BBUILDING: Eco Housing Division

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COMPARISON STUDY OF STATIC BEHAVIOUR OF A REINFORCED CONCRETE STRUCTURE AND LOAD BEARING WALLS IN SILICAWOOD® SUBJECTED TO SEISMIC ACTIONS

Illustrative study with comparative calculations

based on LAGOONS Villa 3714 RIIFA VIEWS , KINGDOM OF Bahrain.

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Revisions

Version	Date	Description of Modifications
1.0	24/06/2012	1st Edition: test and calculation

Distribution List

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INTRODUCTION

Scope of this report is to compare the structural behaviour of the same building for residential housing realized with two different kind of construction system: reinforced concrete frame structure and bearding structure in Silicawood® walls.

The comparison will be performed in terms of stress and displacement.

The applied actions are the same for both structural types, except for the own weight, which is considerably reduced in the case of a structure in Silicawood® due to lower density of the material and for the presence of horizontal elements in wood, therefore lighter.

The modelling is performed through the finite element method: in the first case the structure is modelled as a three-dimensional frame while the walls in Silicawood ® were modelled with the method of the equivalent frame.

MODELLING OF ACTIONS

For both structural types were applied following actions:

- - Permanent load carried: 2 kN / m;
- - Operating load: 2 kN / m;
- - Seismic action, as described in paragraph 4;

These values have been applied both to the deck of the first floor that for the cover.

MODELLING OF MATERIALS

The parameters of elastic modules used for the modeling are given below:

	Num.	Descrizione	E	n	G	C.term.	Peso vol.	Descrizione estesa
●	001)	CALCESTRUZZO	300000.0	0.15	130000.0	1e-05	25.000	CALCESTRUZZO
○	002)	LAMELLARE	94000.0	0.40	7200.0	0	3.800	LAMELLARE GL24h
○	003)	PLS	30000.0	0.40	1500.0	0	10.000	PLS

1. SEISMIC ACTIONS

Seismic action values applied, calculated with reference to European technical regulations are the following:

a_g = 0.126 g

F_0 = 2.481

T_c^* = 0.281 s

C_U = 1.0 (Class of use II)

V_N = 50 anni

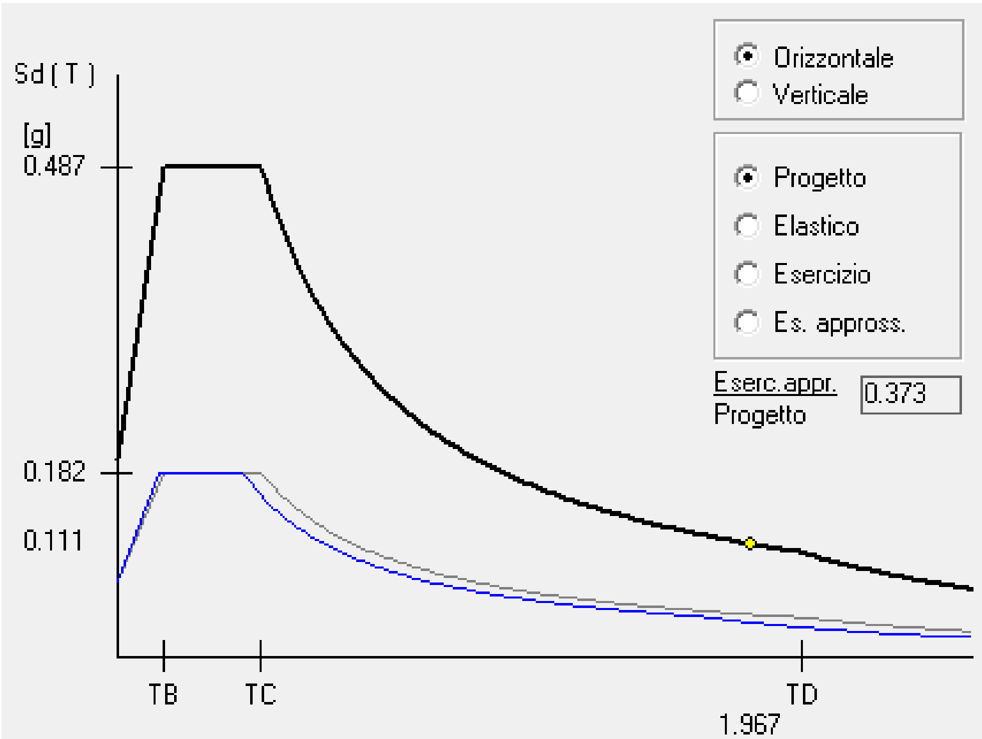
$V_R = C_U \cdot V_N = 1.0 \cdot 50 = 50$ anni

