LA PROGETTAZIONE STATICA DI UN'OPERA INNOVATIVA

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LEIMHOLZKONSTRUKTIONEN
STRUTTURE IN LEGNO LAMELLARE

A RUBNER COMPANY

Ing. Giovanni Brentari – Holzbau S.p.a.

Milano, 6 ottobre 2006

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Centro Commerciale Carrefour – Limbiate (MI)

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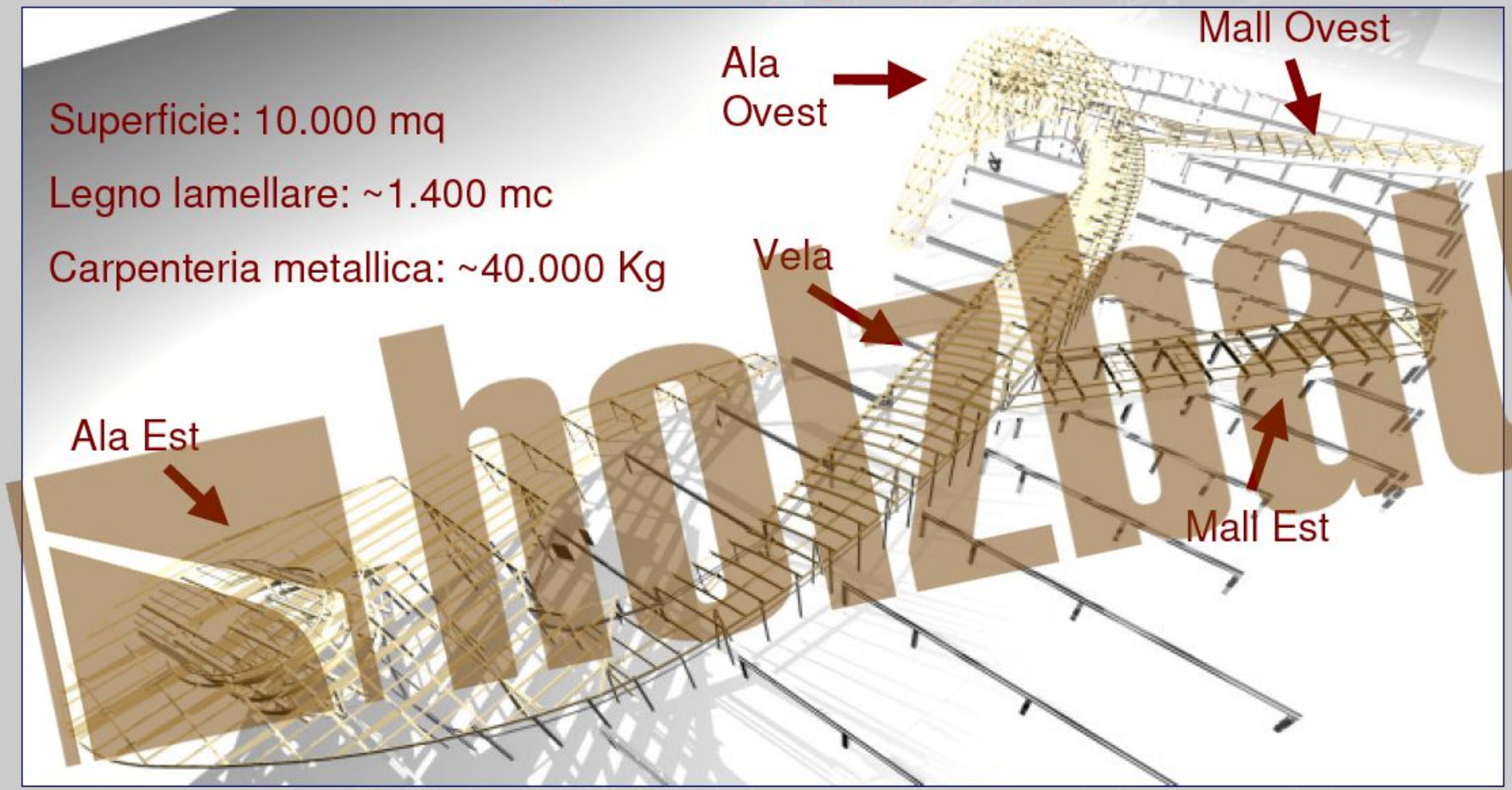
La geometria generale



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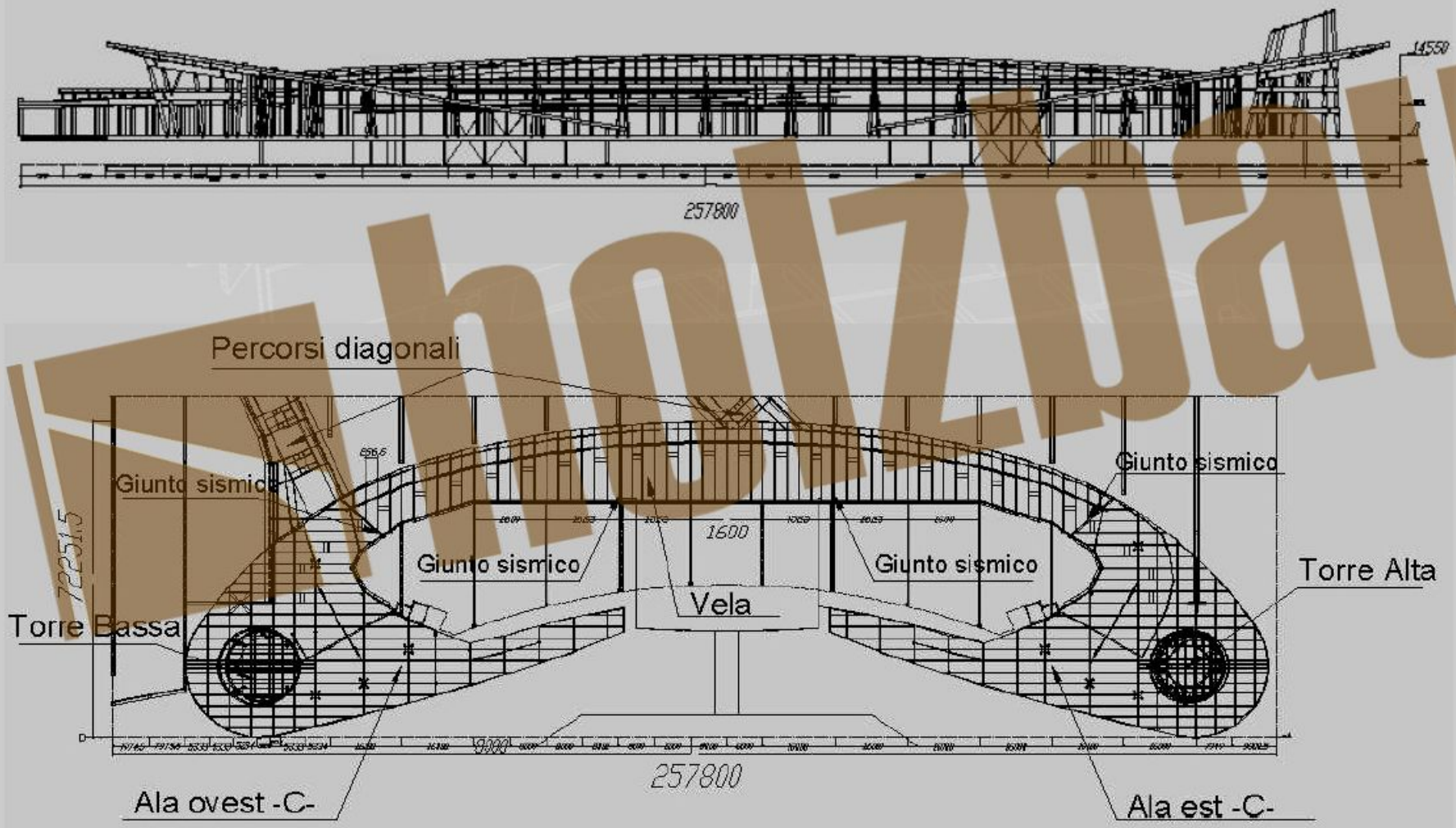
La geometria generale



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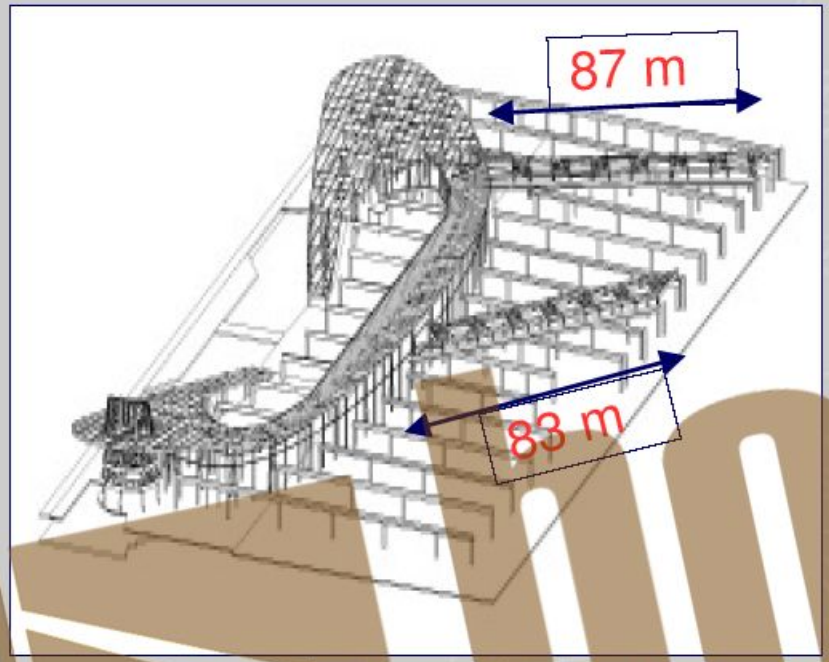
I mall diagonali



