PEDESTRIAN BRIDGE

Gabriele Lipskyte

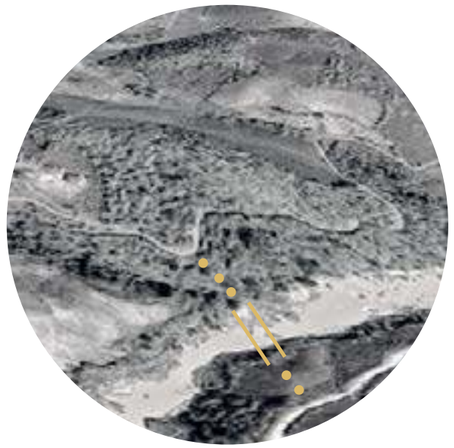
Zeynepnaz Kocabas

Gabriella Luppi Mackenzie

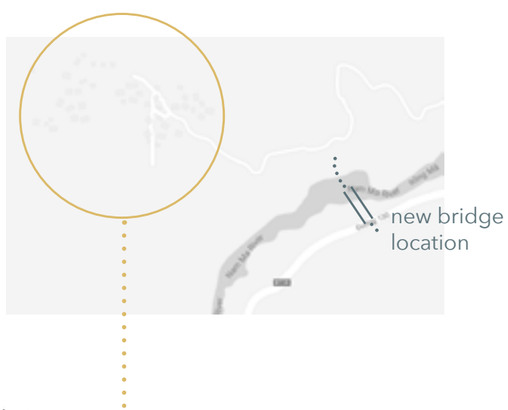
Julia Landreau

L O C A T I O N

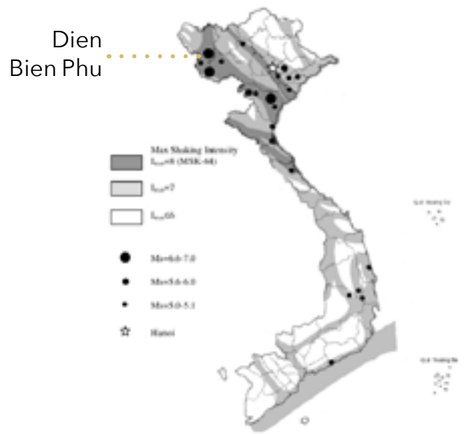
Huoi Ha, Dien Bien province - Vietnam



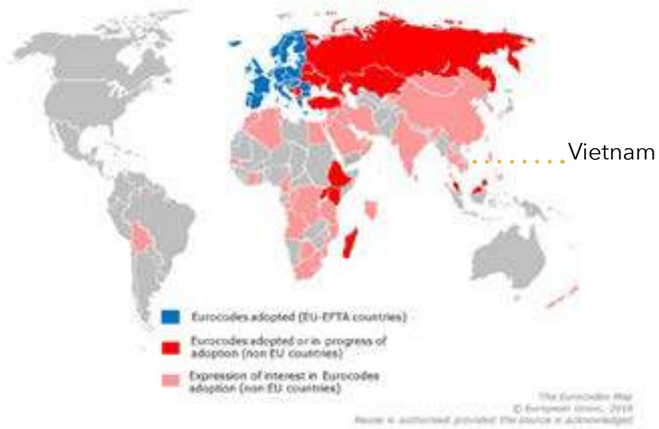
The area is located in the north west part of Vietnam. This was chosen due to lack of circulation in between small villages and cities with well developed infrastructures.



B U I L D I N G R E G U L A T I O N S

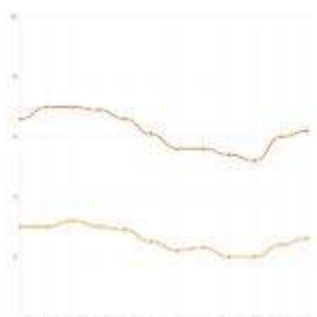


Vietnamese earthquake map
http://www.ejse.org/Archives/Full-text/2008/Special1/200803.pdf

