FABRE – Consorzio di ricerca per la valutazione di ponti viadotti e altre strutture
Ponti, viadotti e gallerie esistenti: ricerca, innovazione e applicazioni
2- 4 Febbraio 2022, Lucca

Alcune riflessioni sulla verifica di ponti a sbalzo con cambiamento di schema statico

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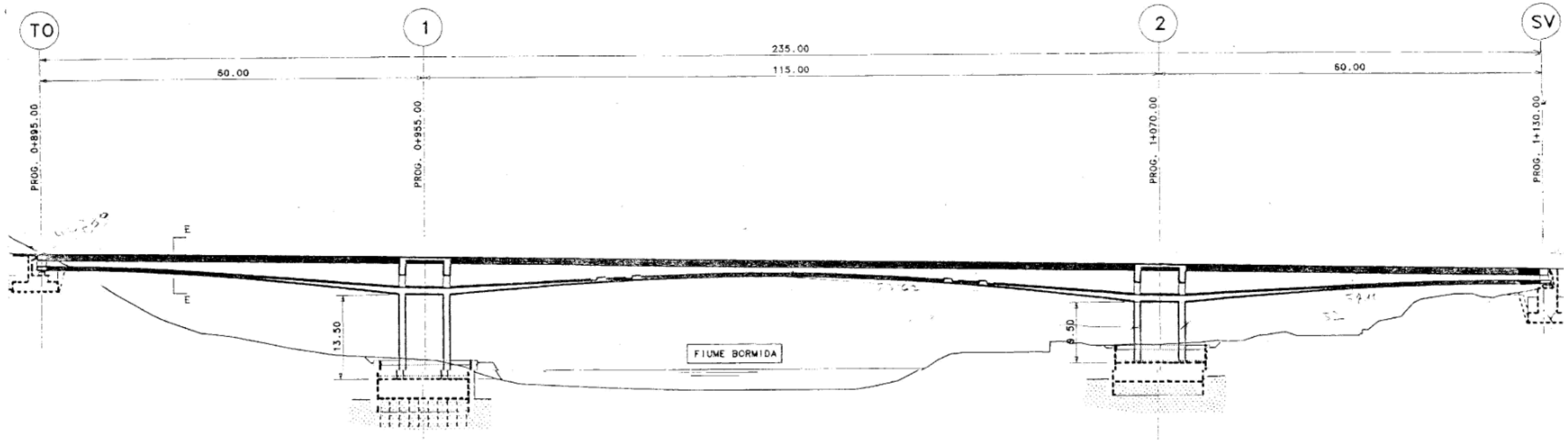
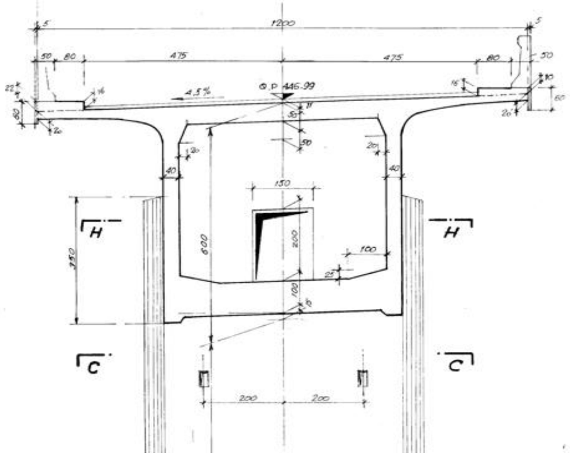
Contenuti

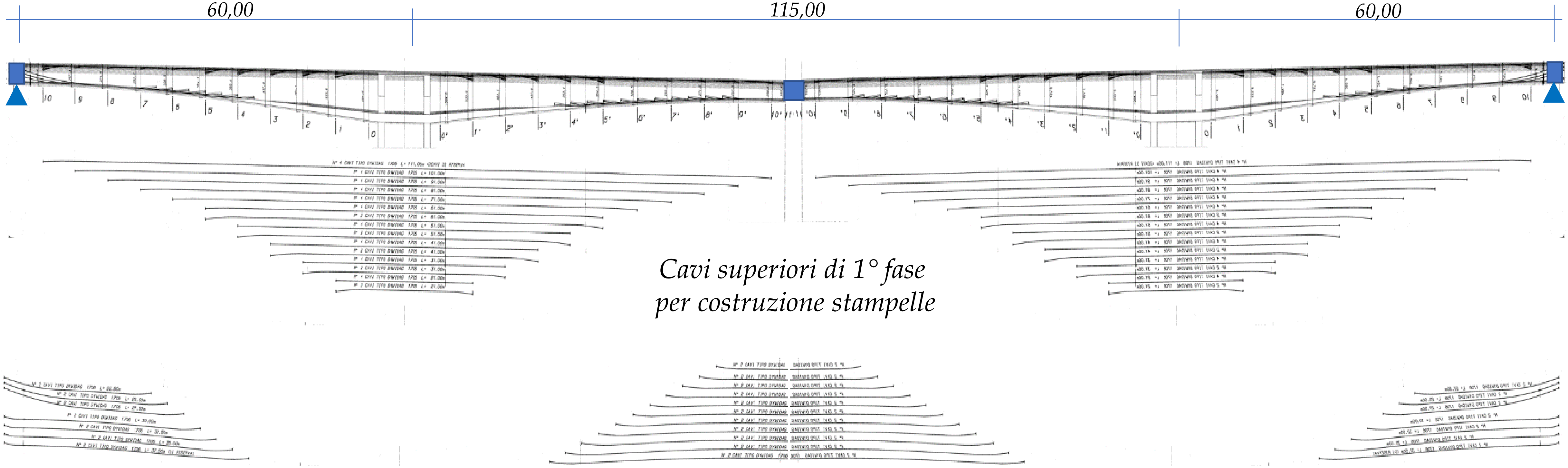
- ✓ Premessa: aspetti costruttivi dei ponti a sbalzo per conci successivi
- ✓ Effetti della viscosità per cambiamento di schema statico
- ✓ Effetti della precompressione di 2° fase (diagrammi M e V)
- ✓ Verifiche agli SLU di flessione e taglio


