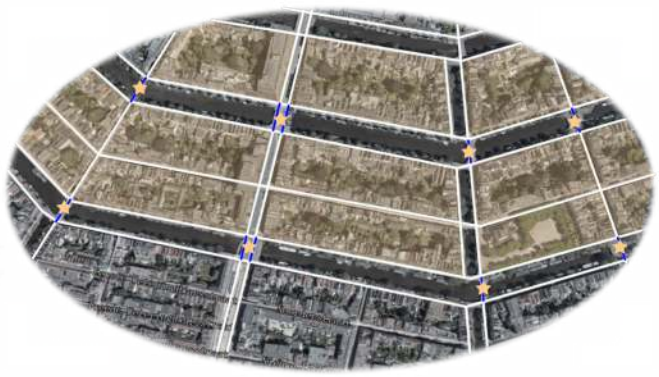
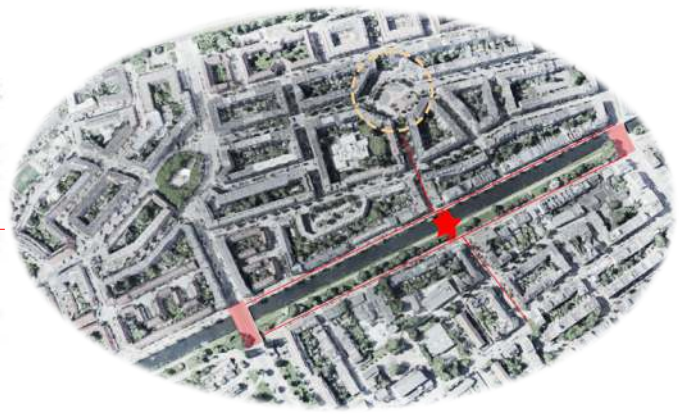