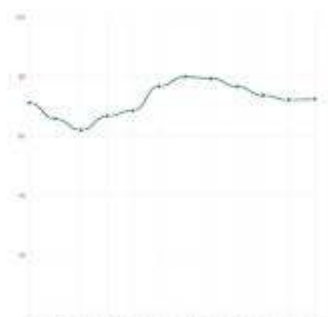


W H E A T E R C O N D I T I O N S

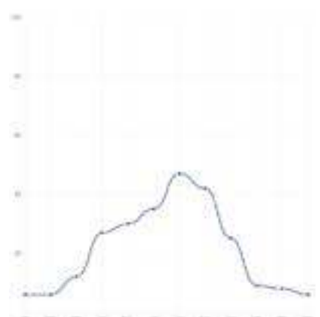
Dien Bien Phu's area



wind speed
max and average in knots



relative humidity
% by month



precipitation - rain
% by month

M A T E R I A L S

FLOORING

Colour	Chocolate
Grooved	No
Dimensions (")	3/4 x 12 x 73
Size	1 x 12 x 6
Length (mm)	1860
Thickness (mm)	20
Width (mm)	305
Surface	Smooth

ROOFING SUPPORT

- **Stock:** 371
- **Model:** BSN-7/8-400-I
- **Weight:** 5.90 kg
- **Packaging:** 400 cm x 8 cm x 8 cm

RAILINGS

- **Stock:** 564
- **Model:** BSN-3/4-500-C
- **Weight:** 1.20 kg
- **Packaging:** 500 cm x 4 cm x 4 cm

ROOFING

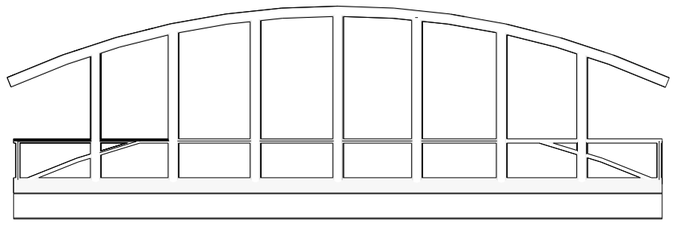
- The longest-lasting fabric membrane of its type in the world
- Blackout (opaque) design minimizes solar gain and controls internal climate
- Material weighs approximately 24 to 30 oz. per sq. yd.
- Helps guard against UV and airborne contaminants
- Dramatically extends the membrane life
- High strength, rip-stop substrate design
- Exceptional fire-retardant capability
- Available in large selection of colors
- Industry leading 20-year warranty

name	material	number	length [m]	weigth 1 unit[kg]	Total weight [N]
flooring	bamboo	22	3		9120.2
railings supporting the roof vertical	bamboo	12	3	4.4	517
railings supporting the roof horizontal	bamboo	6	3	4.4	258.9
railings	bamboo	10	3	0.72	70
roof	fabric	1	43.43m2	0.81-1 kg / m2	459.9