TO
1
2
SV
235.00
60.00
115.00
60.00
PROG. 0+895.00
PROG. 0+955.00
PROG. 1+070.00
PROG. 1+130.00
E
E
13.50
8.50
FIUME BORMIDA


1200
475
475
4.5%
Q.P. 446.99
150
600
200
100
H
H
C
C
200
200

Premessa: Viadotti con impalcato costituito da "stampelle" realizzate a sbalzo per conci successivi gettati in opera e solidarizzate mediante il getto di concio di chiusura e cavi di continuità

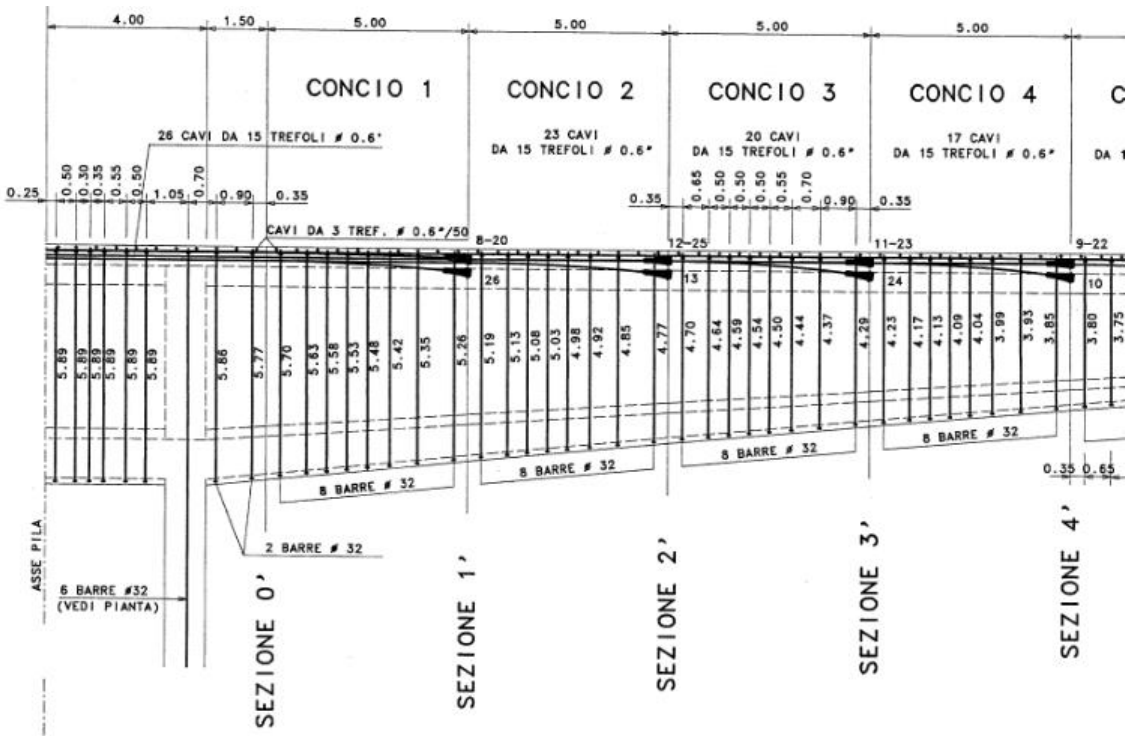
Precompressione longitudinale



Cavi superiori di 1° fase
per costruzione stampelle

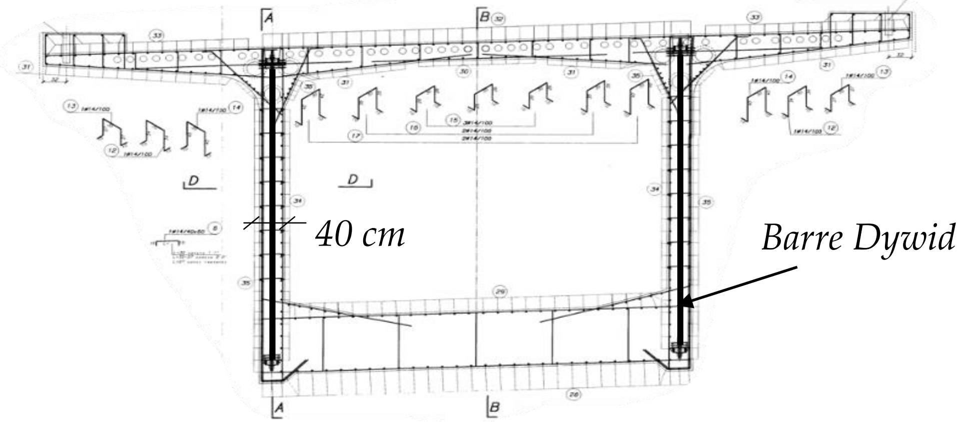
Cavi inferiori di 2° fase

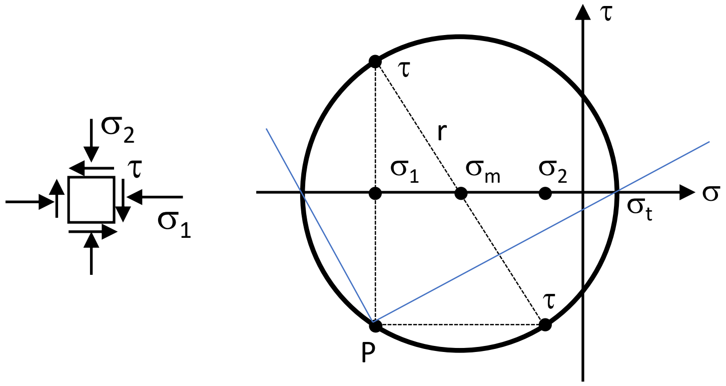
Precompressione verticale con barre Dywidag