S_S = 1.50 (category C)

S_T = 1.0 (category T1)

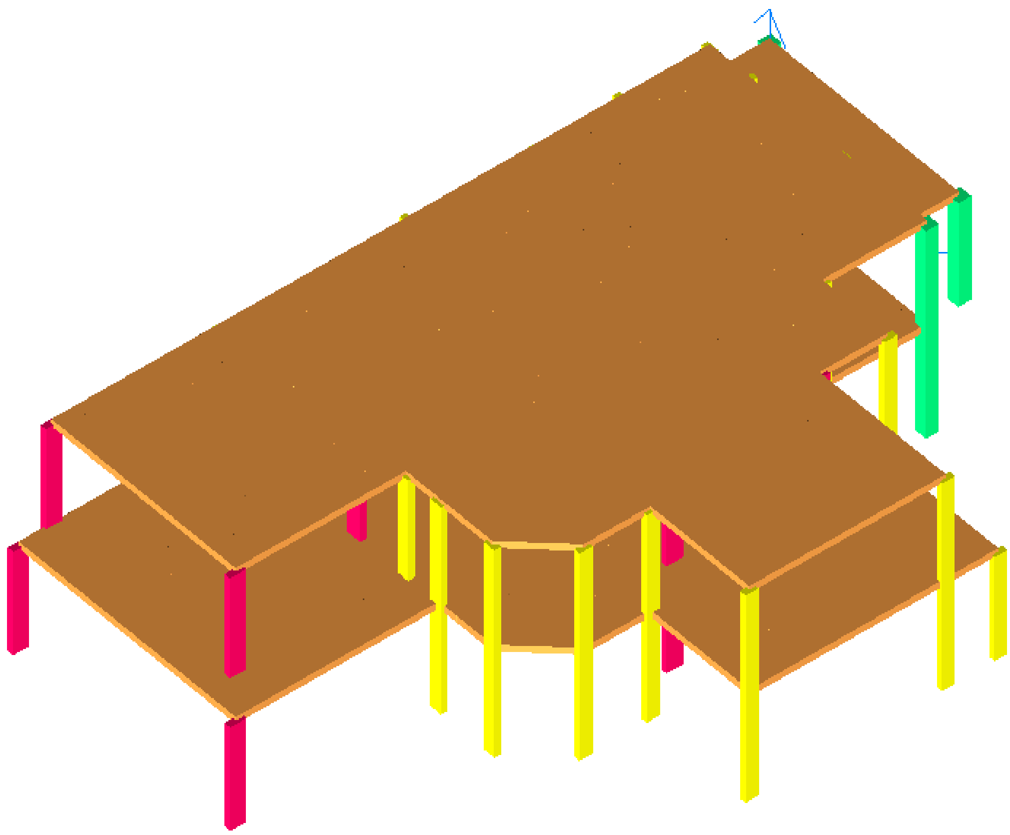
$S = S_S \cdot S_T = 1.5$

The spectra and elastic seismic design are described below:

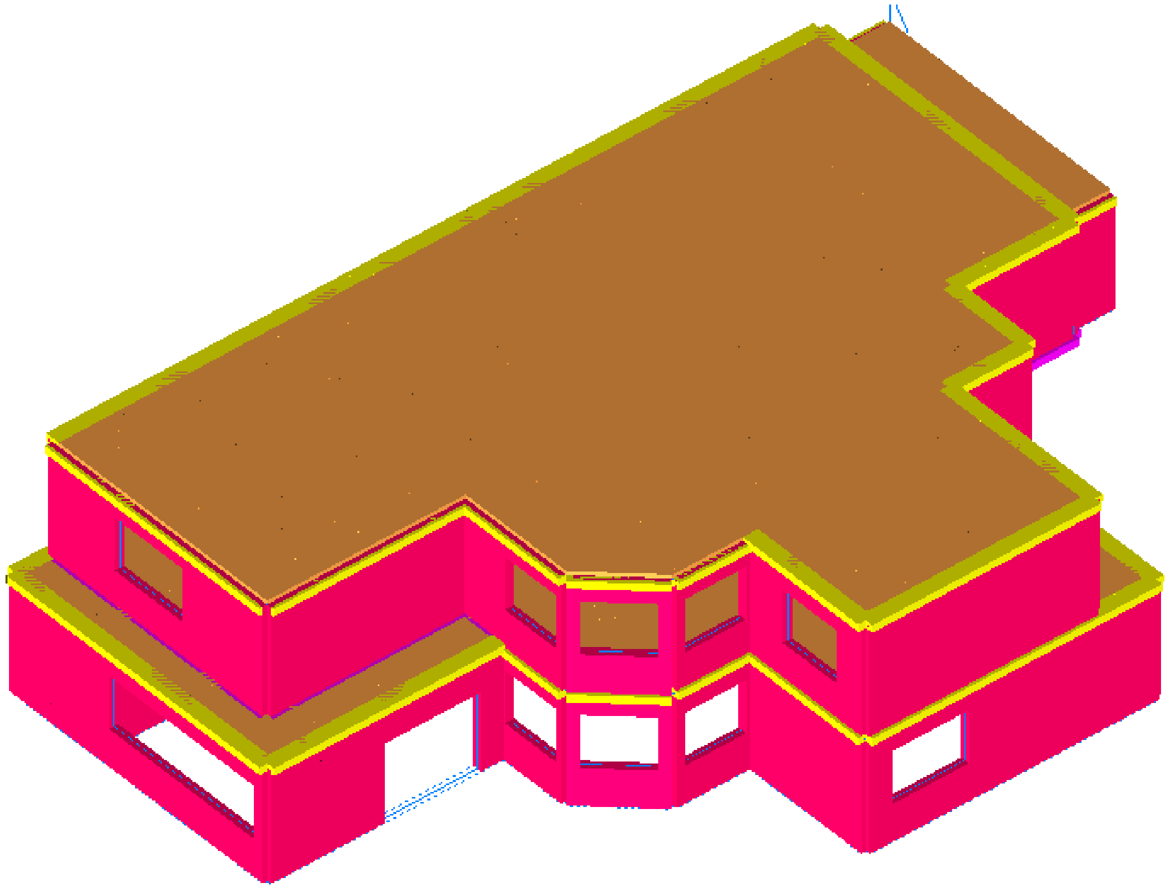


The seismic response spectrum has been obtained by considering a single factor of the structure (q = 1.0) or fails reserves in terms of ductility of the material under seismic action.

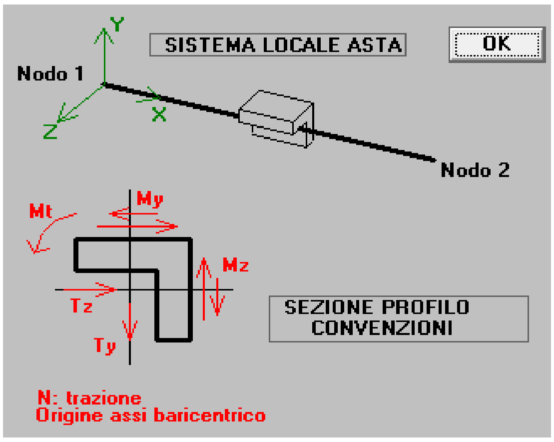
MODEL A (concrete frame structure.)