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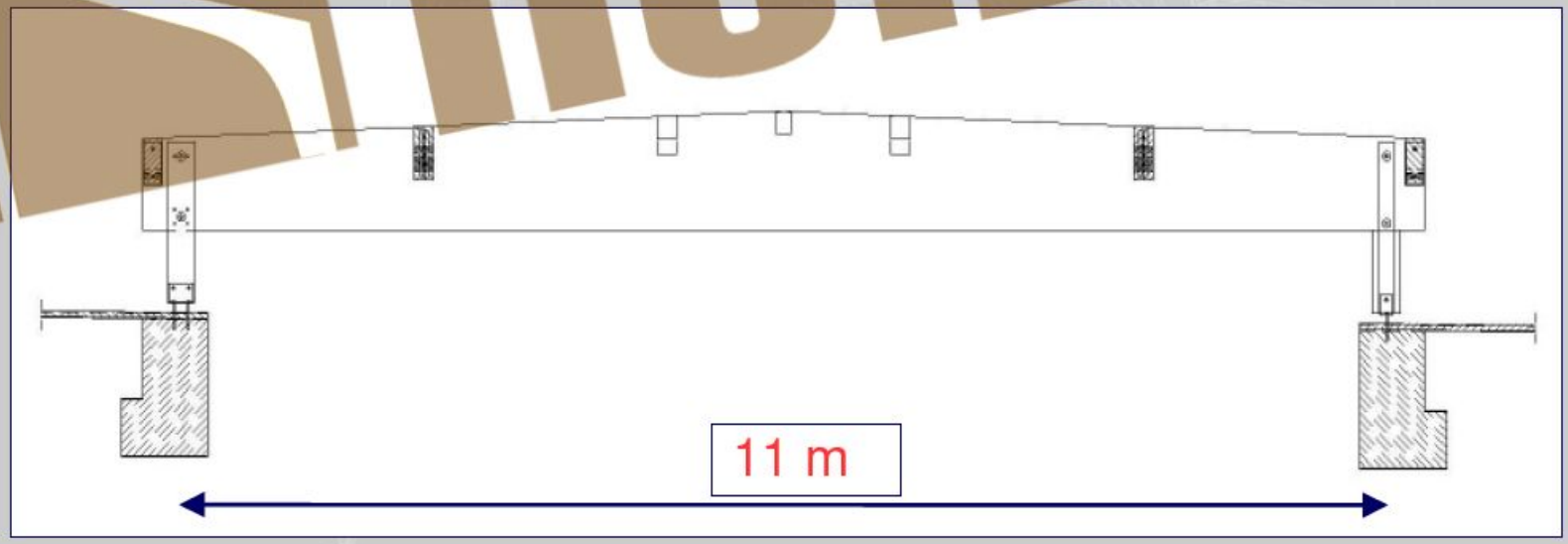
I mall diagonali



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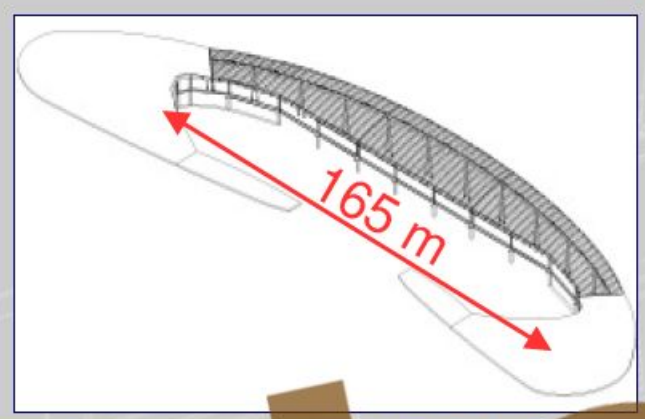
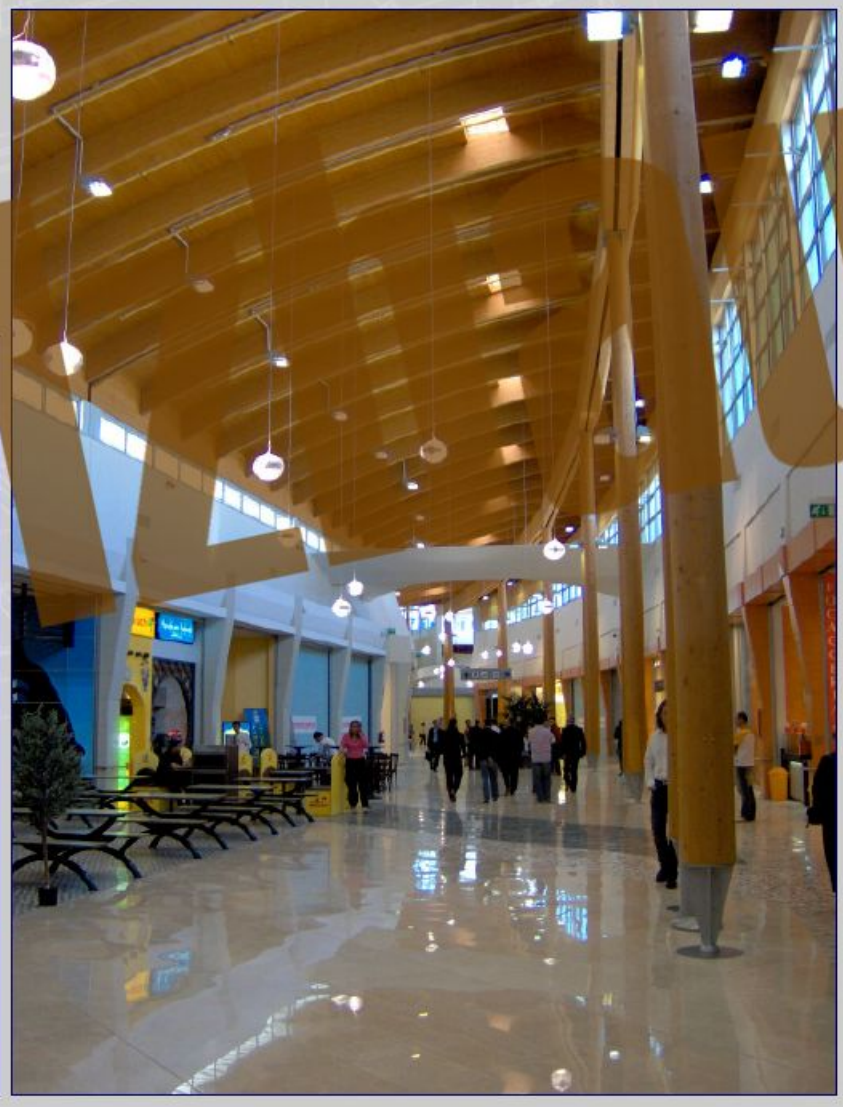
La vela





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La vela

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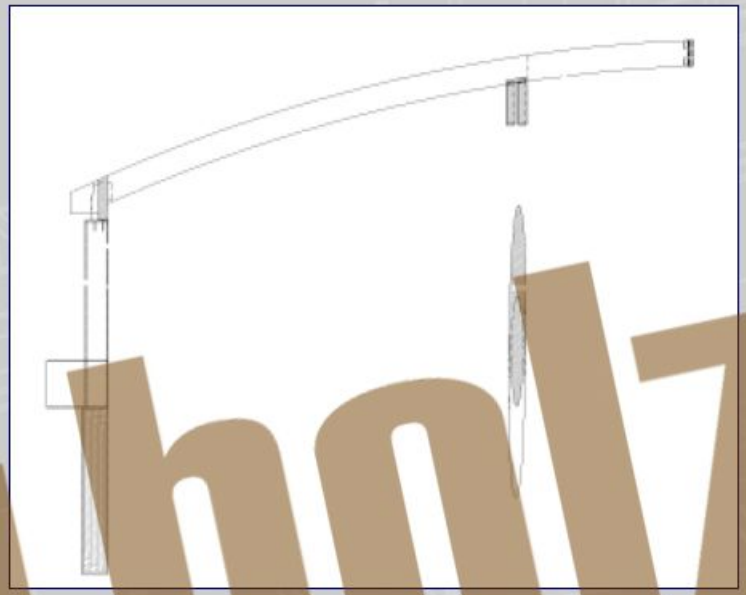
La vela

Telaio tipo:



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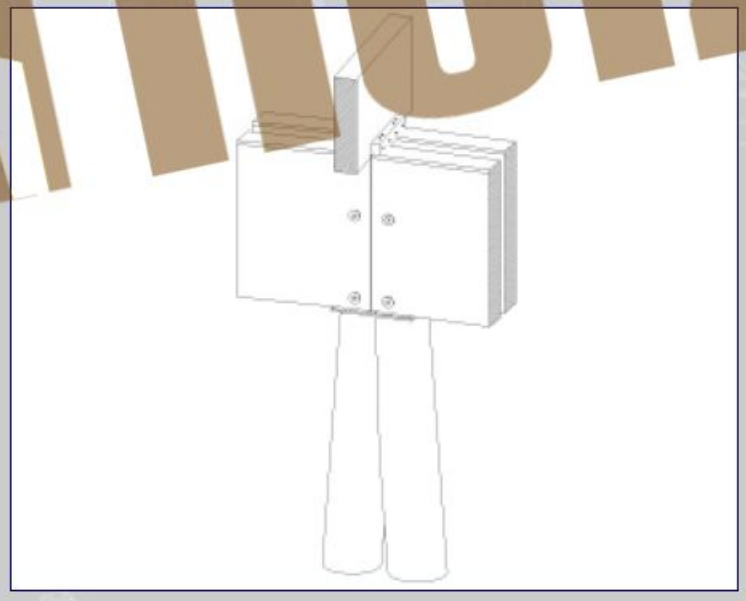
Appoggio architrave doppia:



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La vela

Le colonne come elemento architettonico:

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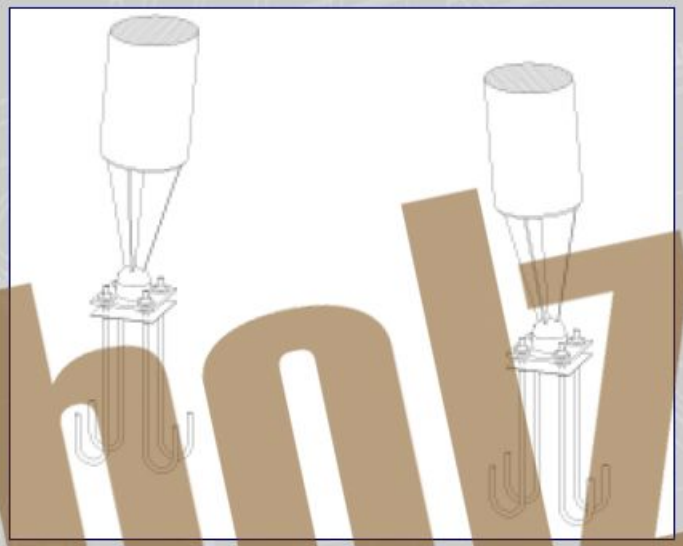
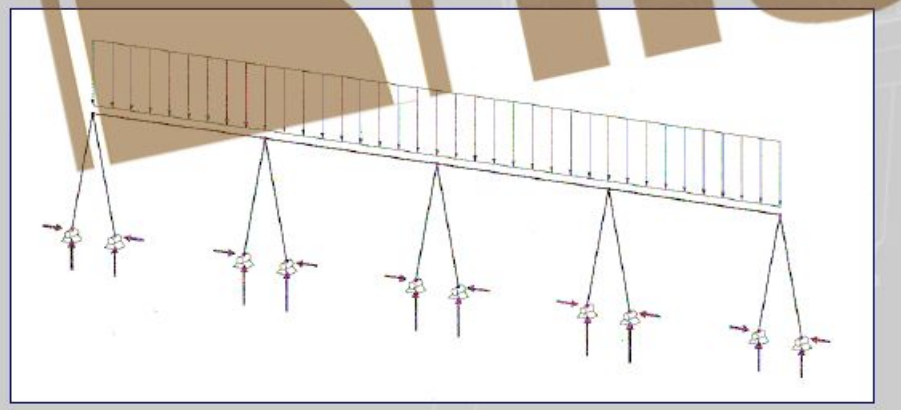
La vela

Le colonne come elemento strutturale:

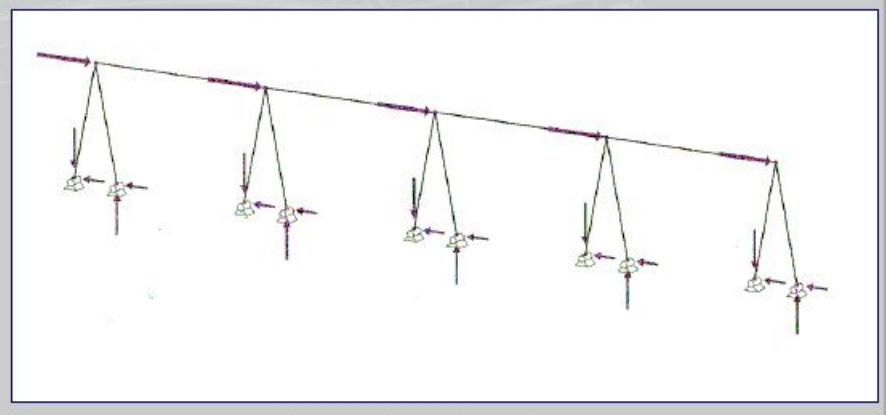


Attacco fondazione

Preassemblaggio a terra



Carichi verticali



Carichi orizzontali

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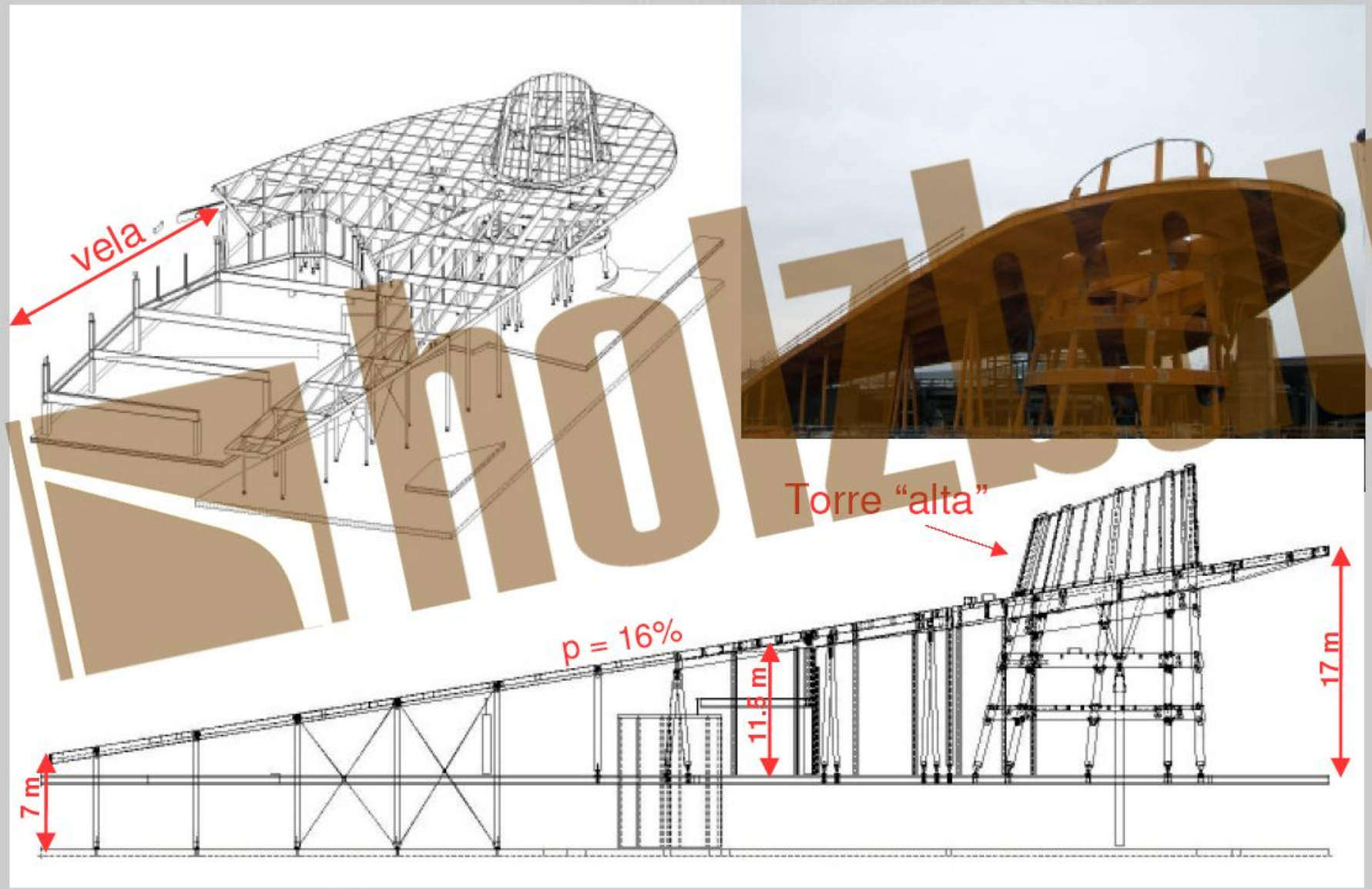
L'ala est



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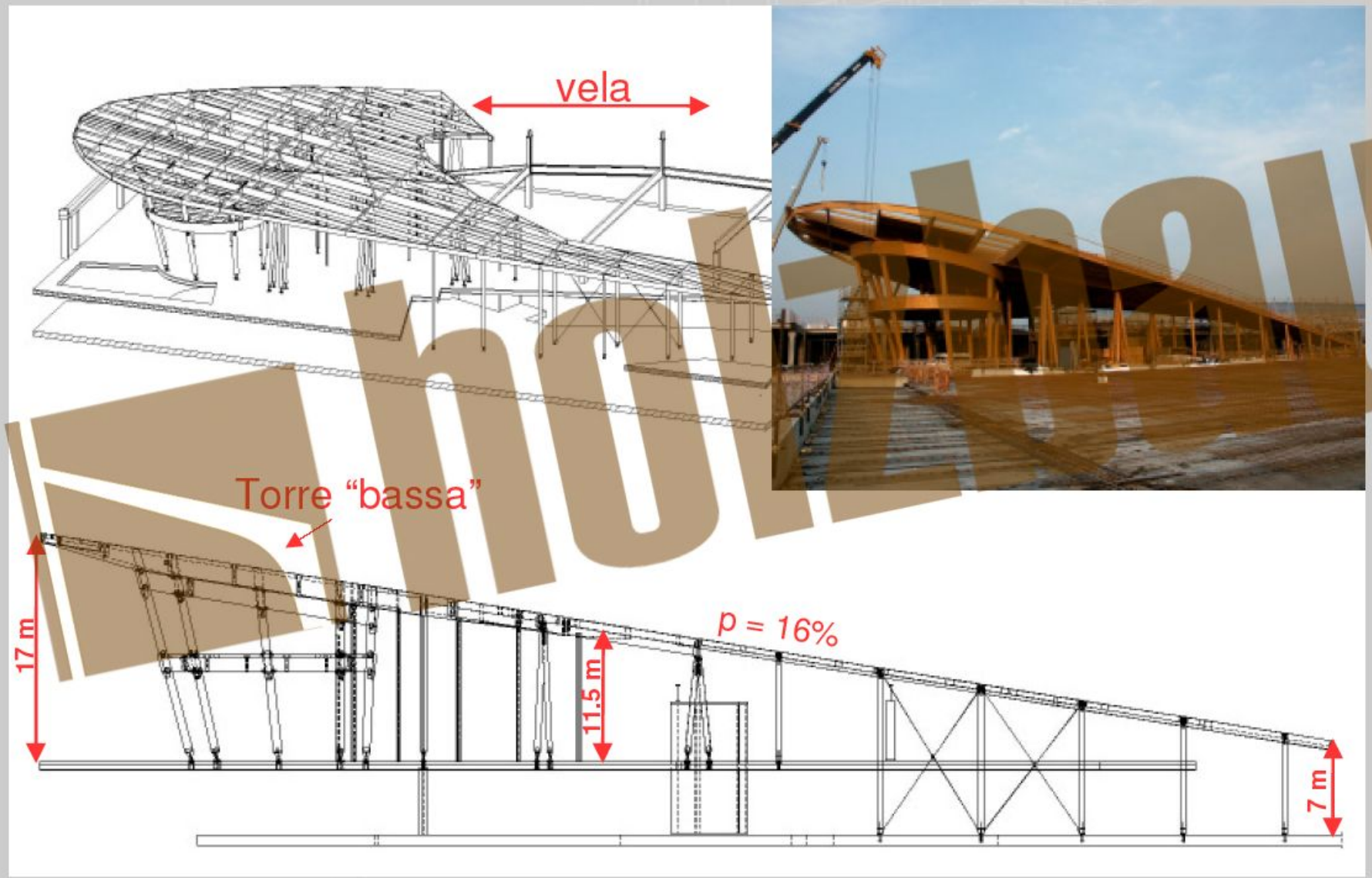
L'ala ovest