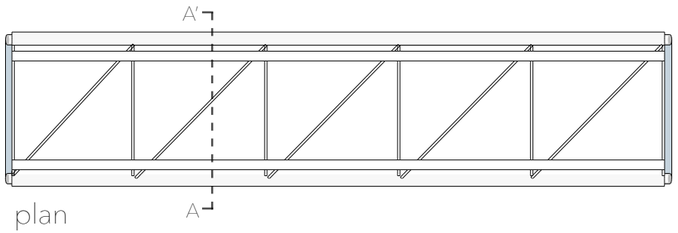
C H O S E N B E A M S

Identification	Nominal weight	Nominal dimensions					Cross-section	Dimensions for detailing					Surface		strong axis x-x						weak axis y-y					
		b	h	s	t	r	A	ht	d	Ø	pmin	pmax	AL	AG	Ix	Wel.x	Wpl.x	ix	Avy	Sx	Iy	Wel.y	Wpl.y	iy	Sy	It	Iw
	kg/m	mm					cm2	mm	mm		mm		m2/m	m2/m	cm4	cm3	cm3	cm	cm2	cm3	cm4	cm3	cm3	cm	mm	cm4	cm
HEB 100	20,4	100	100	6	10	12	26,0	80	56	M10	56	56	0,567	27,78	449,5	89,91	104,2	4,16	9,04	52,1	167,3	33,45	51,42	2,53	40,06	9,25	3,36
HEB 120	26,7	120	120	6,5	11	12	34,0	96	74	M12	66	66	0,686	25,71	864,4	144,1	165,2	5,04	10,96	82,6	317,5	52,92	80,97	3,06	42,56	13,84	9,41
HEB 140	33,7	140	140	7	12	12	43,0	116	92	M16	66	76	0,805	23,88	1509	215,6	245,4	5,93	13,08	123	549,7	78,52	119,8	3,58	45,08	20,66	22,48
HEB 160	42,6	160	160	8	13	15	54,3	134	104	M20	80	84	0,918	21,56	2492	311,5	354,0	6,78	17,59	177	889,2	111,2	170,0	4,05	51,57	31,24	47,94
HEB 180	51,2	180	180	8,5	14	15	65,3	152	122	M24	86	92	1,037	20,25	3831	425,7	481,4	7,66	20,24	241	1363	151,4	231,0	4,57	54,07	42,16	89,75
HEB 200	61,3	200	200	9	15	18	78,1	170	134	M27	100	100	1,151	18,78	5696	569,6	642,5	8,54	24,83	321	2003	200,3	304,8	5,07	60,09	58,28	171,1
HEB 220	71,5	220	220	9,5	16	18	91,0	188	152	M27	100	118	1,270	17,77	8091	735,5	827,0	9,43	27,92	414	2843	258,5	393,9	5,59	62,59	76,57	395,4
HEB 240	83,2	240	240	10	17	21	106,0	206	164	M27	100	138	1,384	16,63	11260	938,3	1053	10,31	33,23	527	3923	326,9	498,4	6,08	68,60	102,7	686,9
HEB 260	93	260	260	10	17,5	24	118,4	225	177	M27	114	158	1,499	16,12	14920	1148	1283	11,22	37,59	641	5135	395,0	602,2	6,58	73,12	123,8	1053
HEB 280	103	280	280	10,5	18	24	131,4	244	196	M27	114	178	1,618	15,69	19270	1376	1534	12,11	41,09	767	6585	471,0	717,6	7,09	74,62	143,7	1530
HEB 300	117	300	300	11	19	27	149,1	262	208	M27	120	198	1,732	14,80	25170	1678	1869	12,99	47,43	936	8563	570,9	870,3	7,58	80,63	185,0	1988
HEB 320	127	300	320	11,5	20,5	27	161,3	279	225	M27	122	198	1,771	13,96	30820	1926	2149	13,82	51,27	1070	9239	615,9	939,1	7,57	84,13	225,1	2669
HEB 340	134	300	340	12	21,5	27	170,9	297	243	M27	122	198	1,810	13,49	36660	2156	2408	14,65	56,09	1200	9690	646,0	985,7	7,53	86,63	257,2	2454
HEB 360	142	300	360	12,5	22,5	27	180,6	315	261	M27	122	198	1,849	13,04	43190	2400	2683	15,46	60,60	1340	10140	676,1	1032	7,49	89,13	292,5	2683
HEB 400	155	300	400	13,5	24	27	197,8	352	298	M27	124	198	1,927	12,41	57680	2884	3232	17,06	69,98	1620	10820	721,3	1104	7,40	93,13	355,7	3617
HEB 450	171	300	450	14	26	27	218,0	398	344	M27	124	198	2,026	11,84	79890	3551	3982	19,14	79,66	1990	11720	781,4	1196	7,33	97,63	440,5	5258
HEB 500	187	300	500	14,5	28	27	238,6	444	390	M27	124	198	2,125	11,34	107200	4287	4815	21,19	89,02	2410	12620	841,6	1292	7,27	102,1	538,4	7019
HEB 550	199	300	550	15	29	27	254,1	492	438	M27	124	198	2,224	11,15	136700	4971	5591	23,20	100,1	2800	13380	891,8	1341	7,17	104,6	600,3	8856
HEB 600	212	300	600	15,5	30	27	270,0	540	486	M27	126	198	2,323	10,96	171000	5701	6425	25,17	110,8	3210	13530	902,0	1391	7,08	107,1	667,2	10070