4.00
1.50
5.00
CONCIO 1
CONCIO 2
CONCIO 3
CONCIO 4
26 CAVI DA 15 TREFOLI ø 0.6"
23 CAVI DA 15 TREFOLI ø 0.6"
20 CAVI DA 15 TREFOLI ø 0.6"
17 CAVI DA 15 TREFOLI ø 0.6"
CAVI DA 3 TREF. ø 0.6"/50
8-20
12-25
11-23
9-22
8 BARRE ø 32
2 BARRE ø 32
6 BARRE ø32 (VEDI PIANTA)
ASSE PILA
SEZIONE 0'
SEZIONE 1'
SEZIONE 2'
SEZIONE 3'
SEZIONE 4'

Stralcio impalcato

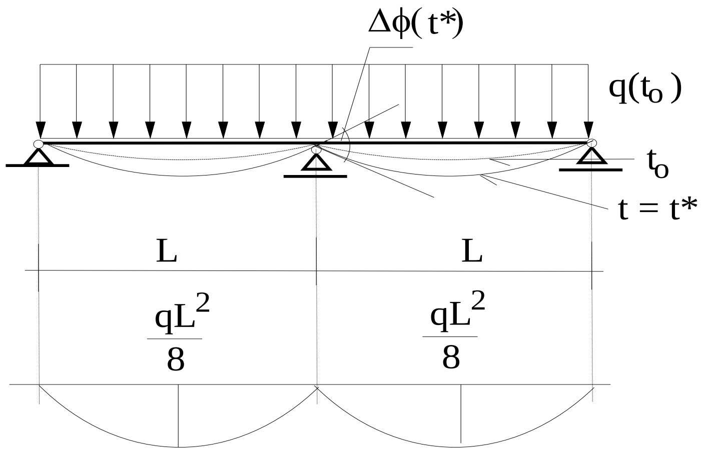
Sezione trasversale

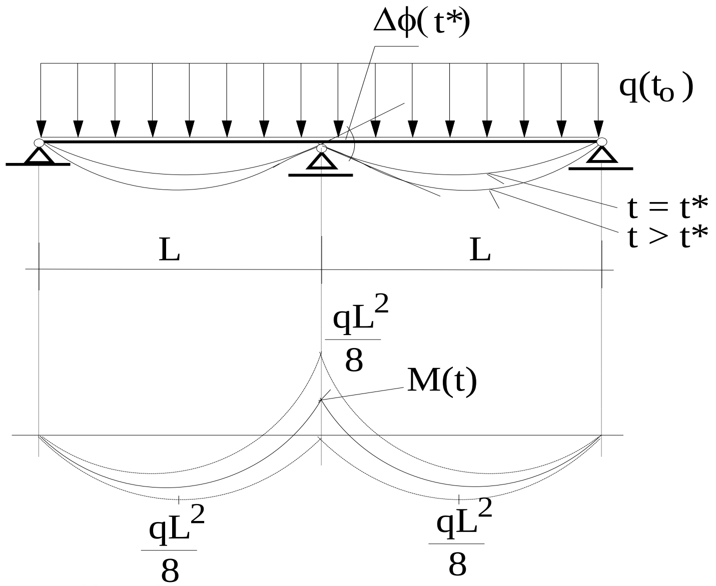

40 cm
Barre Dywidag Ø32


τ
σ
σ2
σ1
τ
r
σm
σt
P

$$\sigma_t = r - \sigma_m = \sqrt{\tau^2 + \left(\frac{\sigma_1 - \sigma_2}{2}\right)^2} - \frac{\sigma_1 + \sigma_2}{2}$$