MODEL B (Silicawood® panels structure)



SIGN CONVENTIONS

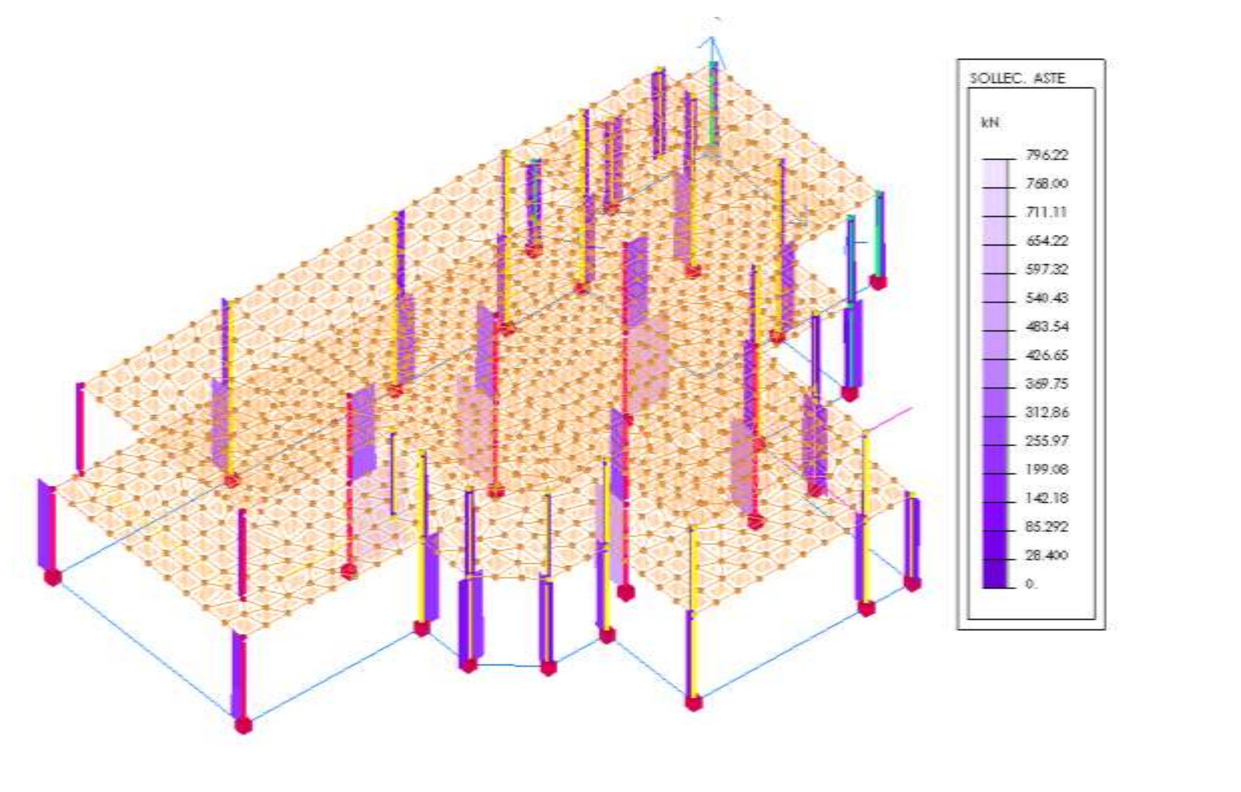


