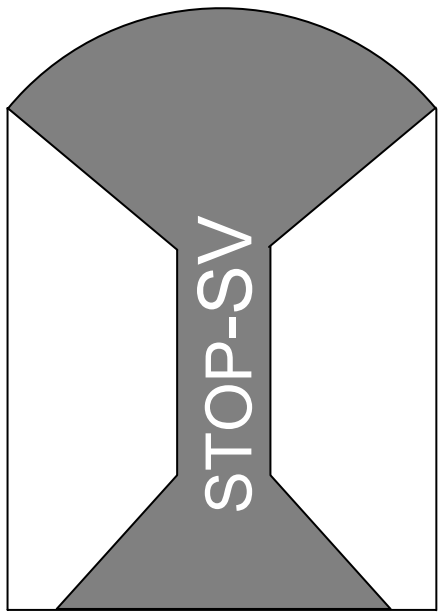
VADEMECUM STOP

SUPPORT OF VAULTS AND ARCHES



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ABRUZZO EARTHQUAKE 2009
COORDINATION TEAM FOR TEMPORARY WORKS

WORKING GROUP FOR THE VADEMECUM STOP
under the supervision of Sergio Basti - Central director for emergency and urgent technical rescue manual licensed by note no. EM3064/5001-11 dated 2009-06-15

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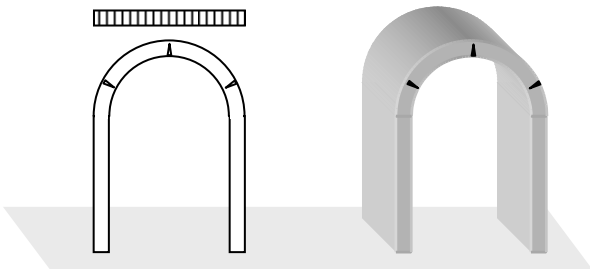
SUPPORT OF VAULTS AND ARCHES: general recommendations

STOP-**SV**

Typical damage:

cracks appear at the crown and at the reins of the vault/arch



Description

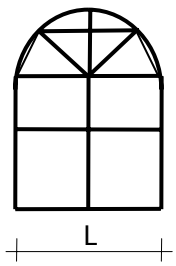
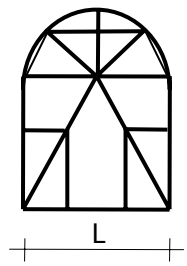
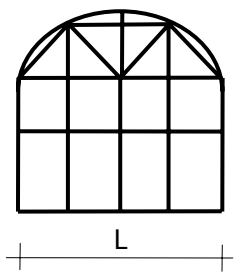
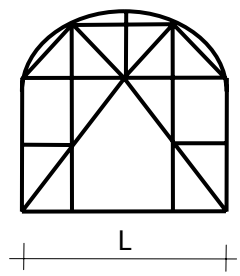
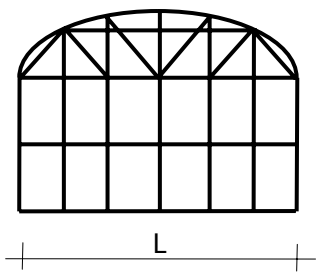
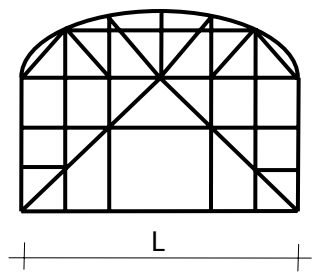
In general vaults and arches with excessive loads show cracks at the crown and at the reins. In this case the shore is needed to discharge the structure.

Warning

The use of the present procedure is not allowed for reinforced concrete vaults or arches and it can only be used for rounded or reduced wall arches. For the carpentry of reduced wall arches it is possible to refer to rounded arches.

Function of the support: to direct the loads to the ground discharging the lateral masonry structure.