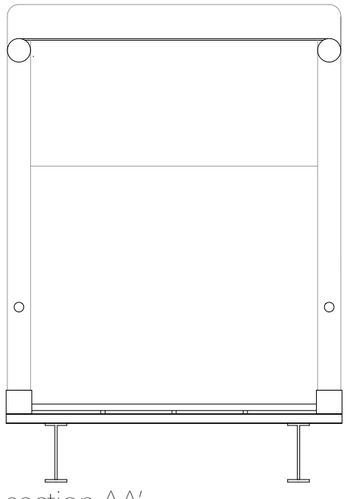
3 D M O D E L



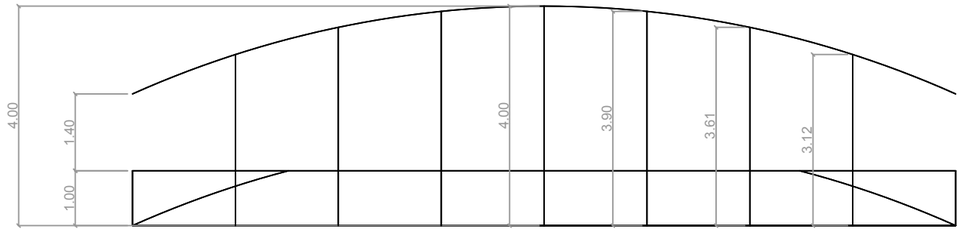
elevation

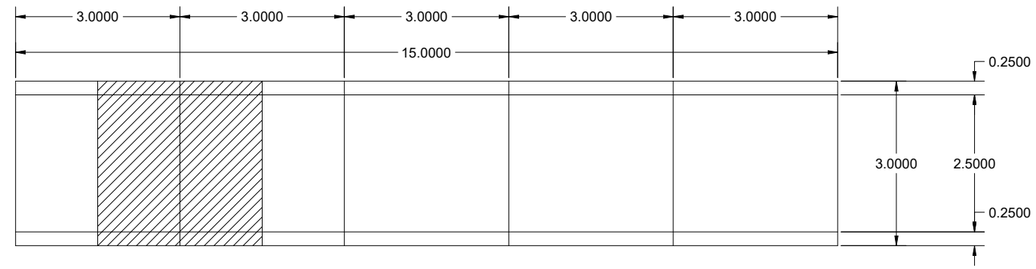


plan



section AA'





STRUCTURE SELF LOAD

	Material	number of beams	length [m]	weight [N]
Structure HEB 300	Steel	6	3	3400
Structure main beam HEB 600	Steel	2	15	31200
Bracing HEB 100	Steel	5	3	600.1

LIVE LOADS (FROM EUROCODE)

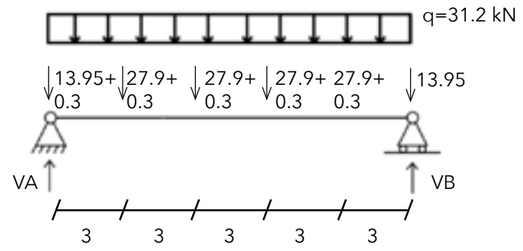
Live load	4000N/m2	45m2	180kn
Snow load	1.6N/m2	45m2	72kN

C A L C U L A T I O N S

P R I M A R Y B E A M S

27.9 kN Is the reaction

13.95 kN is the reaction for ending points



ΣFy=0

VA+VB-4(27.9)-31.2-4(0.3)=0

ΣMA=0

VB*15-(27.9+0.3)(3)-(27.9+0.3)(6)-27.9+0.3(9)-(27.9+0.3)(12)-31.2(7.5)=72kN

VB=71.4kN

VA=VB=72kN

Main beam max bending- 26.2mm

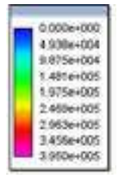
Critical deformation for main beam - 15m/400=0.0375m=37.5mm