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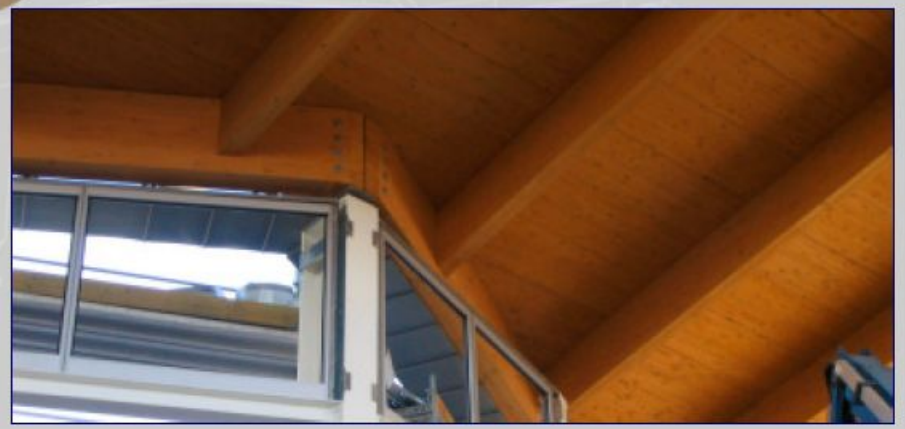
Le ali



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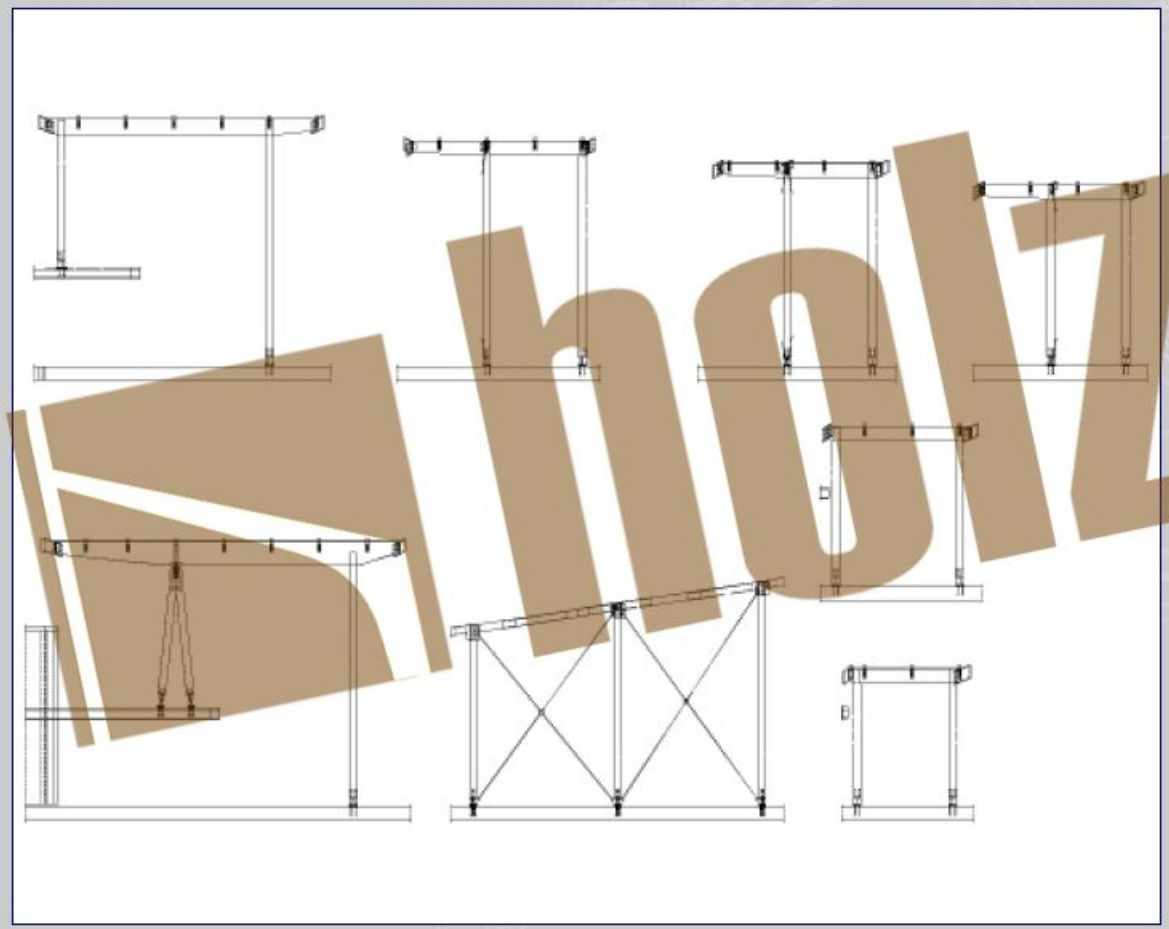
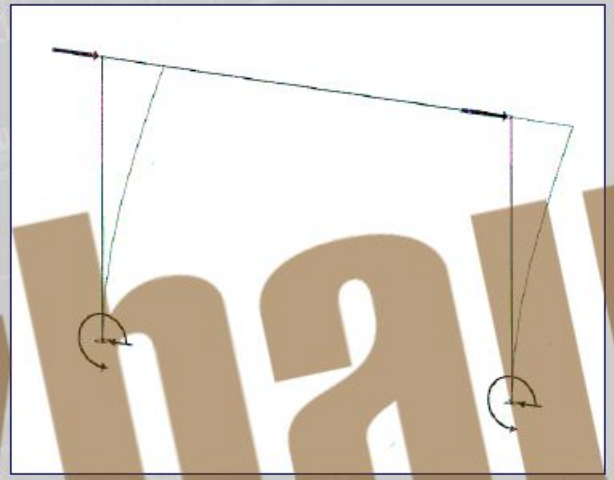
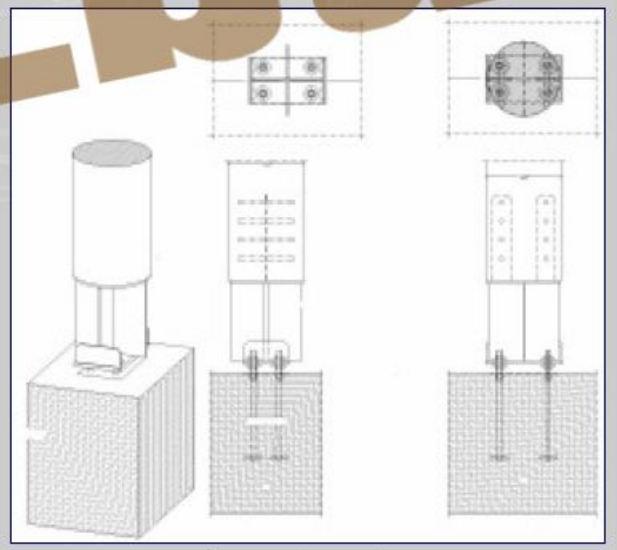
Le ali

Lo schema statico:





Assorbimento carichi orizzontali



Incastro a terra

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Le torri

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Le torri

Le strutture portanti verticali

Colonne a 4

Torre

Colonne a 2

Colonne a 4

Colonne a 1

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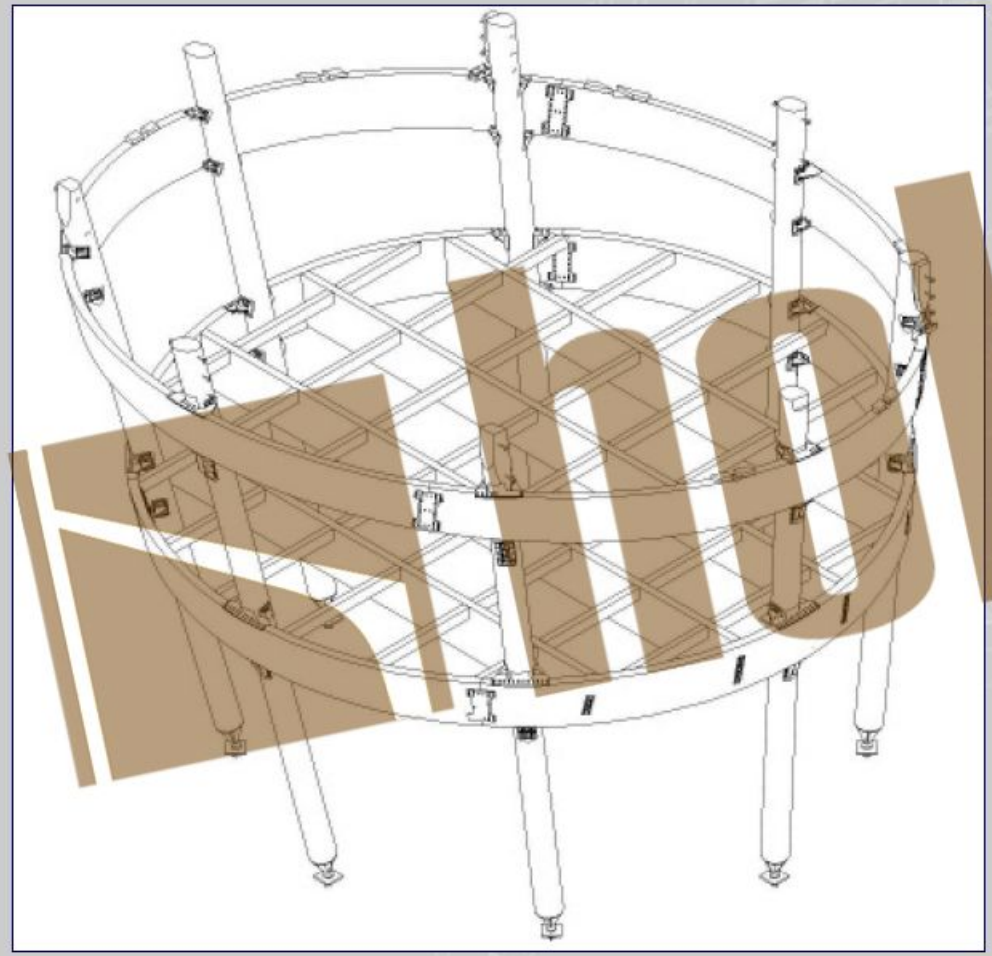
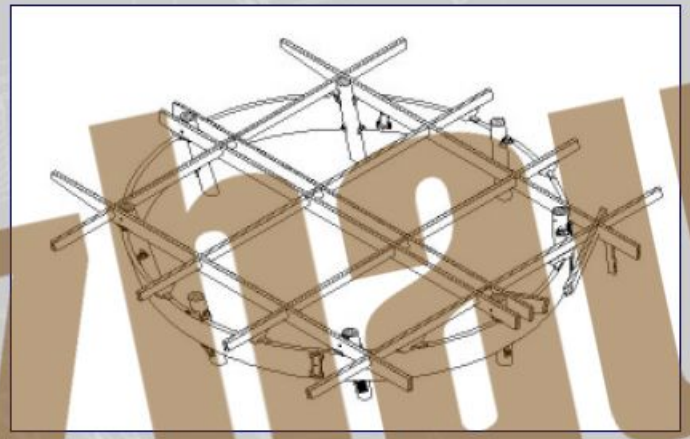
Le torri