TYPES AND SELECTION CRITERIA

DIMENSIONAL PARAMETERS	FUNCTIONAL PARAMETERS: There's no need to pass through (Closed passage)	FUNCTIONAL PARAMETERS: There's need to pass through (Allowed passage)
0m<L≤3m	 **C1**	 **A1**
3m<L≤6m	 **C2**	 **A2**
6m<L≤8m	 **C3**	 **A3**

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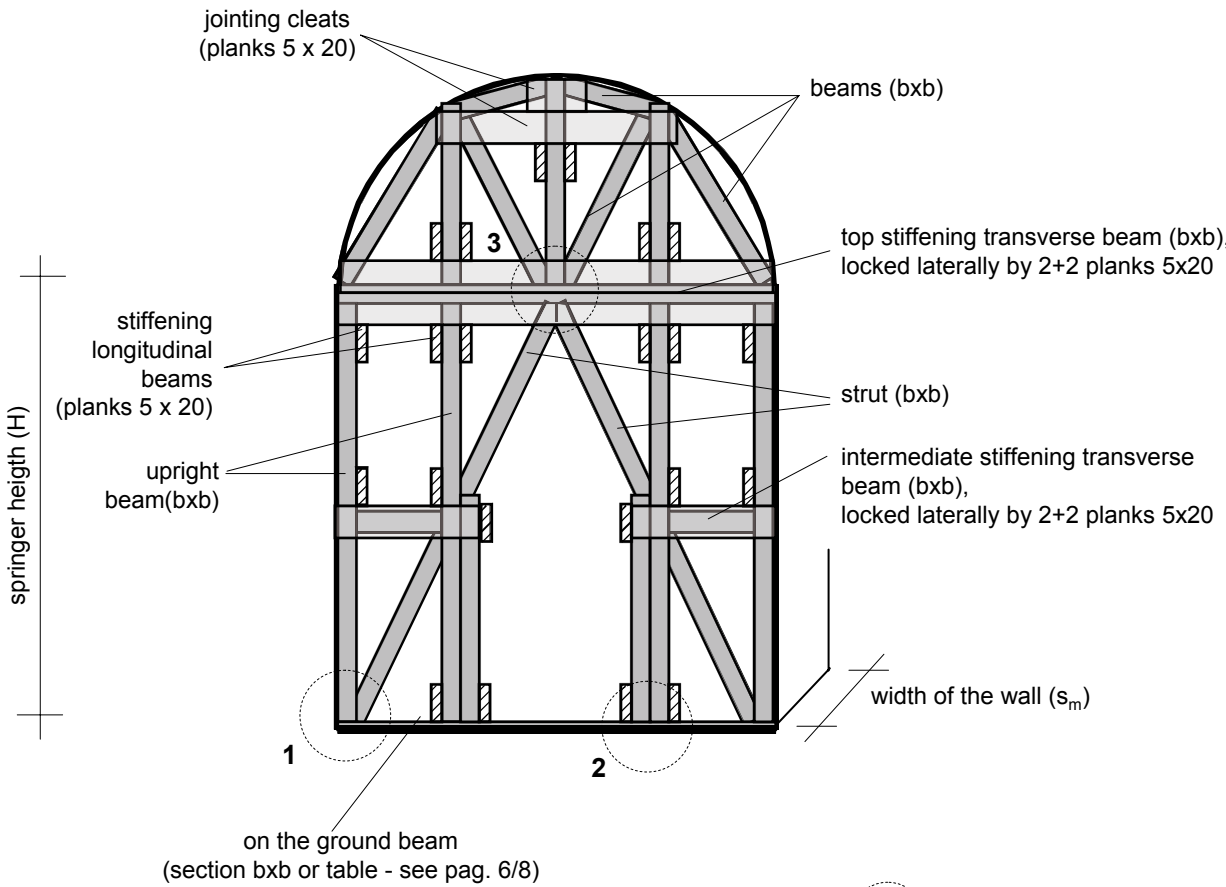
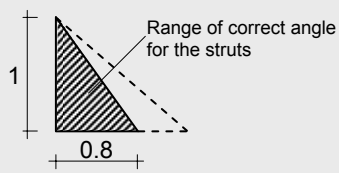
SUPPORT OF VAULTS AND ARCHES: parts list

STOP-**SV**



WARNING:

⚠ This symbol indicates the range of inclination allowed for the struts.