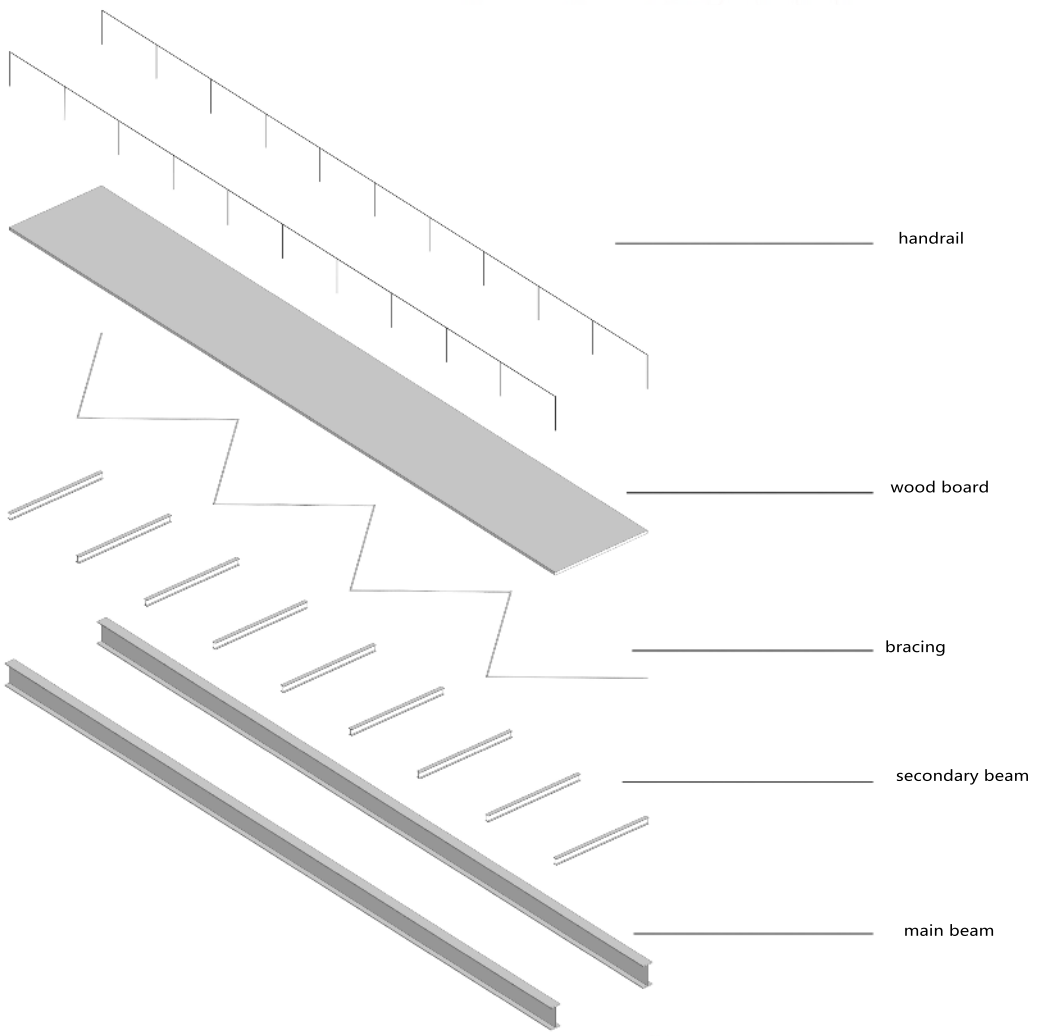
Part of the Central Area



Bridge location

3D view of the bridge

The bridge is only built on the roadside with roads on both sides of the river, that is, as a facility connecting the roads on both sides of the river.
Our bridge is built on a river with roads on both sides, and has a distance of more than 100m from the original bridges on both sides.



Exploded view of the bridge

Main materials

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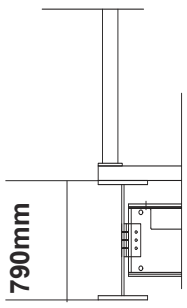
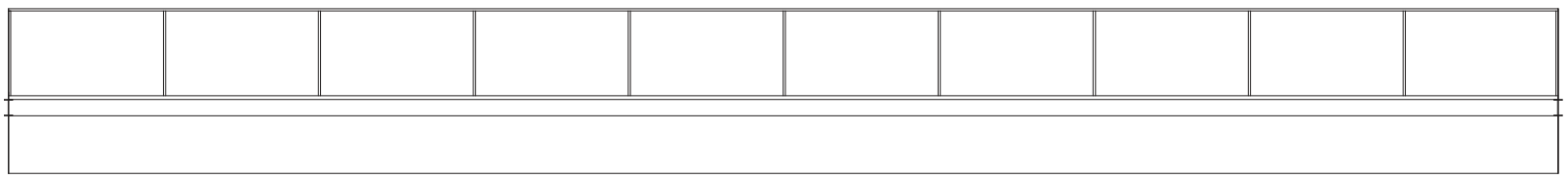
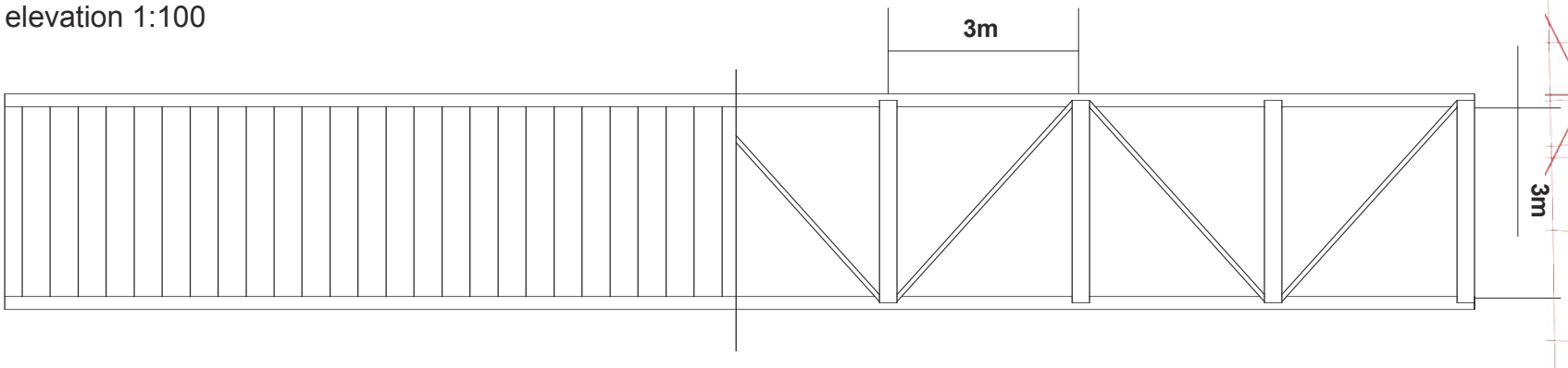
section 1:50