La torre bassa

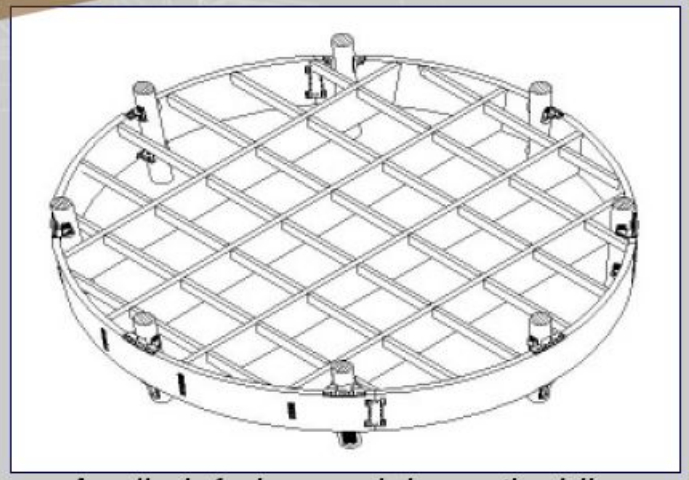


d_{base} = 13 m

d_{apice} = 18 m



Anello superiore: appoggio travi copertura
g = 1,2 kN/m² q_{sk} = 1,6 kN/m²



Anello inferiore: solaio praticabile
g = 3,0 kN/m² q = 2,0 kN/m²

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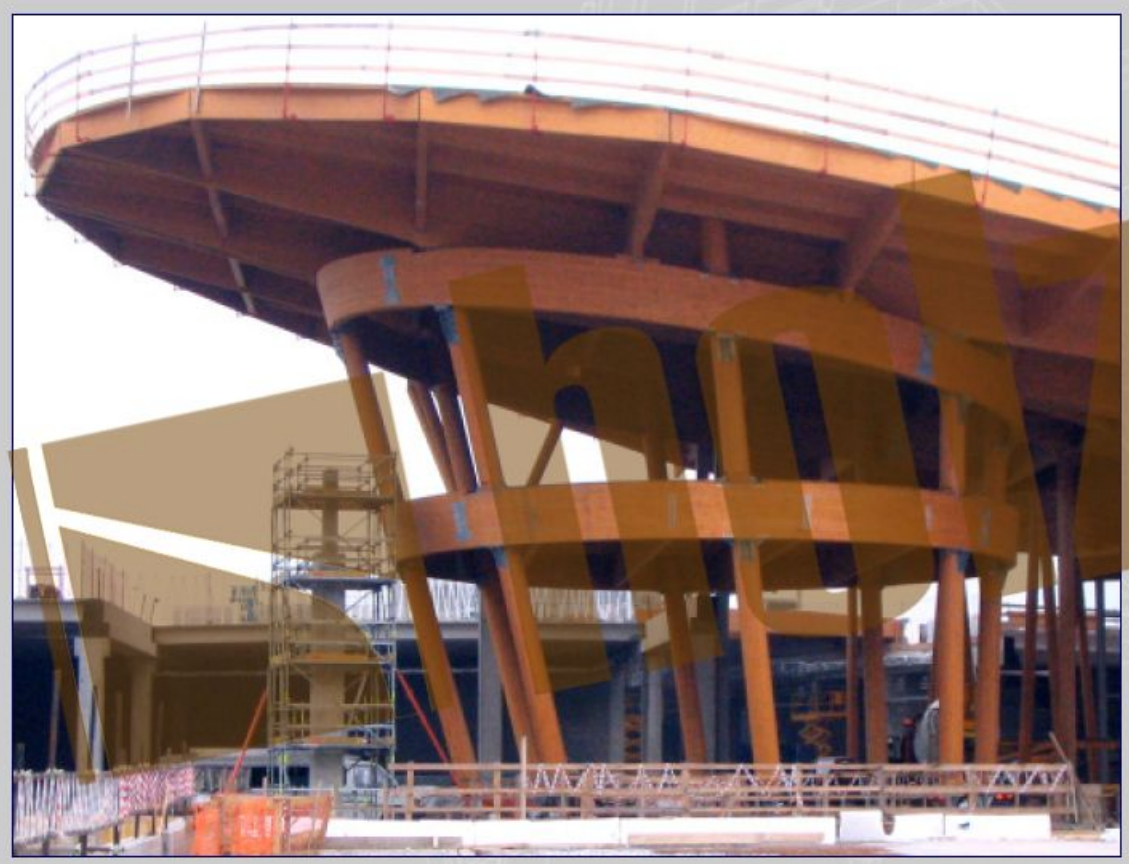
Le torri

La torre bassa



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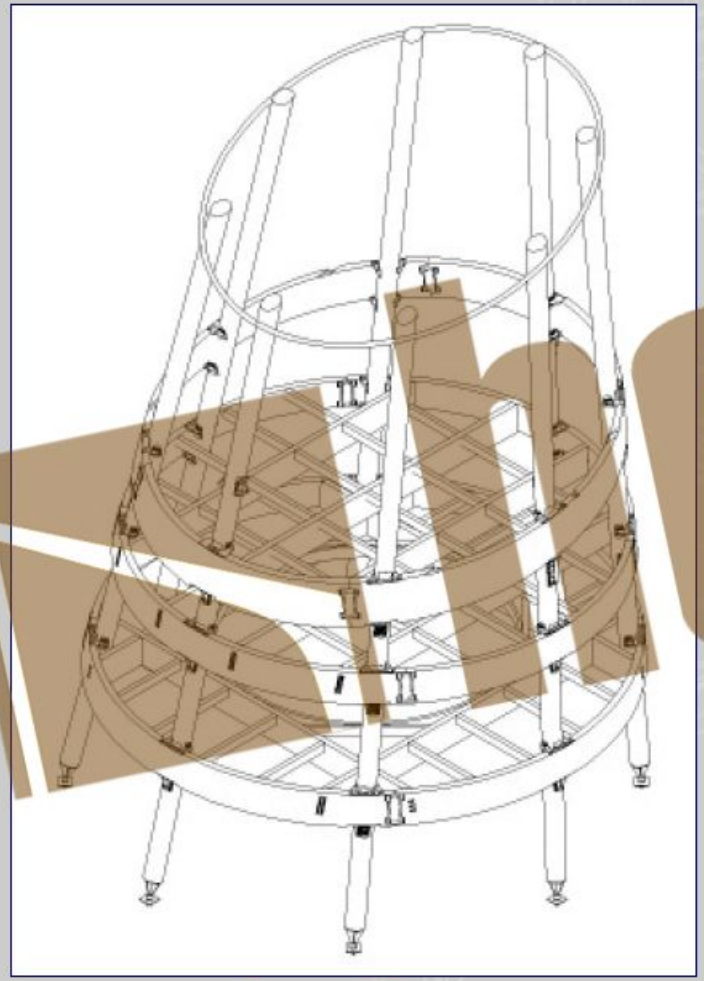
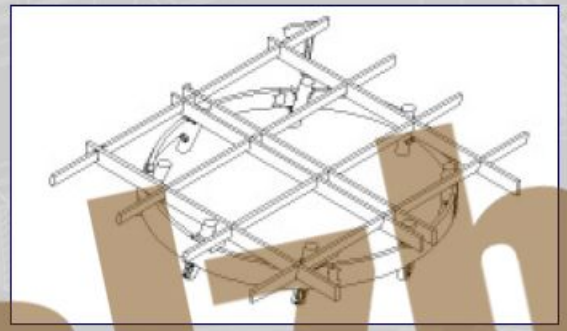
Le torri