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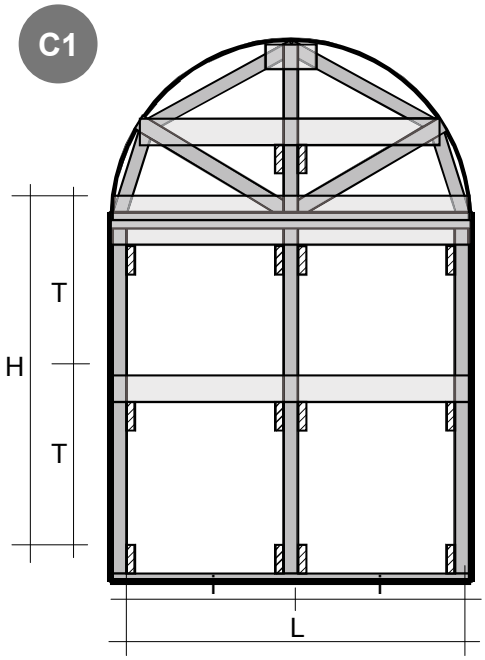
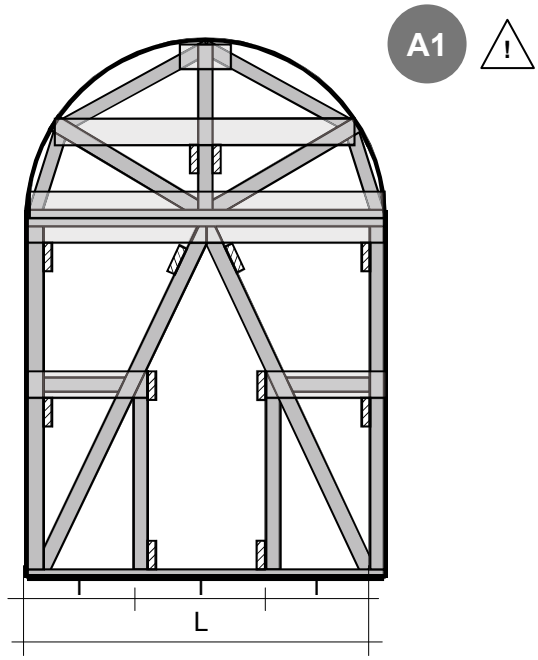
SUPPORT OF VAULTS AND ARCHES: Shores with span between 1.5 and 3 m | STOP-**SV**

SHORING WITH 3 OR 4 UPRIGHT BEAMS: SIZING CRITERIA



Closed passage



Allowed passage

Table 1 – Arches: maximum distance between transverse beams for braced multiple shores (T) and maximum springer heigth (H) for single shores

Span (L)	**Shores for wall width 0.5m ≤ s_m ≤ 1.0 m** Braced multiple shores				**Shores for wall width s_m ≤ 0.5 m** Single shore	
	Cross sections of beams and struts (bxb)				Cross sections of beams and struts (bxb)	
	13x13	15x15	18x18	20x20	18x18	20x20
L ≤ 1.5 m	T ≤ 2.0m	T ≤ 3.0 m	T ≤ 4.0 m	T ≤ 4.5 m	H ≤ 5.0 m	H ≤ 6.0 m
1.5 m < L ≤ 2.0 m	T ≤ 1.5 m	T ≤ 2.5 m	T ≤ 3.5 m	T ≤ 4.0 m	H ≤ 4.5 m	H ≤ 5.5 m
2.0 m < L ≤ 3.0 m	-	T ≤ 1.0 m	T ≤ 2.0 m	T ≤ 2.5 m	H ≤ 3.0 m	H ≤ 4.0 m

Table 2 - Vaults: maximum distance between transverse beams (T)

Span (L)	**Shores for barrel vaults** Maximum longitudinal distance between shores: 1.0 m		
	Cross sections of beams and struts (bxb)		
	15x15	18x18	20x20
L ≤ 1.5 m	T ≤ 1.5 m	T ≤ 2.5 m	T ≤ 3.0 m
1.5 m < L ≤ 2.0 m	-	T ≤ 1.5 m	T ≤ 2.0 m
2.0 m < L ≤ 3.0 m	-	-	T ≤ 1.0 m