Effetti della viscosità: Cambiamento di schema statico (3° Principio visco-elasticità lineare)



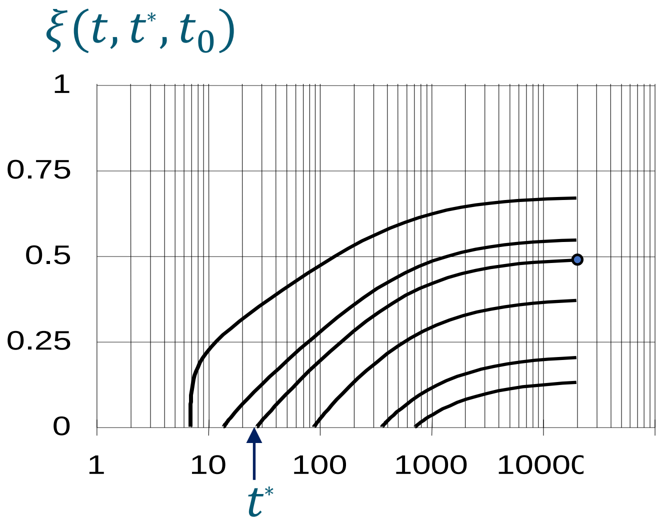


$$M(t) = M^{el}\,\xi(t,t^*,t_0)$$

$$\xi(t,t^*,t_0) = \int_{t^*}^{t} R(t,\tau)\,dJ(\tau,t_0)$$

$\xi(t,t^*,t_0)$ = Funzione di Ridistribuzione

$\xi_{\min}$ $(t_{0,\max})$ $\quad$ $\xi_{\max}$ $(t_{0,\min})$



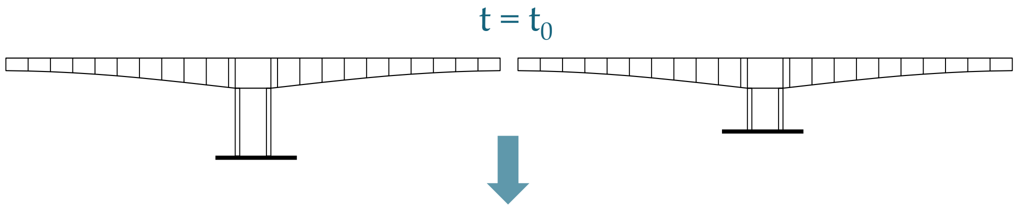
Soluzione approssimata
Metodo AAEM
(Age Adjusted Effective Modulus)

$$\xi(t,t^*,t_0) \cong \left(\frac{\varphi(t,t_0)-\varphi(t^*,t_0)}{1+\chi(t,t^*)\varphi(t,t^*)}\right)\frac{E_C(t^*)}{E_C(t_0)}$$

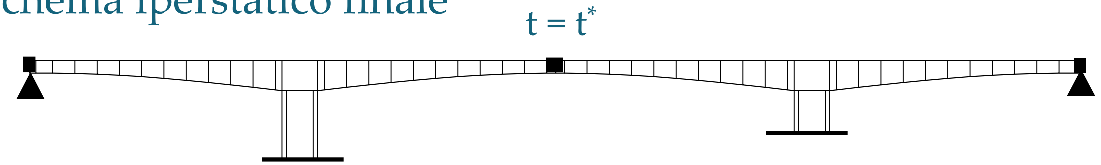
Caso studio

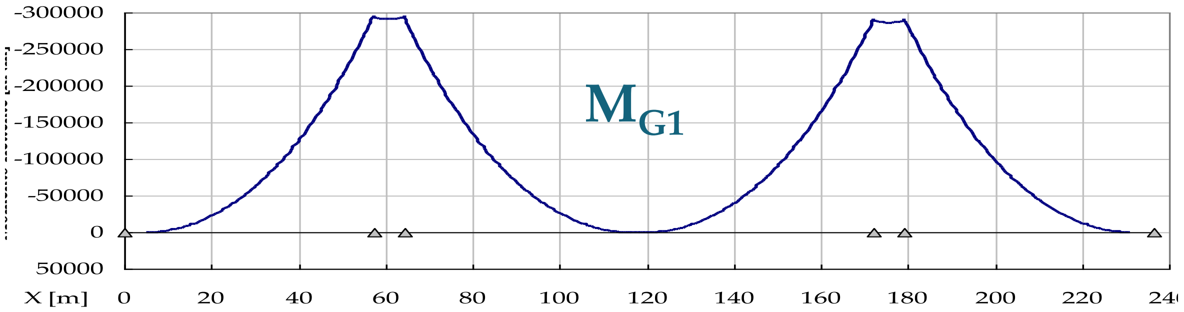
Effetti della viscosità: Cambiamento di schema statico