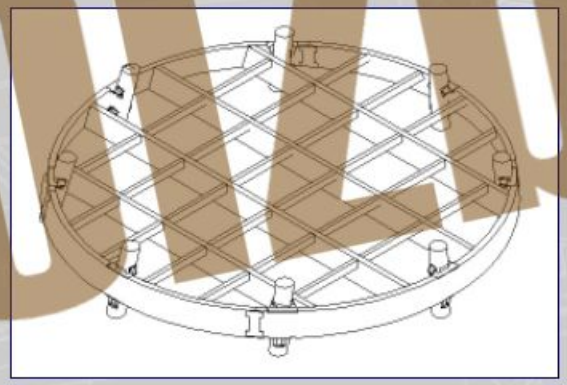
La torre alta

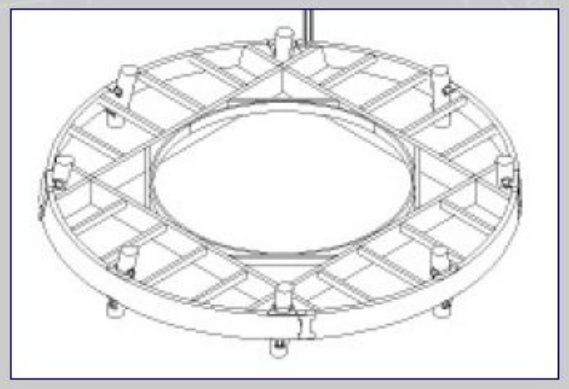


d_{base} = 17 m

d_{apice} = 10 m







Anello superiore:
appoggio travi copertura
g = 1,2 kN/m²
q_{sk} = 1,6 kN/m²

Anello intermedio:
appoggio solaio
g = 3,0 kN/m²
q = 2,0 kN/m²

Anello inferiore:
appoggio ballatoio
g = 2,0 kN/m²
q = 5,0 kN/m²

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Le torri

La torre alta

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Le torri

Elementi strutturali principali

Anello

Sottoelementi anello

Montaggio anello

Colonna

Intaglio colonne

Colonne con ferramenta premontata

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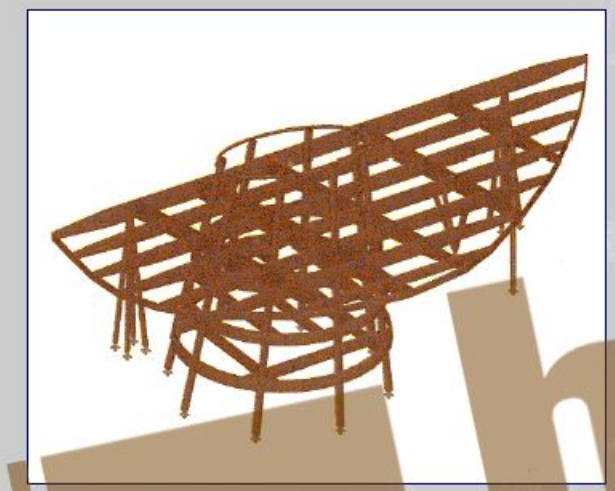
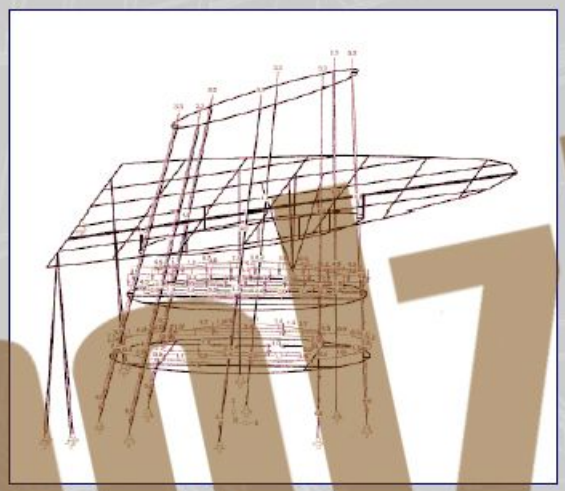
Le torri

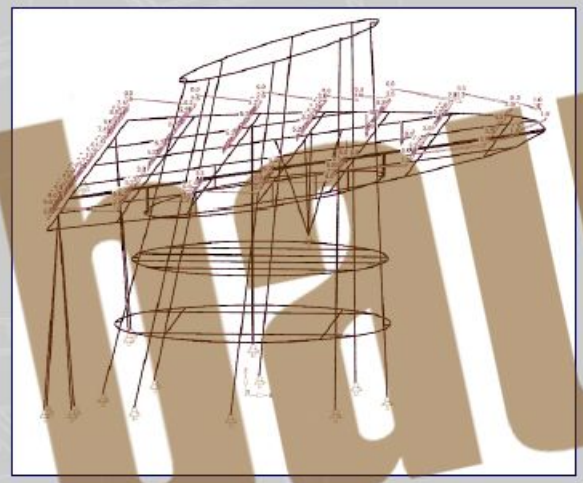
L'importanza di un'analisi statica globale



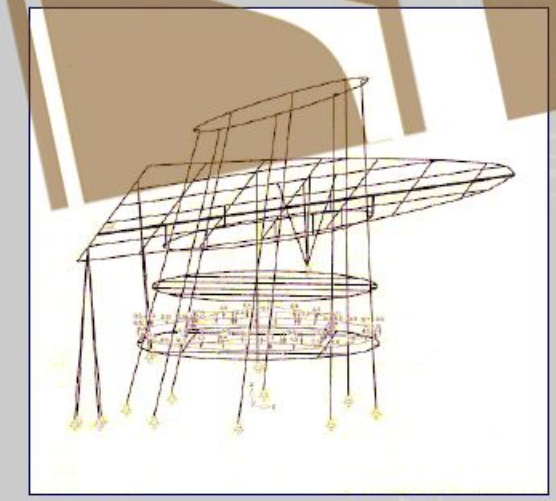
Modellazione ala-torre elementi finiti



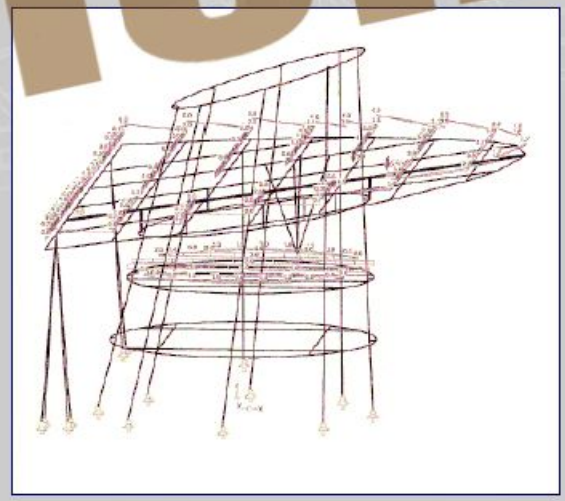
Carico permanente torre



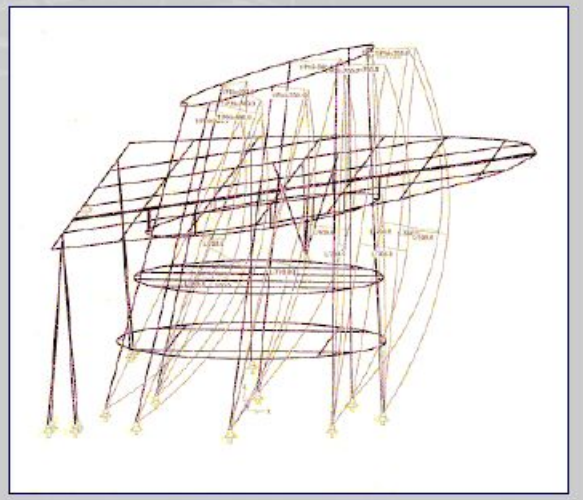
Carico permanente copertura



Carico accidentale ballatoio



Carico neve



Imperfezioni: analisi II ordine

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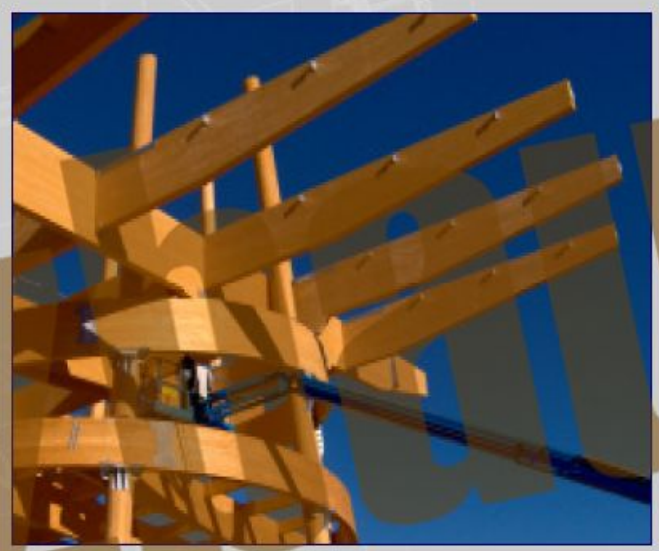
Le torri

Le travi a sbalzo della copertura



Aggetto massimo = 10 m !

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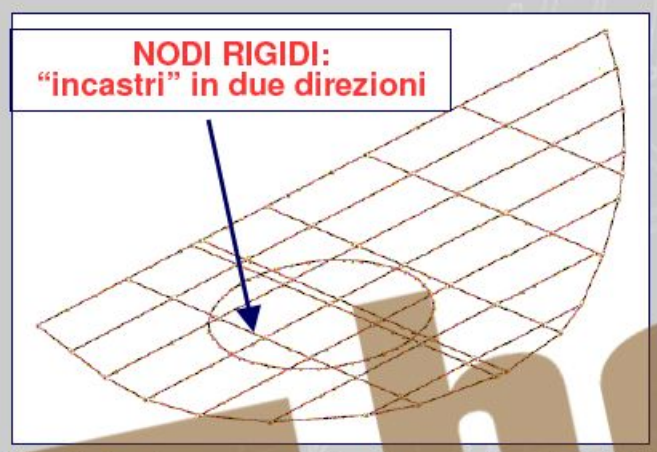
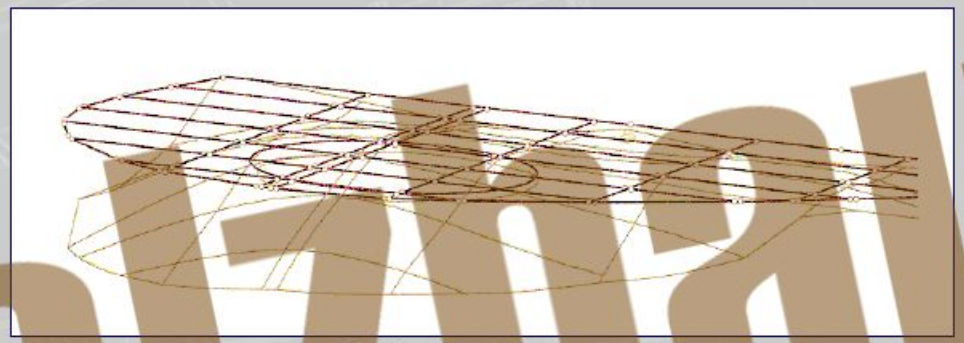
Le torri