N.B. remember to provide a continuous layer of planks under the wall structure to transfer the load from the masonry to the shore

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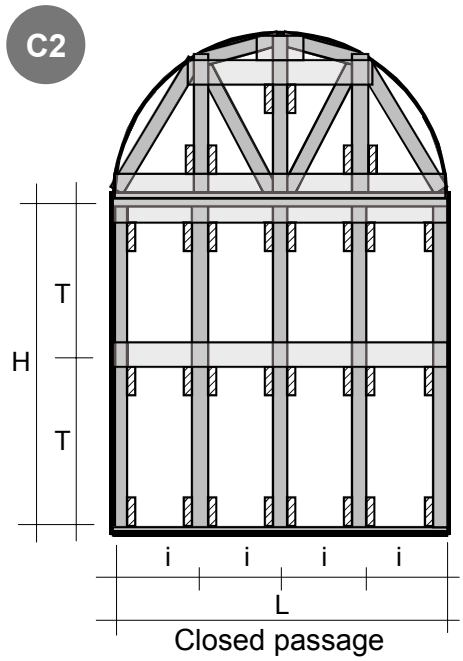
SUPPORT OF VAULTS AND ARCHES: shores with spans between 3 and 6 m | STOP-**SV**

SHORES WITH 5 OR 6 UPRIGHT BEAMS: SIZING CRITERIA



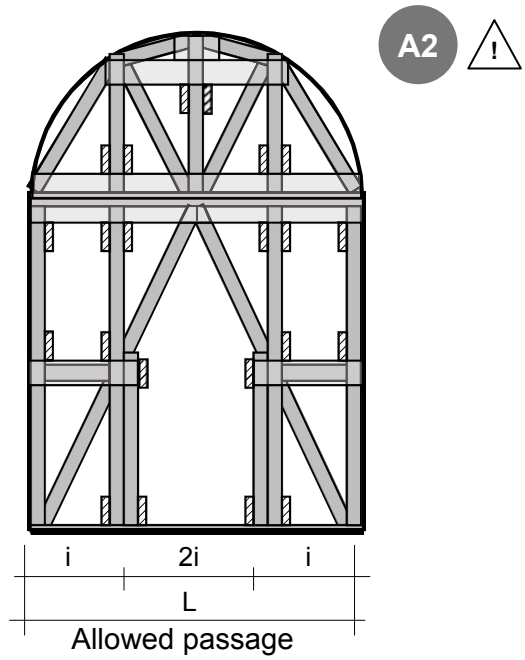


Table 3 – Arches: maximum distance between transverse beams for braced multiple shores (T) and maximum springer heigth (H) for single shores

Span (L)	**Shores for wall width 0.5m ≤ s_m ≤ 1.0 m** Braced multiple shores				**Shores for wall width s_m ≤ 0.5 m** Single shore	
	Cross sections of beams and struts (bxb)				Cross sections of beams and struts (bxb)	
	13x13	15x15	18x18	20x20	18x18	20x20
3.0 m < L ≤ 4.5 m	T ≤ 1.0 m	T ≤ 2.0 m	T ≤ 3.5 m	T ≤ 3.5 m	H ≤ 4.5 m	H ≤ 5.0 m
4.5 m < L ≤ 6.0 m	T ≤ 1.0 m	T ≤ 2.0 m	T ≤ 3.0 m	T ≤ 3.5 m	H ≤ 4.0 m	H ≤ 5.0 m

Table 4 - Vaults: maximum distance between transverse beams (T)

Span (L)	**Shores for barrel vaults** Maximum longitudinal distance between shores: 1.0 m	
	Cross sections of beams and struts (bxb)	
	18x18	20x20
3.0 m < L ≤ 4.5 m	T ≤ 1.5 m	T ≤ 2.0 m
4.5 m < L ≤ 6.0 m	T ≤ 1.0 m	T ≤ 2.0 m

N.B. remember to provide a continuous layer of planks under the wall structure to transfer the load from the masonry to the shore

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SUPPORT OF VAULTS AND ARCHES: shores with spans between 6 and 8 m | STOP-**SV**