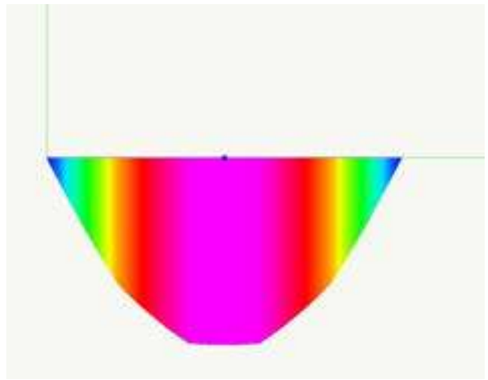
Both are less than the critical load

600.1 N

600.1/2=300.05=0.3 kN

self weight of the bracing
for each ending of the bracing





S T R E N G T H D E S I G N

MAIN BEAM - HEB 600

M_x= 3.95x10^{5}N x m (maximum moment from Nolian)
I_x=171000 cm^4=1.71x10^{-3}m^4
y_{max}=H/2=600mm=600/2=300mm=3x10^{-1}

$\sigma_z=M_xy/I_x$=(3.95x3)/(1.71)x10^{5-1+3}= 6.93x10^{7}N/m^2=69.3x10^{6}N/m^2=
=69.3x10^{6}Pa=69.3MPa

exposed steel s235MPa

0.8f_{yk}x235=188MPa

69.3MPa<188MPa

SECONDARY BEAM - HEB 300

M_x= 0.0345x10^{5}N x m (maximum moment from Nolian)
I_x=25170 cm^4=0.25x10^{-3}m^4
y_{max}=H/2=300/2=150mm=1.5x10^{-1}

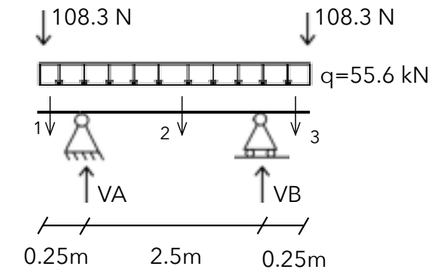
$\sigma_z=M_xy/I_x$=(0.0345x1.5)/(0.25)x10^{5-1+3}= 0.207x10^{7}N/m^2=2.1x10^{6}N/m^2=
=2.1x10^{6}Pa=2.1MPa

exposed steel s235MPa

0.8f_{yk}x235=188MPa

2.1MPa<188MPa

S E C O N D A R Y B E A M S



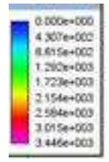
ΣFy=0
VA+VB-0.1083(2)-(55.6)=0
VA+VB=55.8

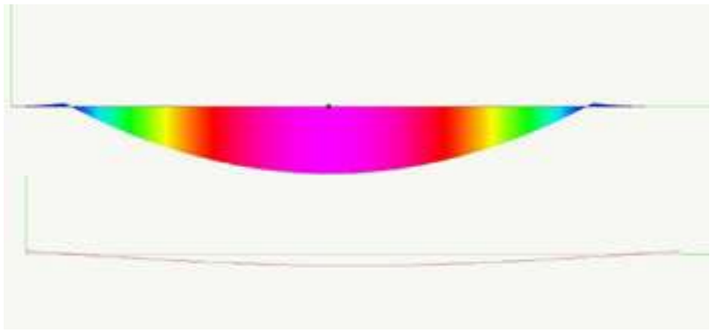
ΣMA=0
VB*2.5-2.75(0.1083)+0.25(0.1083)-1.375(50.9)
+0.125(4.63)
VB=27.9

VA=VB=27.9kN

Secondary beam max bending-0.04mm

Critical deformation for secondary beam
3m/400=0.0075m=7.5mm





Uniform loads = snow load+ live load+ flooring

72000+180000+9120.2=261120.2N=261.1kN

261.1kN/5=52.2kN/m (weight distributed on one secondary beam)

52.2kN+3.4kN=55.6kN

q= 55.6kN q/12= 4.63kN for each segment of 0.25m

1=4.63kN 2=46.3kN 3=4.63kN

Punctual load (from the roof)

Whole roof weight= 517+258.9+70+459.9=1305.8N=1.3kN

1.3kN/6=216.7N (load of the roof distributed on one secondary beam)

216.7N/2=108.3N (punctual load from the roof on one of the ends of secondary beam)