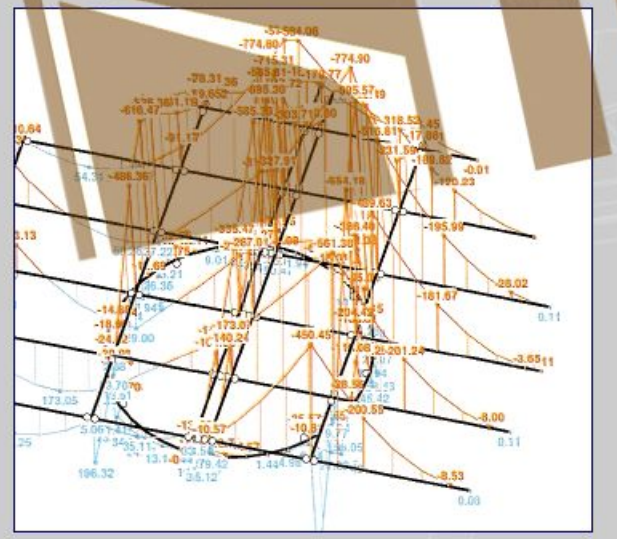
Il comportamento a piastra della copertura



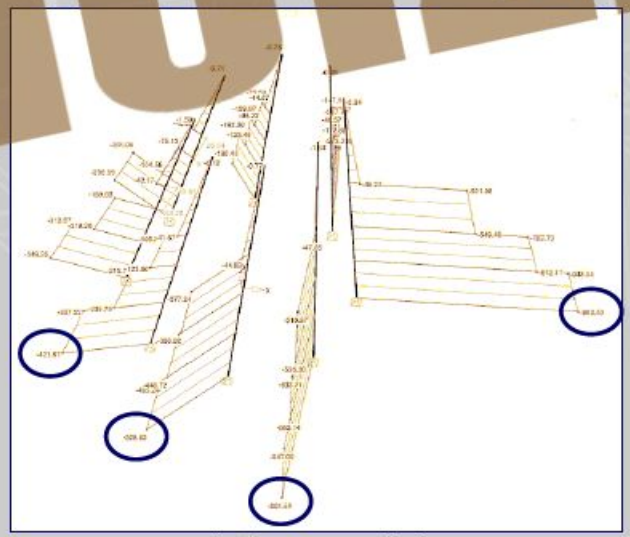
Modellazione copertura a graticcio rigido



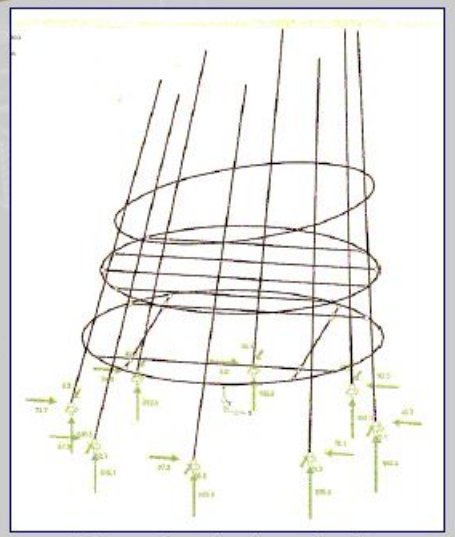
Deformata copertura



Momento flettente



Azione assiale



Reazioni vincolari

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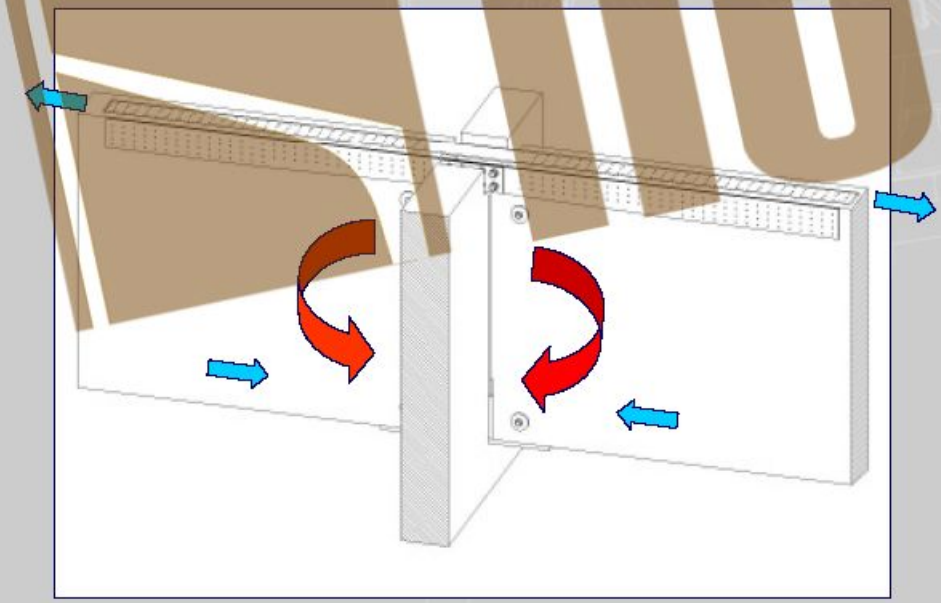
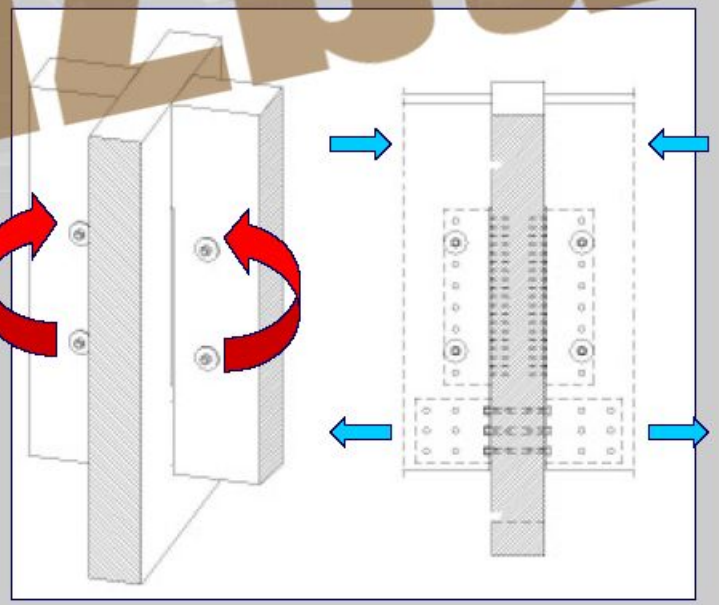
Le torri

Giunti rigidi trave-trave



Momento flettente negativo



Momento flettente positivo

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Le torri

Limitare gli spostamenti globali verso l'esterno: la vera sfida strutturale

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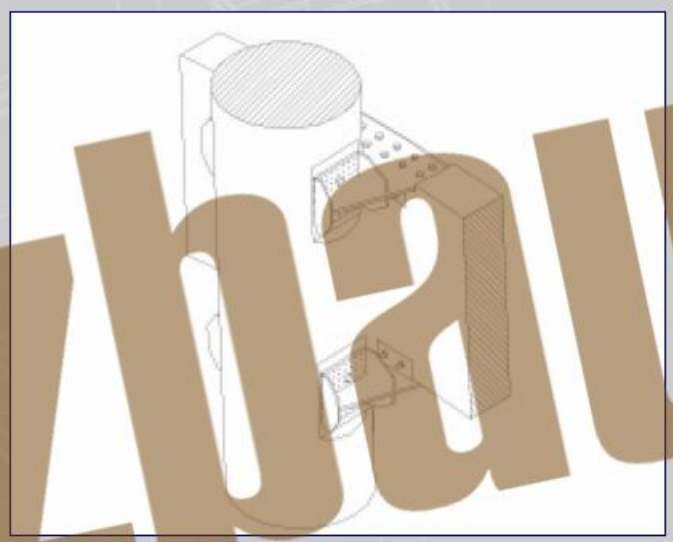
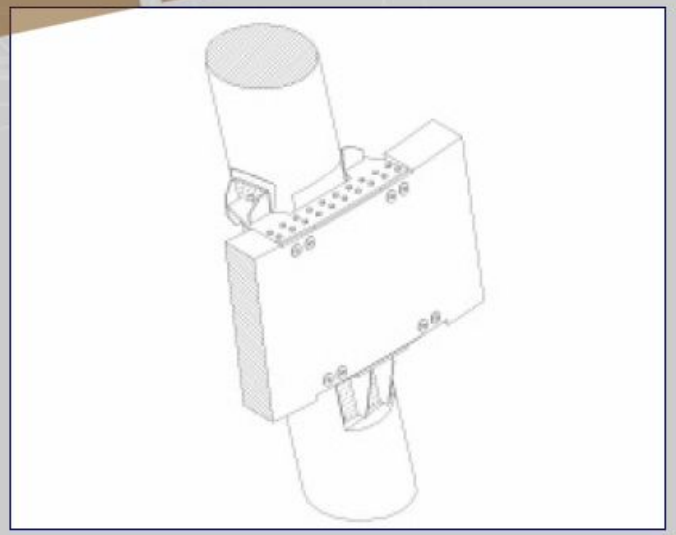
Le torri