SHORES WITH 7 OR 8 UPRIGHT BEAMS: SIZING CRITERIA

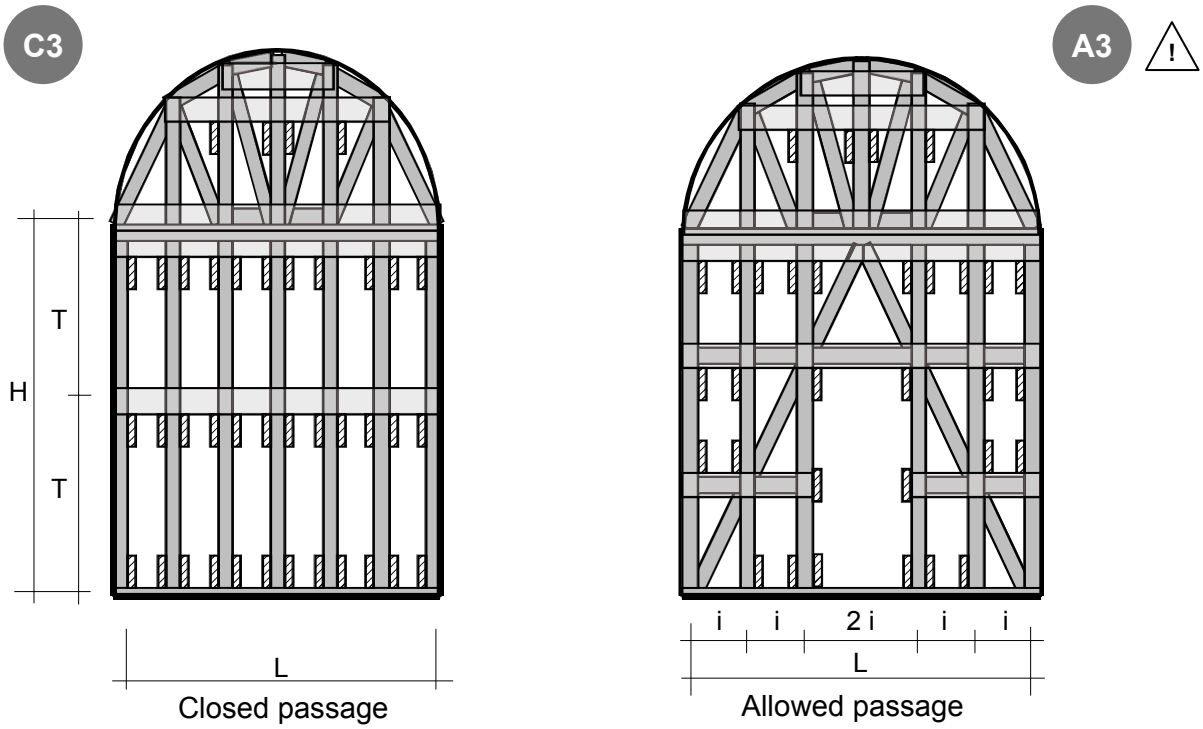

Table 5 – Arches: maximum distance between transverse beams for braced multiple shores (T) and maximum springer heigth (H) for single shores

Span (L)	**Shores for wall width 0.5m ≤ s_m ≤ 1.0 m** Braced multiple shores				**Shores for wall width s_m ≤ 0.5 m** Single shore	
	Cross sections of beams and struts (bxb)				Cross sections of beams and struts (bxb)	
	13x13	15x15	18x18	20x20	18x18	20x20
6.0 m < L ≤ 8.0 m	T ≤ 1.5 m	T ≤ 2.0 m	T ≤ 3.0 m	T ≤ 4.0 m	H ≤ 4.0 m	H ≤ 5.5 m

Table 6 - Vaults: maximum distance between transverse beams (T)

Span (L)	**Shores for barrel vaults** Maximum longitudinal distance between shores: 1.0 m	
	Cross sections of beams and struts (bxb)	
	18x18	20x20
6.0 m < L ≤ 8.0 m	T ≤ 1.5 m	T ≤ 2.0 m

N.B. remember to provide a continuous layer of planks under the wall structure to transfer the load from the masonry to the shore

