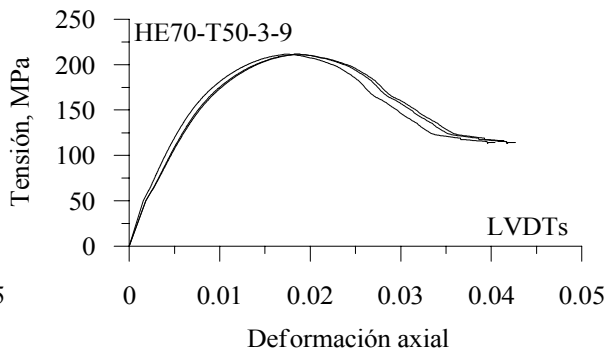
Probeta Identificación	Edad (días)	$f_{max}$ (MPa)	$\epsilon_{max}$ ( $\mu\epsilon$ )	$E_o$ (GPa)	$E_i$ (GPa)
HE70-T40-3-3	94	197.6	20292	28.0	20.4

**Figura C.14** Curva tensión-deformación axial de probetas de hormigón confinado en célula triaxial-Serie HE70- Presión de confinamiento hidrostática,  $\sigma_3$ : 50 MPa

**Probeta HE70-T50-3-8**



**Probeta HE70-T50-3-9**



Probeta	Edad	$f_{max}$	$\epsilon_{max}$	$E_o$	$E_i$
Identificación	(días)	(MPa)	( $\mu\epsilon$ )	(GPa)	(GPa)
HE70-T50-3-8	189	215.7	18386	28.9	22.9
HE70-T50-3-9	190	211.5	18351	28.9	19.1