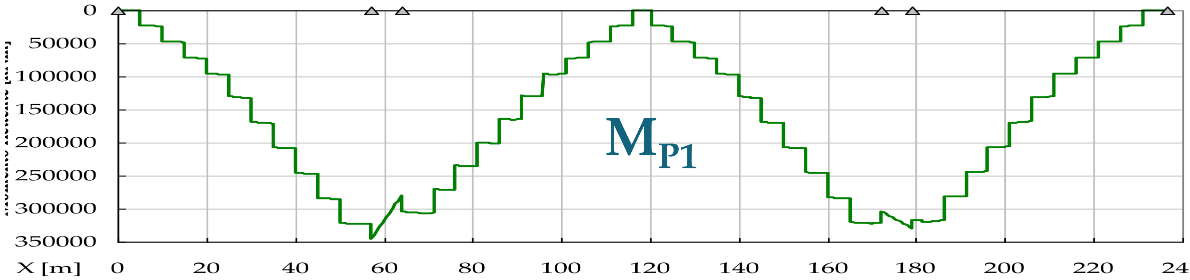
Schema isostatico iniziale con cavi di 1° fase

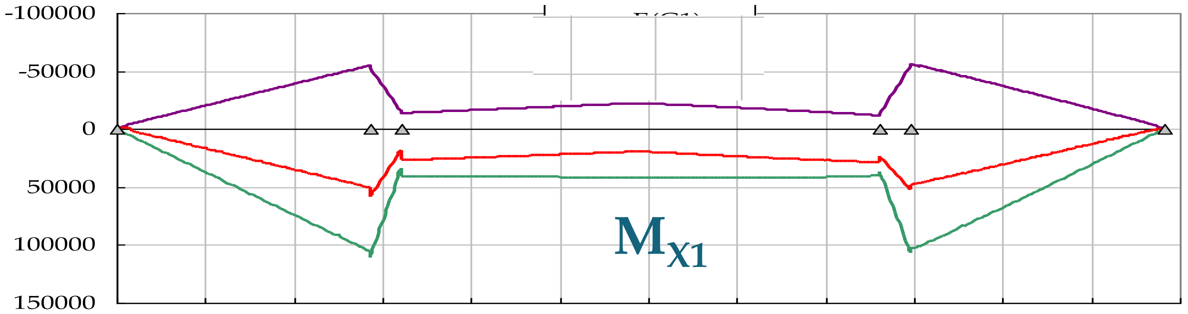


Schema iperstatico finale



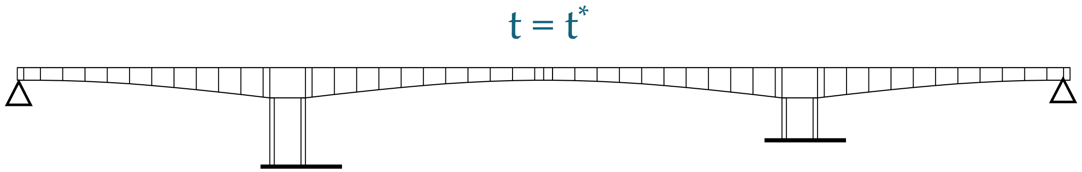




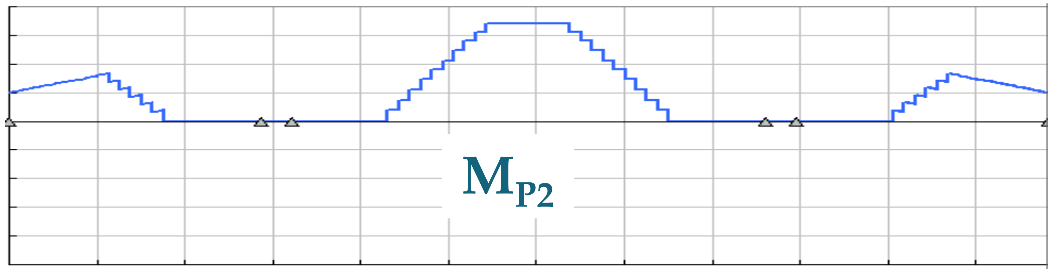


Caso studio

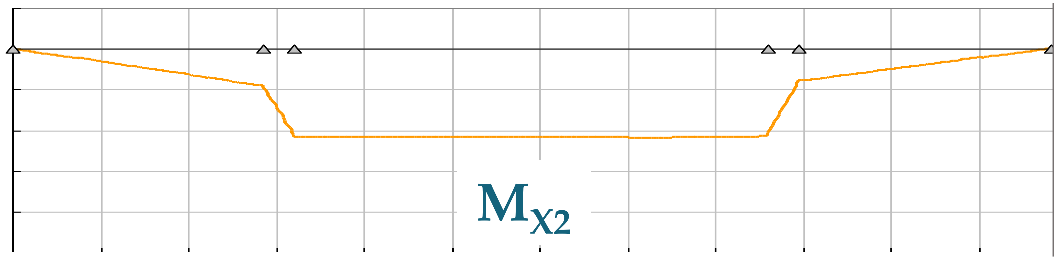
Effetti della precompressione (cavi di 2° fase) sullo schema iperstatico finale