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SUPPORT OF VAULTS AND ARCHES: critical considerations

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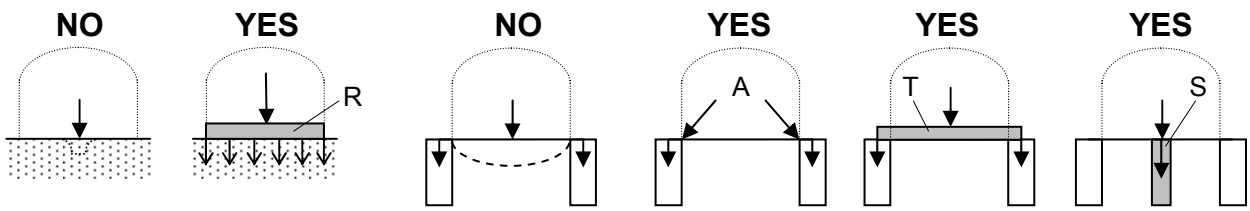
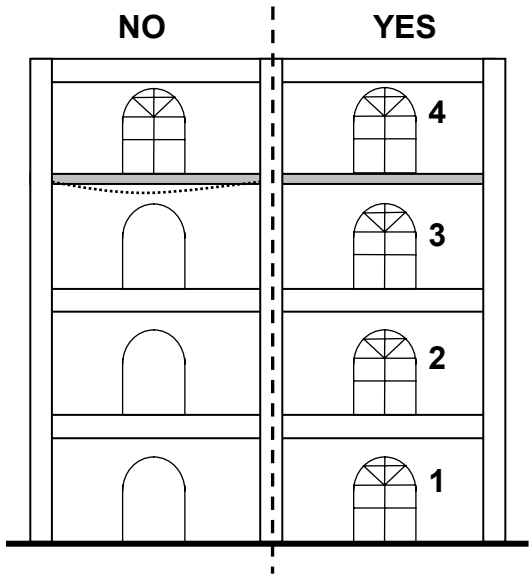
CRITICAL CONSIDERATIONS

One of the most significant critical considerations is the transferring of the loads from the shore to the ground. If the ground is too soft, it is important to provide a distribution element (R) under the structure or a lateral discharge pattern for the loads (A) or a horizontal beam (T) or an alternative path for the loads (S).



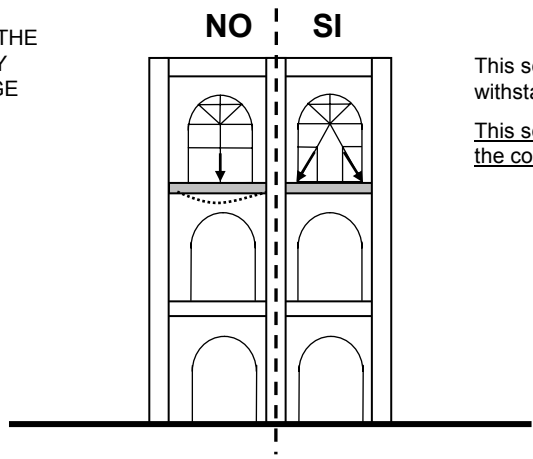
The following two examples are significant:

PRESENCE OF VOIDS UNDER THE FLOOR



In this case see the correct sequence for the implementation of the shores: bottom-top approach

PRESENCE OF VOIDS UNDER THE FLOOR WITH THE POSSIBILITY OF A NEW PATH TO DISCHARGE THE LOADS



This solution can be used if the structure can withstand the new path for the load.

This solution is the best as it doesn't require the construction of shores under the floor.