COMPARISON

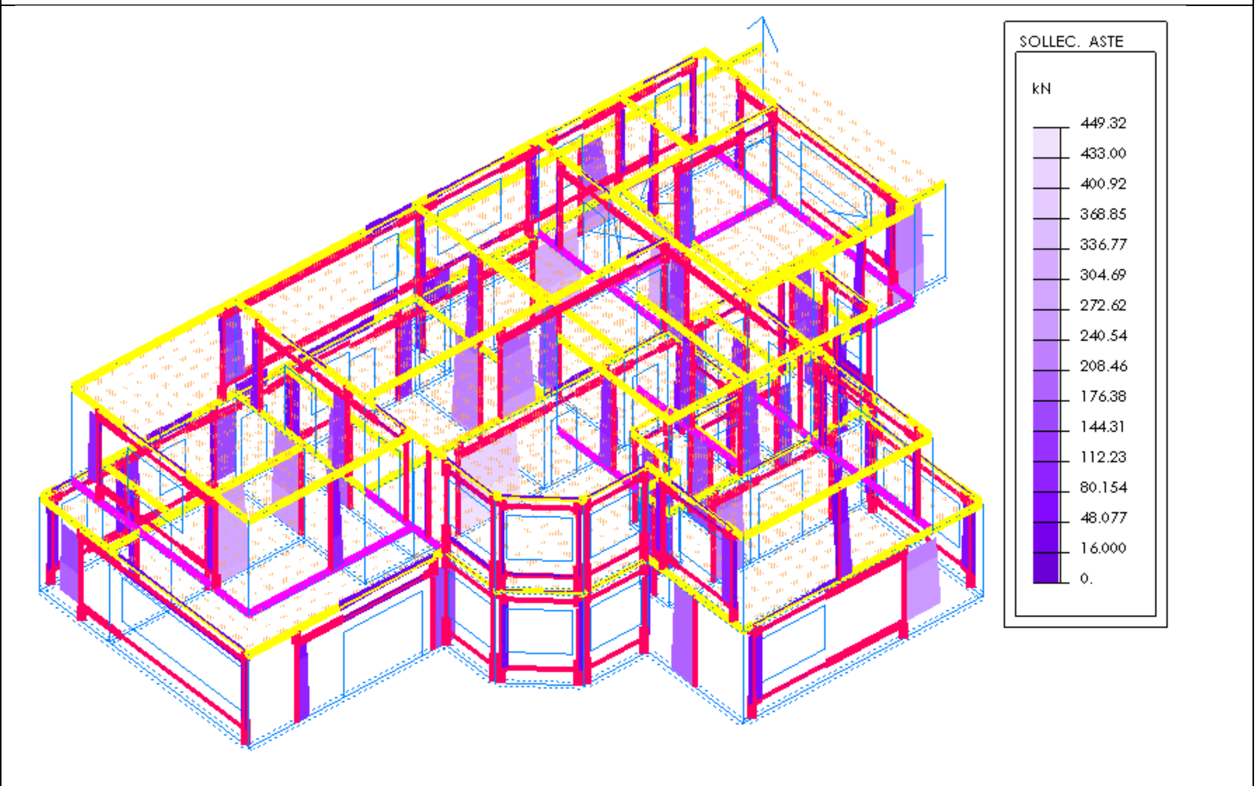
1.1. Stressement (SLV)