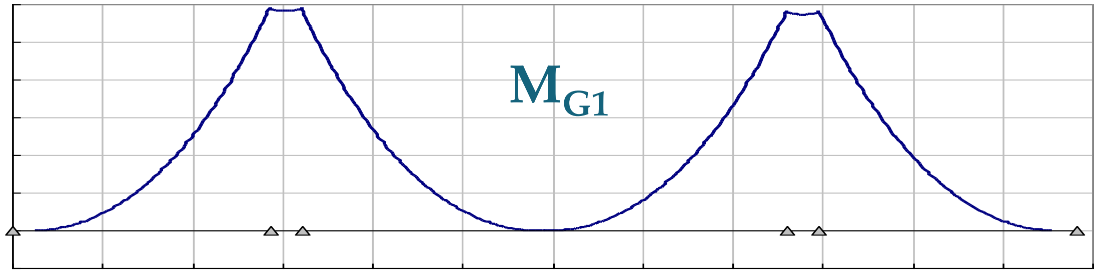
Effetti isostatici

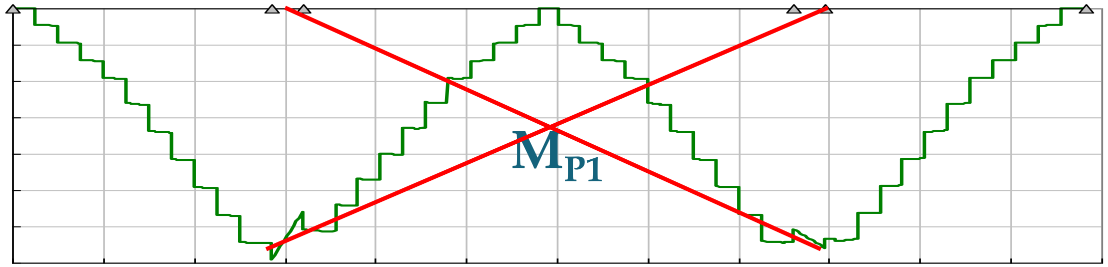


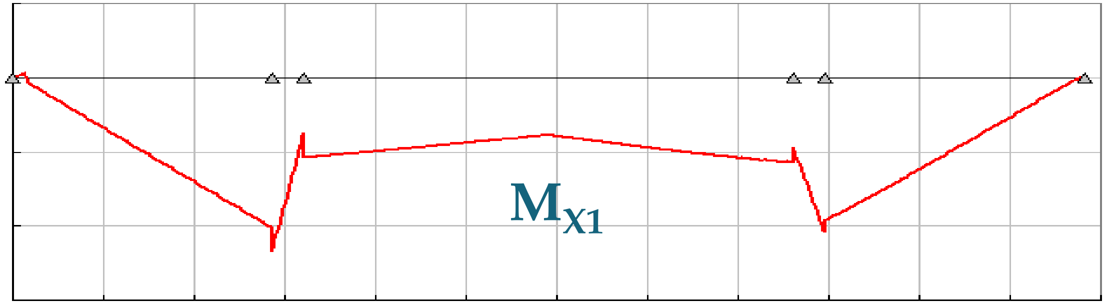
Effetti iperstatici

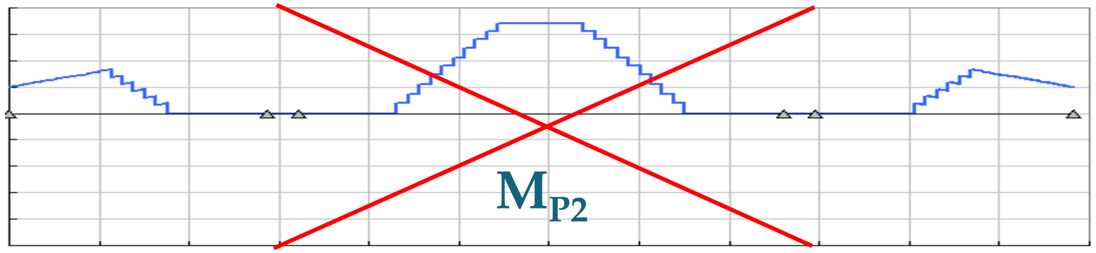


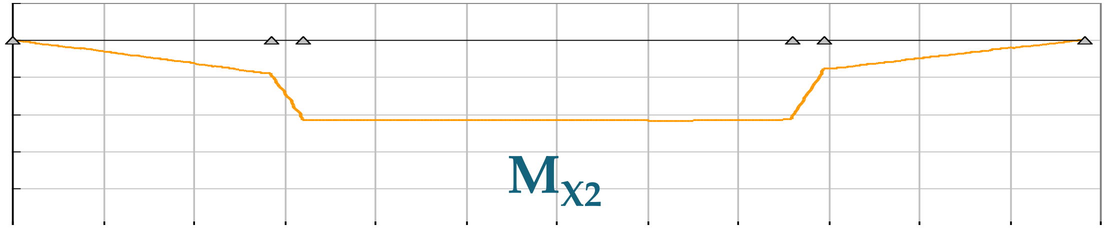
Diagrammi dei momenti flettenti

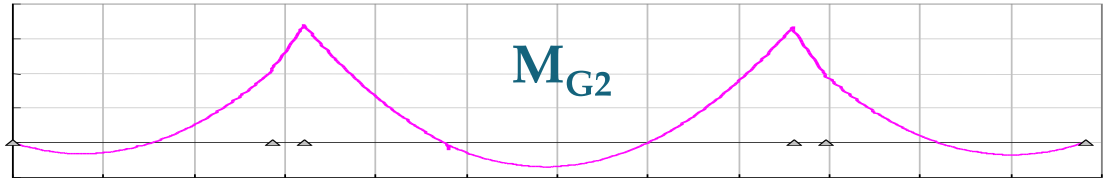


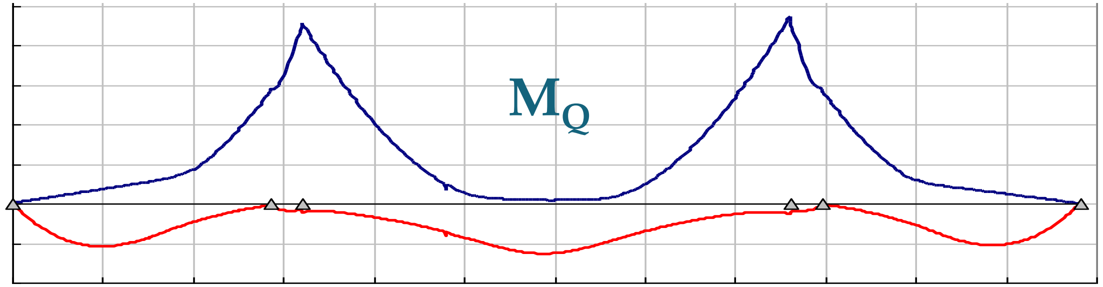




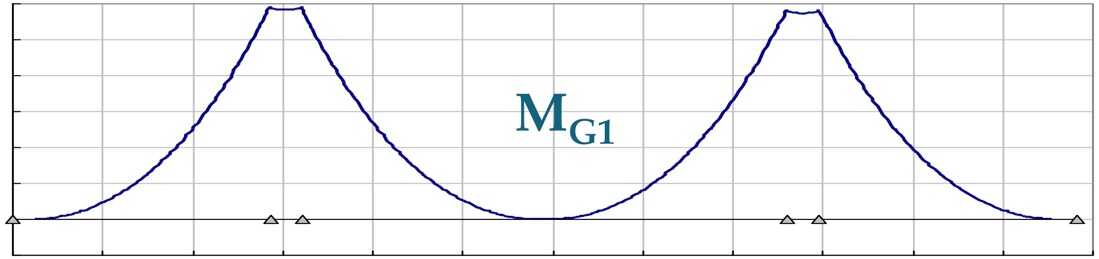


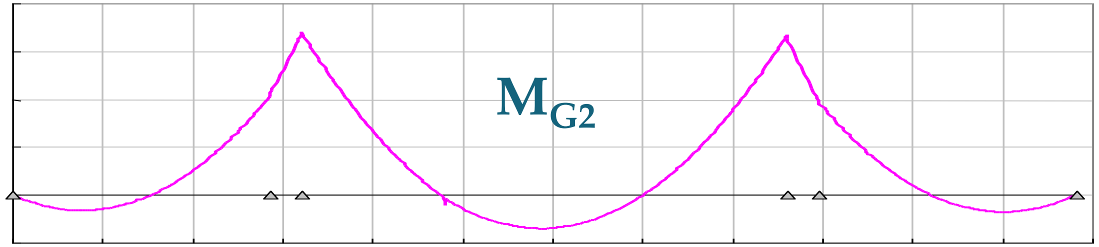


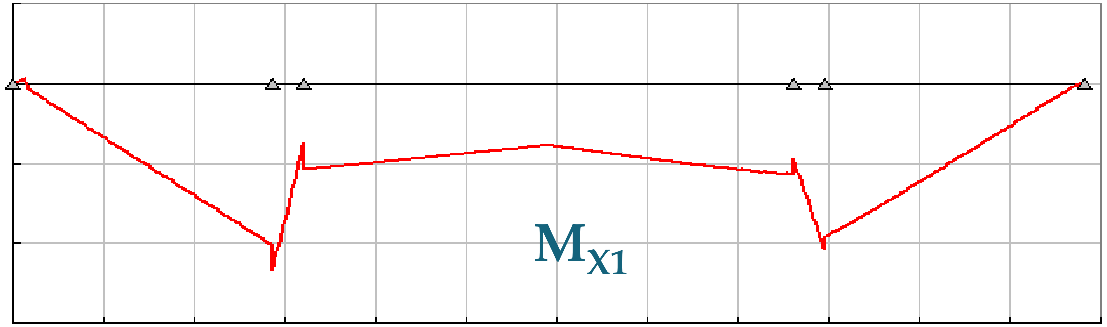