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SUPPORT OF VAULTS AND ARCHES: details

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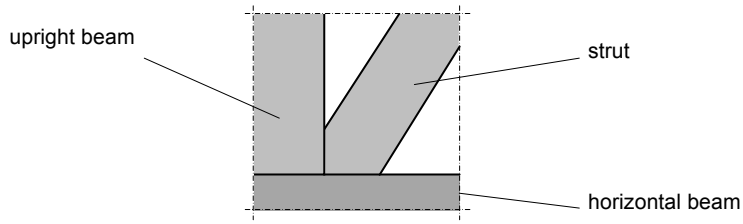
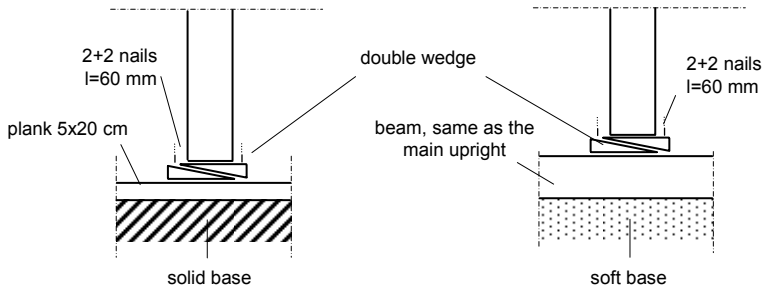
Detail 1 — CONNECTION UPRIGHT BEAM - STRUT

DOUBLE CHAMFER IS ALWAYS REQUIRED



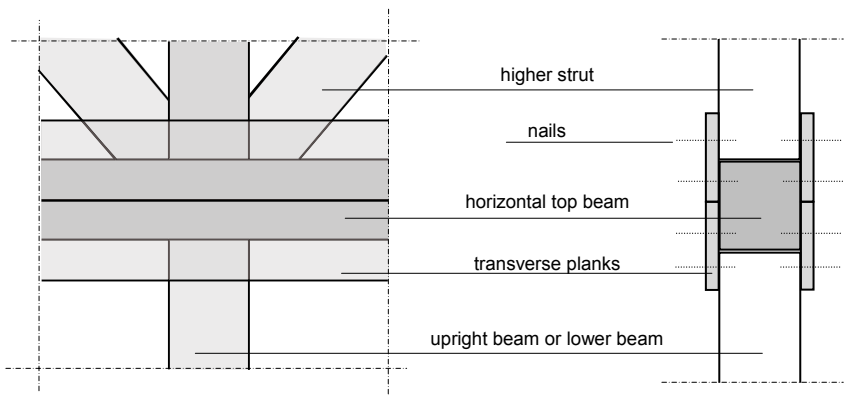
Detail 2 — GROUND CONNECTION

SYSTEM TO CONNECT THE SHORES TO THE GROUND



Detail 3 — TOP CONNECTION

2+2 PLANKS TO CONNECT THE HORIZONTAL BEAM



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SUPPORT OF VAULTS AND ARCHES

Field of application

The present procedure can be used only for wall arches or wall rounded or reduced barrel vaults. It can't be used for concrete structures. If the lateral walls are in rotation other measures should be used. The maximum value of the stringer height is 8.0 m for vaults and 6 m for arches ($s_m \leq$ 1.0 m).

General assumptions

The purpose of the shore is to maintain the arch/vault and to reduce the loads on the lateral walls. **It is necessary to verify the load bearing capacity of the surface under the shore** (see page 6/8).
For vaults it is necessary to provide a continuous set of planks between the wall and the shore.

Instructions

After measuring the span "L" it is possible to select the type of shore:
- on page 3/8 the solutions for a span of no more than 3 m are listed;
- on page 4/8 the solutions for a span of no more than 6 m are listed;
- on page 5/8 the solutions for a span of no more than 8 m are listed.

For arches, it is possible to provide a single shore if the width of the wall is less than 50 cm and two braced shores if the width of the wall is less than 100 cm.
After the selection of the type, it is possible to define the cross section of the beams and then the maximum distance between the transverse planks for multiple shores or the maximum height of the arch for single shore solutions (if $s_m \leq 50$ cm)
All the beams have the same cross section.
The type with passage allowed is possible if the inclination of the strut is less than 1/0.8.
For example, each of the two shores to provide for an arch in a wall with s_m = 0.7 m and span of 5.5 m can be built using beams 13x13 with the distance between the transverse beams not more than 1.0 m or with beams 15x15 with the maximum distance between the transverse beams equal to 2.0 m and so on.
The maximum longitudinal distance between the shores is 1.0m. For distances less than 1.0 m it is only necessary to link the beam with screws.

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