Normal effort N

A

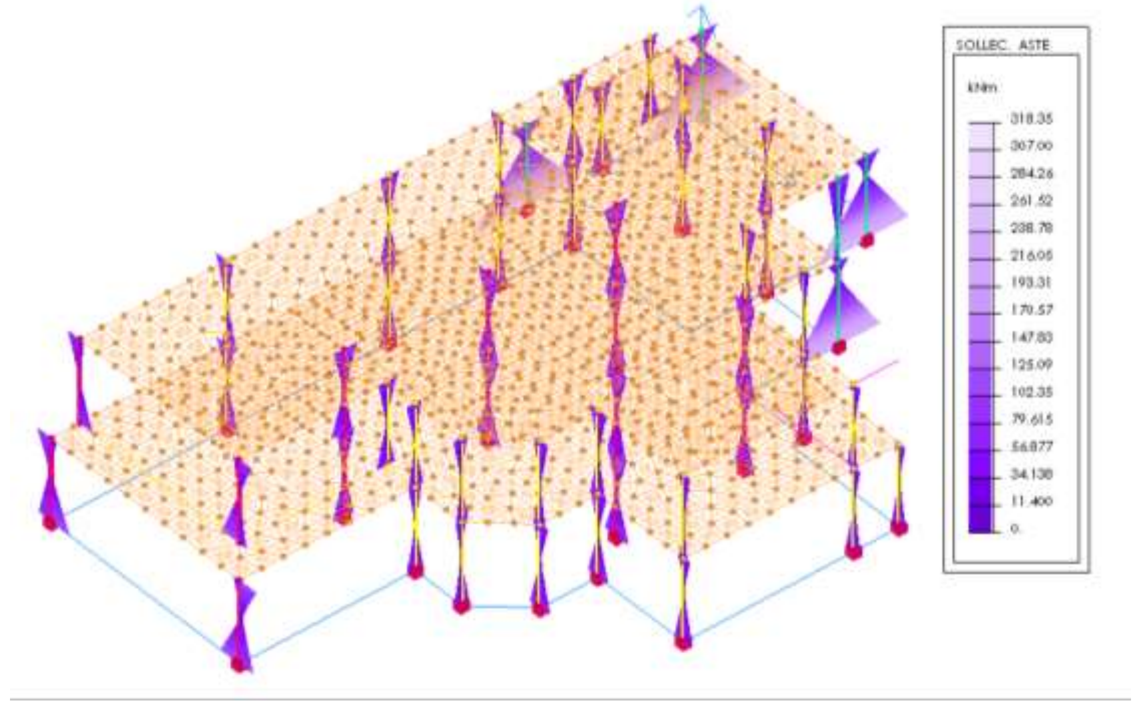


B

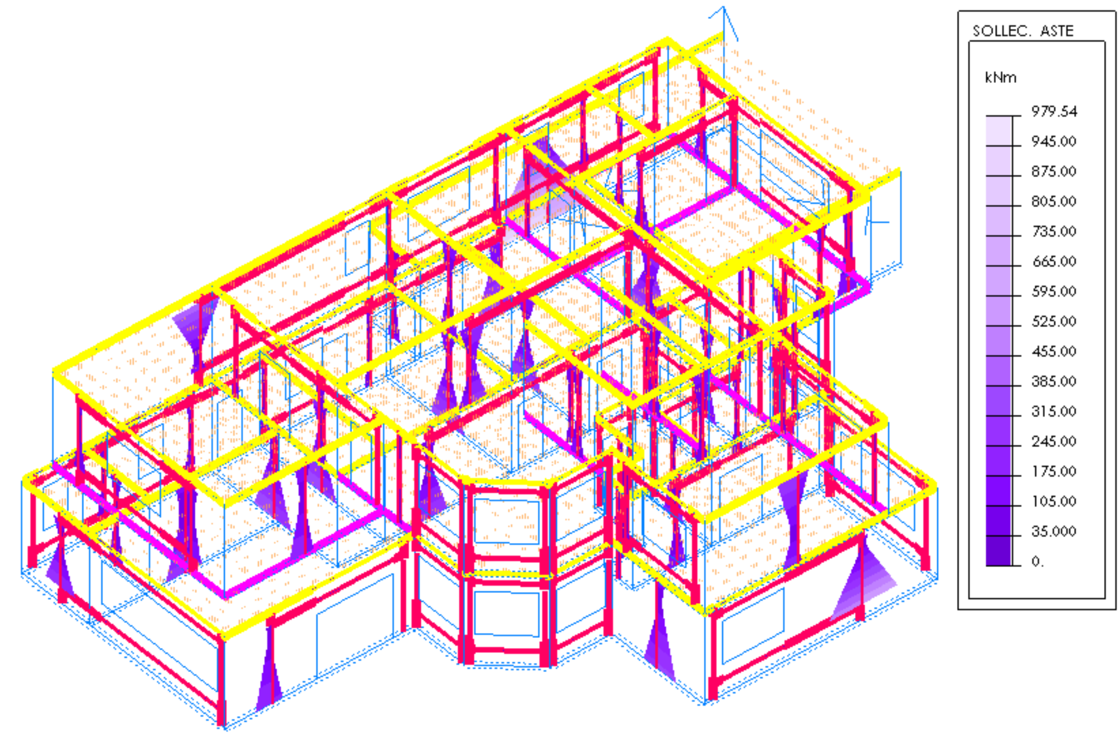


Bending moment M_z

A