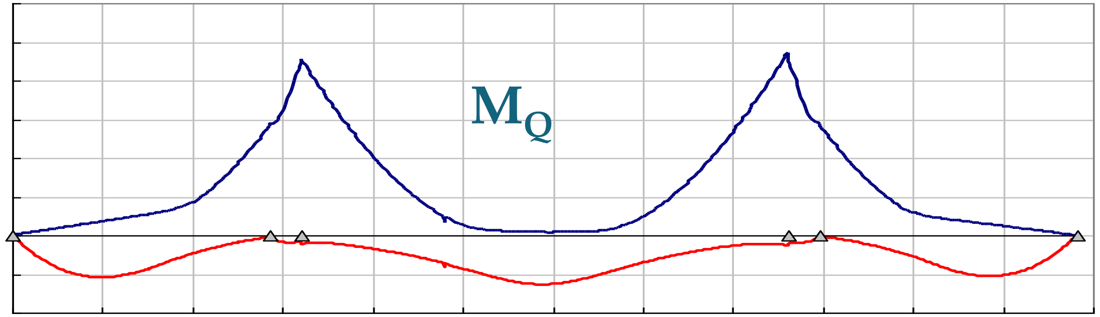


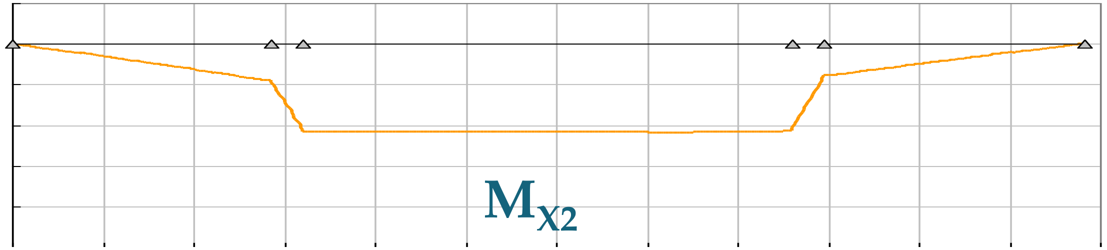
Diagrammi dei momenti flettenti da considerare nelle verifiche









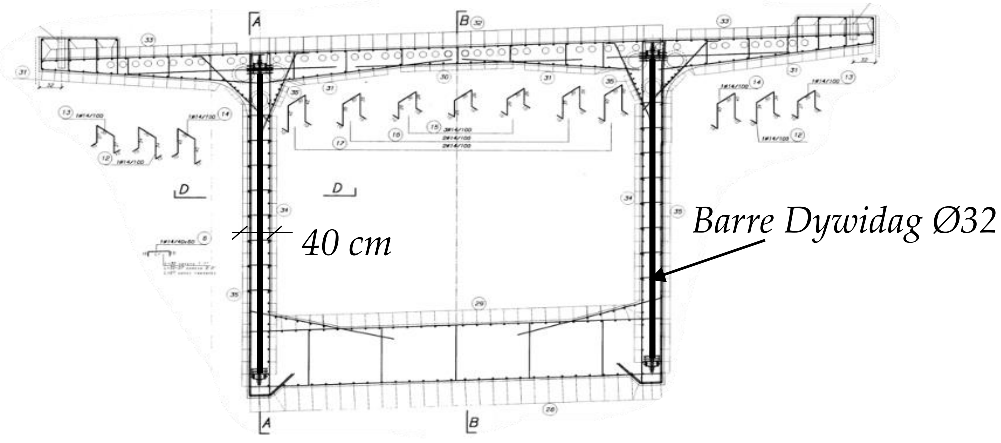


Verifica sezione più gravosa $M_{Rsd}/M_{Ed} = 1{,}07$

Per la verifica a taglio si considerano i diagrammi concomitanti a quelli del momento flettente.

Verifica a taglio

$$V_{Rcd} = 0{,}9\mathrm{d} \cdot b_w \cdot \alpha_c \cdot \upsilon \cdot f_{cd} \cdot \frac{(cotg\alpha + cotg\vartheta)}{(1 + cotg^2\vartheta)} < V_{Rsd}$$



ν = 0,6 (tensioni armatura a taglio $\sigma_s < 0.8\ f_{wk}$

(UNI EN 1992-2:2006, par. 6.2.3)

$$f_{cd} = \min\left(\frac{f_{cm}}{FC \cdot \gamma_M}; \frac{f_{ck}}{FC}\right) = \min\left(\frac{57{,}58}{1 \cdot 1{,}5}; \frac{47{,}06}{1}\right) = 38{,}38\ MPa$$

$$V_{Ed} = V_{Ed,V} + V_{Ed,T} = \frac{V}{2} + \frac{T}{2A} i$$

$$\frac{V_{Rsd}}{V_{Ed}} = 1{,}66$$

$$V_{Rd} = \min(V_{Rsd}, V_{Rcd})$$

$$\boxed{\frac{V_{Rcd}}{V_{Ed}} = 1{,}01}$$