connection detail 1:50



elevation 1:100



plan with detail 1:100

People load : 5000N/m ^{2}
people load of internal beam : 5000N/m^3 x 3m = 15000N/m
people load of external beam : 5000N/m^3 x 1.5m = 7500N/m

snow load : 700N/m^2
snow load of internal beam : 700N/m^3 x 3m = 2100N/m
snow load of external beam : 700N/m^3 x 1.5m = 1050N/m

wood board : 5.4kN/m^3 **thickness : 0.05m**

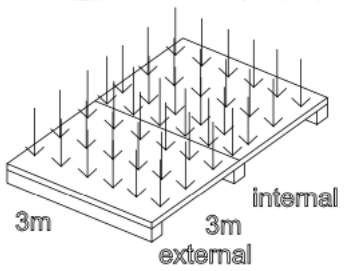
Total load of internal secondary beam : 15000N/m + 810N/m + 2100N/m + 437N/m = 18350N/m

Total load ofexternal secondary beam : 7500N/m + 405N/m + 1050N/m + 437N/m = 9390N/m

Main beam self weight : 2240N/m

Type of steel

secondary beam : IPE 220 **main beam : HEA 800**



Dimension of the beams

Identification	Nominal weight 1m	Nominal dimensions					Cross-section		Dimensions for detailing				Surface	
HEA		b	h	s	t	r	A	h1	d	Ø	emin	emax	AL	AG
	kg/m	mm					cm2	mm	mm		mm		m2/m	m2/m
HEA 800	224	300	790	15	28	30	285,8	734	674	M 27	130	198	2,698	12,03
		strong axis x-x							weak axis y-y					
	Ix	Wel.x	Wpl.x	ix	Avy		Sx	Iy	Wel.y	Wpl.y	iy	Ss	It	Iw
	cm4	cm3	cm3	cm	cm2		cm3	cm4	cm3	cm3	cm	mm	cm4	cm
HEA 800	303400	7682	8699	32,58	138,8		4350	12640	842,6	1312	6,65	106,1	596,9	18290

Identification	Nominal weight 1m	Nominal dimensions					Cross-section		Dimensions for detailing				Surface	
	kg/m	mm					A	h1	d	Ø	pmin	pmax	AL	AG
		b	h	t1	t2	R1	cm2	mm	mm		mm	mm	m2/m	m2/m
		strong axis x-x							weak axis y-y					
	Ix	Wel.x	Wpl.x	ix	Avy		Sx	Iy	Wel.y	Wpl.y	iy	Ss	It	Iw
	cm4	cm3	cm3	cm	cm2		cm3	cm4	cm3	cm3	cm	mm	cm4	
IPE 220	26,2	110	220	5,9	9,2	12,0	33,40	201,6	177,6	M12	60	62	0,848	32,36

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Secondary beam

length of the beam : 3m Vlim : 3/400 = 0.0075m E : 2.1e11N/m^2 q = 18350N/m

after calculation with the formula $I_x = \frac{1}{48}\frac{Q_d L^3}{E v_{lim}}$ we got the Ix = 655.4cm^4 which means we can use IPE 220

Double check : $v_\gamma = \frac{5}{384}\frac{G_d L^4}{E I_x}$ Vr = 4.7 x 10^{-5}m < Vlim so the material can be used

Because of the load of the external beams is less than internal beams. This type of beam can also be used as the external beams.