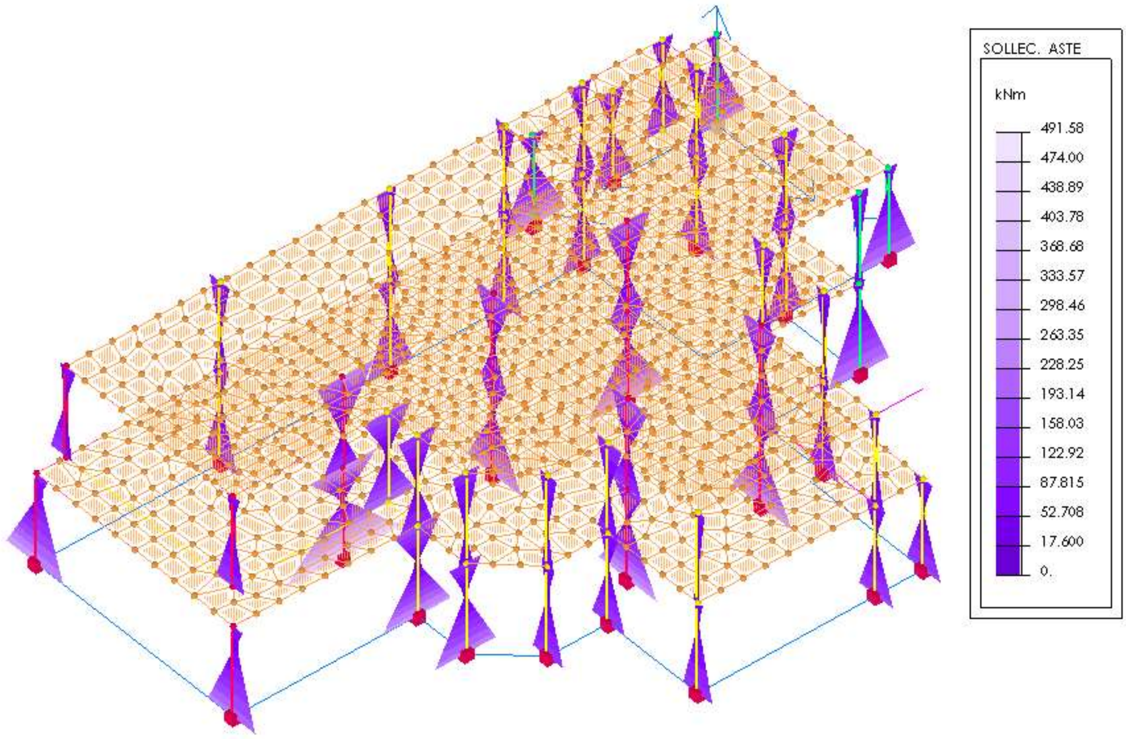


B



Bending moment M_y

A



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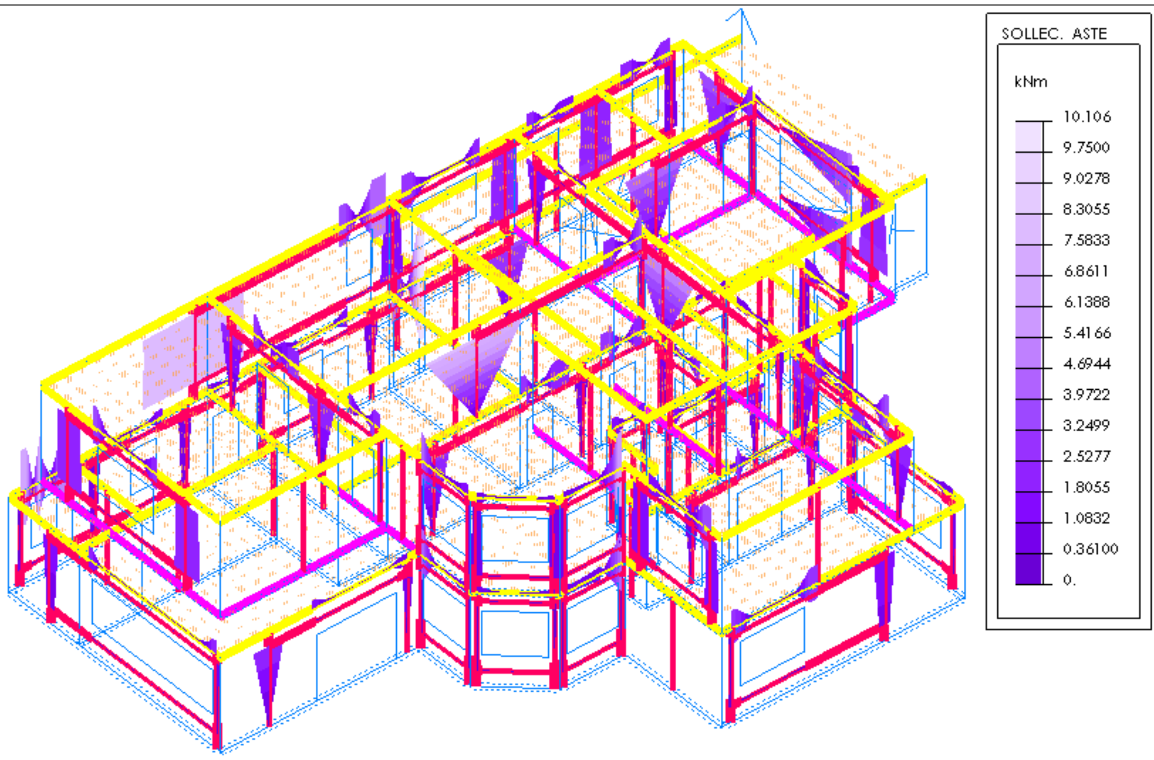