1) Realizzare il nodo colonna-anello rigido





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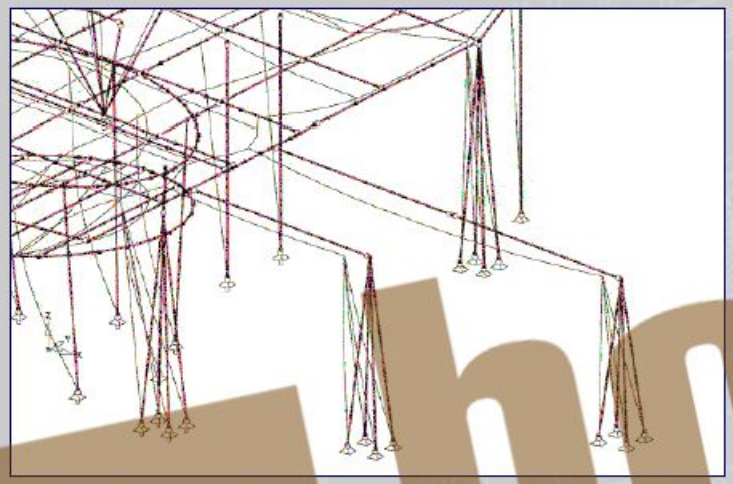
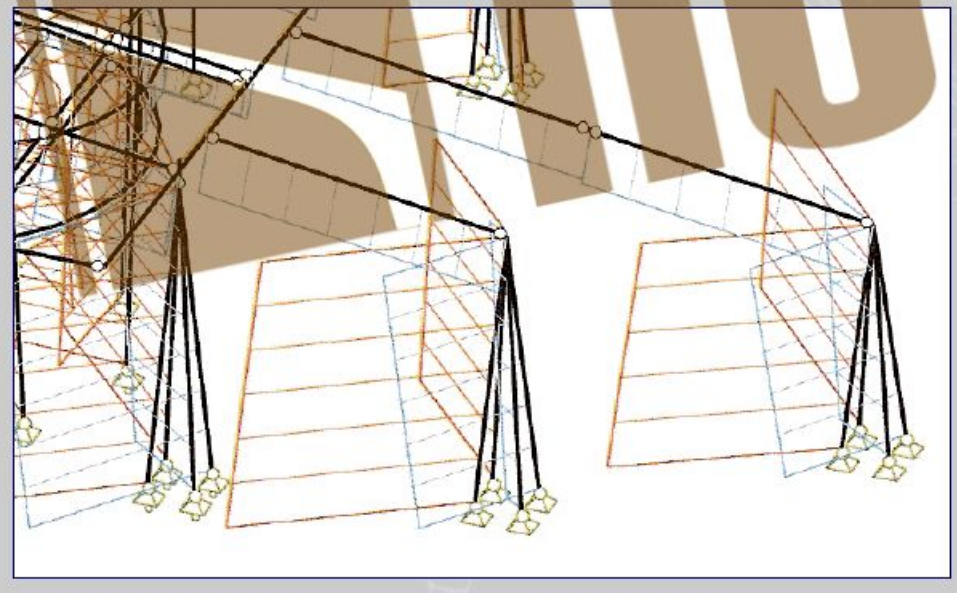
Le torri

2) Sfruttare la rigidezza dei pilastri a 4





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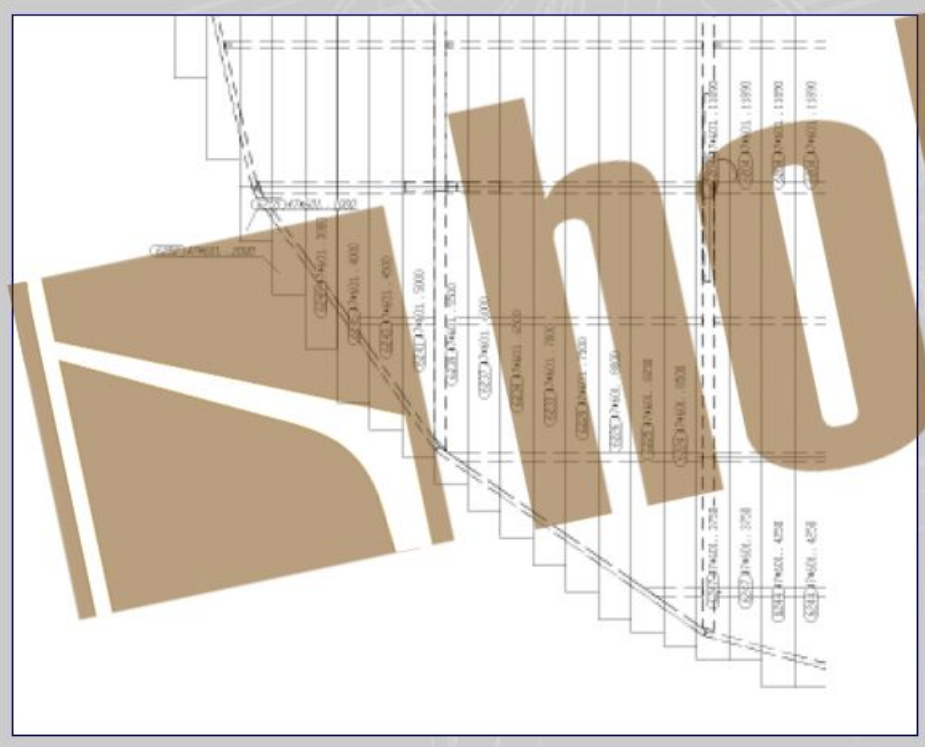
Il pannello strutturale in legno lamellare

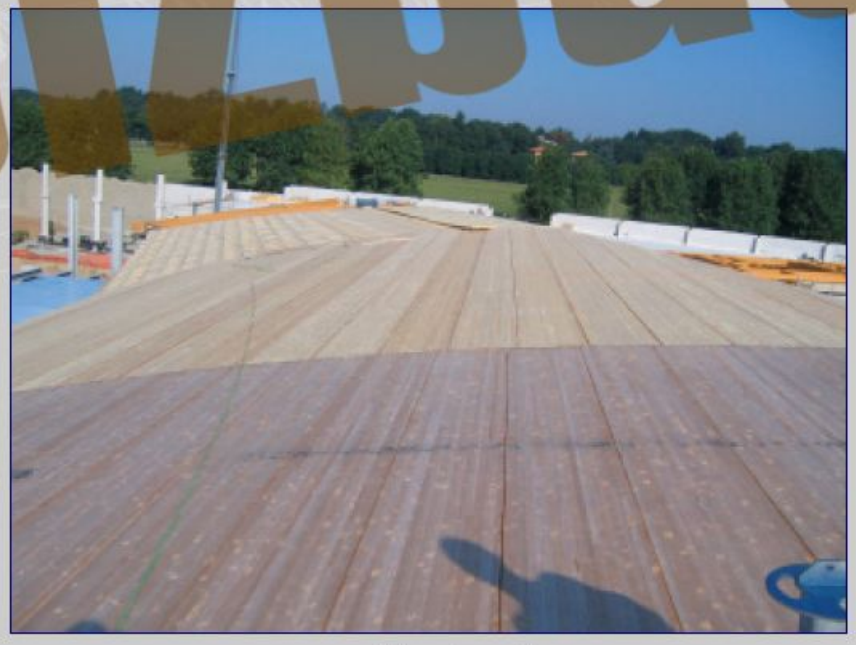
Travi in legno lamellare posate distese e affiancate

Misura 4.7x60.1xL



Schema di montaggio

Stoccaggio del materiale in cantiere



Montaggio

PROGETTARE IL FUTURO IN LEGNO LAMELLARE

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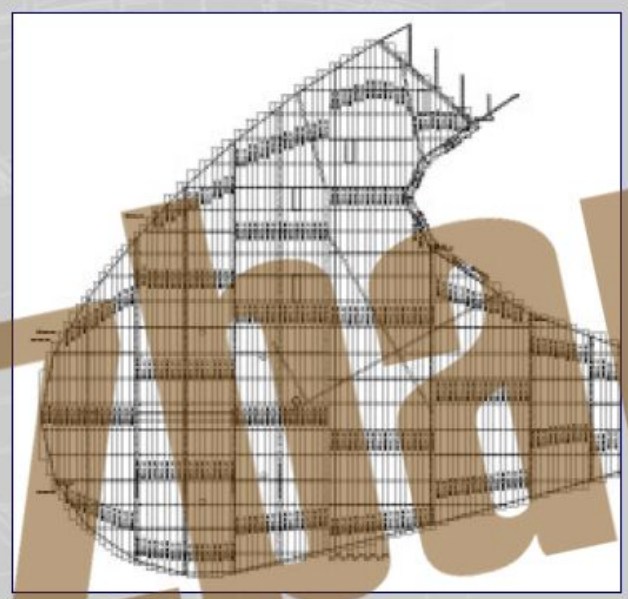
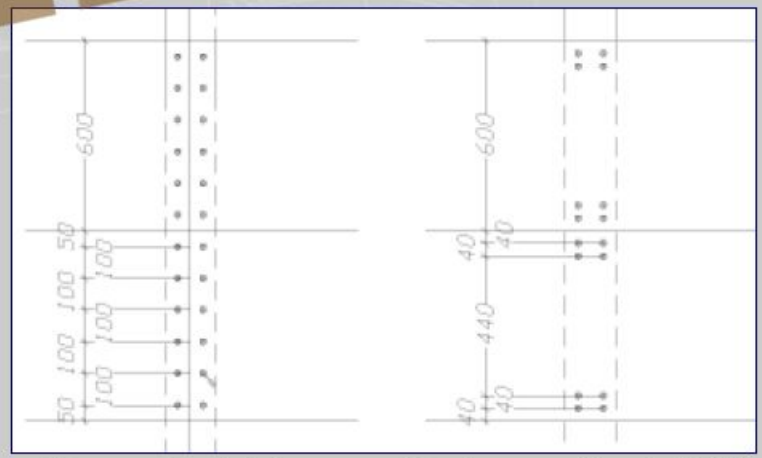
Il pannello strutturale in legno lamellare

Vantaggi:

- *resistenza strutturale*
- *rigidezza strutturale*
- *resistenza al fuoco R60*
- *estetica*



Posa sfalsata



Fissaggio rigido con chiodi → alta duttilità

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Fuoco e sisma

RESISTENZA AL FUOCO R=60':

- Metodo della sezione efficace ridotta
- Resistenza R=60' garantita già con il dimensionamento "a freddo"

ANALISI SISMICA – O.P.C.M. 3274:

- Analisi dinamica modale su modello strutturale tridimensionale
- Zona sismica 4: $a_g = 0.05$ g
  Fattore di struttura: q = 1.5
  Fattore di importanza: q = 1.2
- Confermati i vantaggi del legno lamellare:
  - leggerezza → diminuisce $W = G_k + \Psi_{Ei} Q_{ki}$
  - resistenza carichi istantanei → aumenta R_d
  - deformabilità → aumenta T → diminuisce $S_d(T)$


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Grazie per
l'attenzione