Critical load

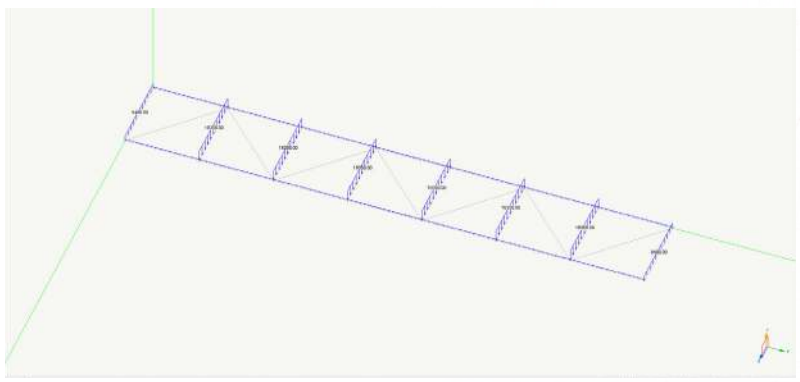
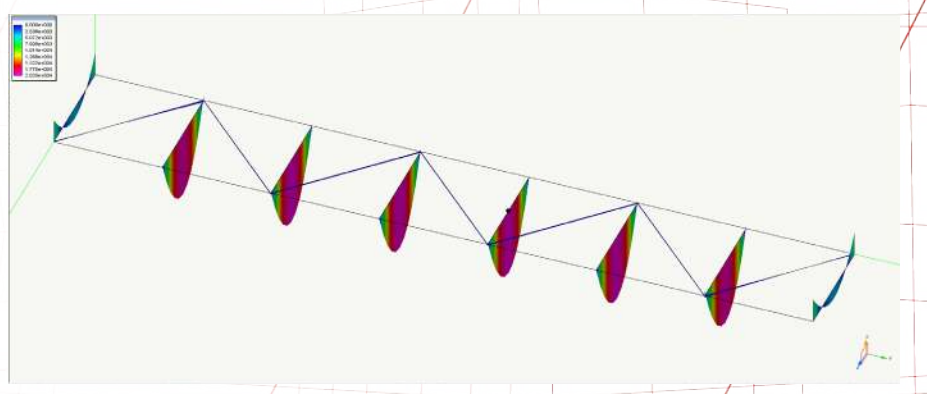
Because of the maximum normal force is on the main beam so we don't need to calculate the critical load of secondary beam.

Slenderness

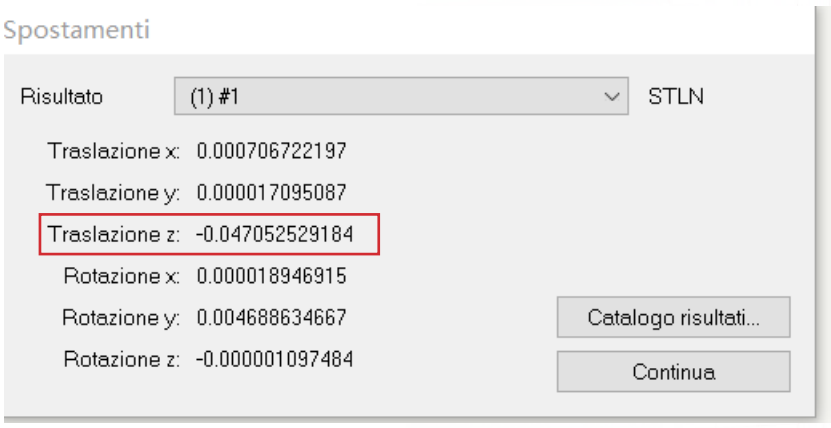
Ix = 2772 x 10^{-8} m^4 A = 33.4 x $10^{-4}$$m^2$ λ = L/(√Ix/A) = 104.17 < 200

Stress

normal stress of the secondary beam : δzmax = (Mx/Ix * ymax) + N/A = 81.3 MPa < 0.8fyk = 188MPa

load of the secondary beam	moment of the secondary beam
	

Main beam



We can got the maximum displacement of main beam in Nòlian which located in the middle of the bridge.

The maximum displacement of main beam is 0.047m

Vlim : 21/400 = 0.0525m

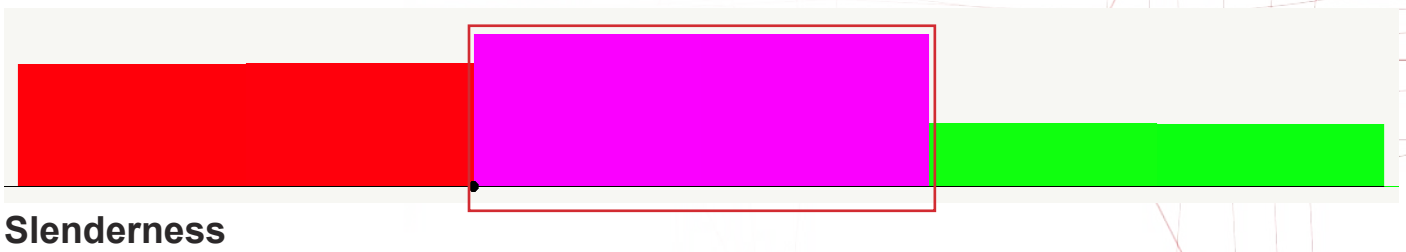
0.047m < 0.0525m

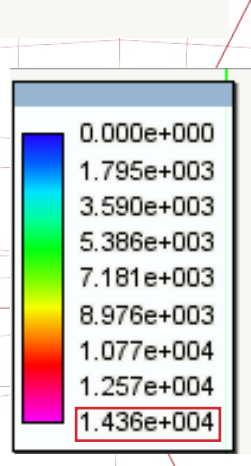
So we can use HEA800 as main beam.

Critical load

L0 = 3m Imin = 12640 x $10^{-8}$$m^4$

Ncr = π^2EImin/$L0^2$ = 2.9 x 10^4kN Nx = 14.36kN (from Nòlian) Ncr > Nx so it's correct



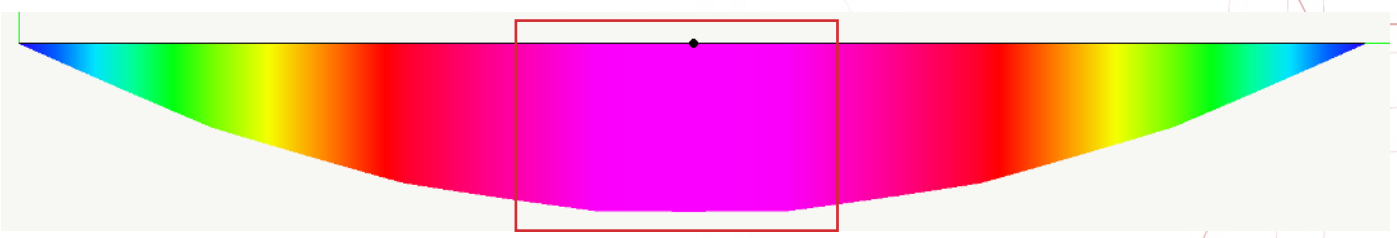


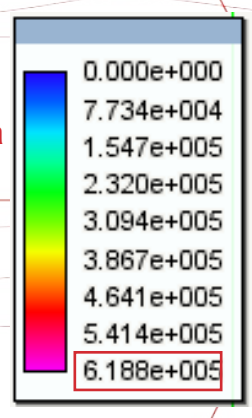
Slenderness

Ix = 303400 x $10^{-8}$$m^4$ A = 285.8 x $10^{-4}$$m^2$ λ = L/(√Ix/A) = 70 < 200

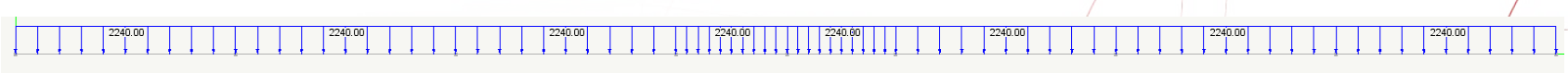
Stress

normal stress of the secondary beam : δzmax = (Mx/Ix * ymax) + N/A = 81.22MPa < 0.8fyk = 188MPa





Load of main beam



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