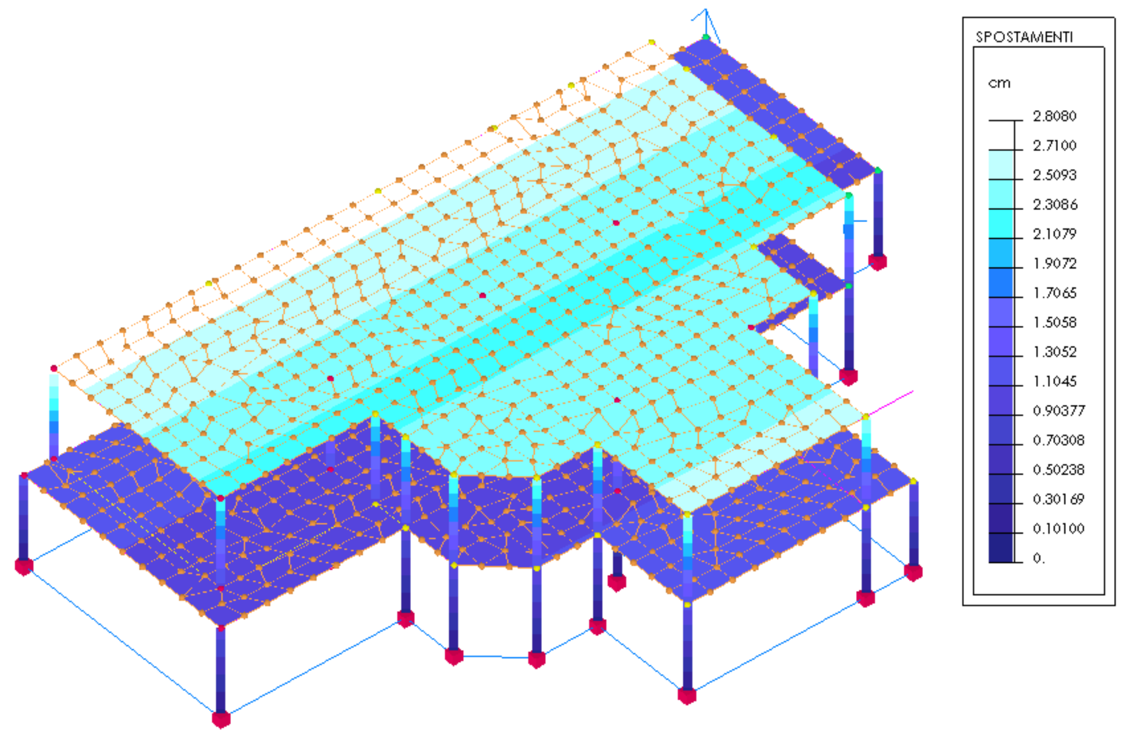


1.2. Displacement (SLV)

Direction x

A



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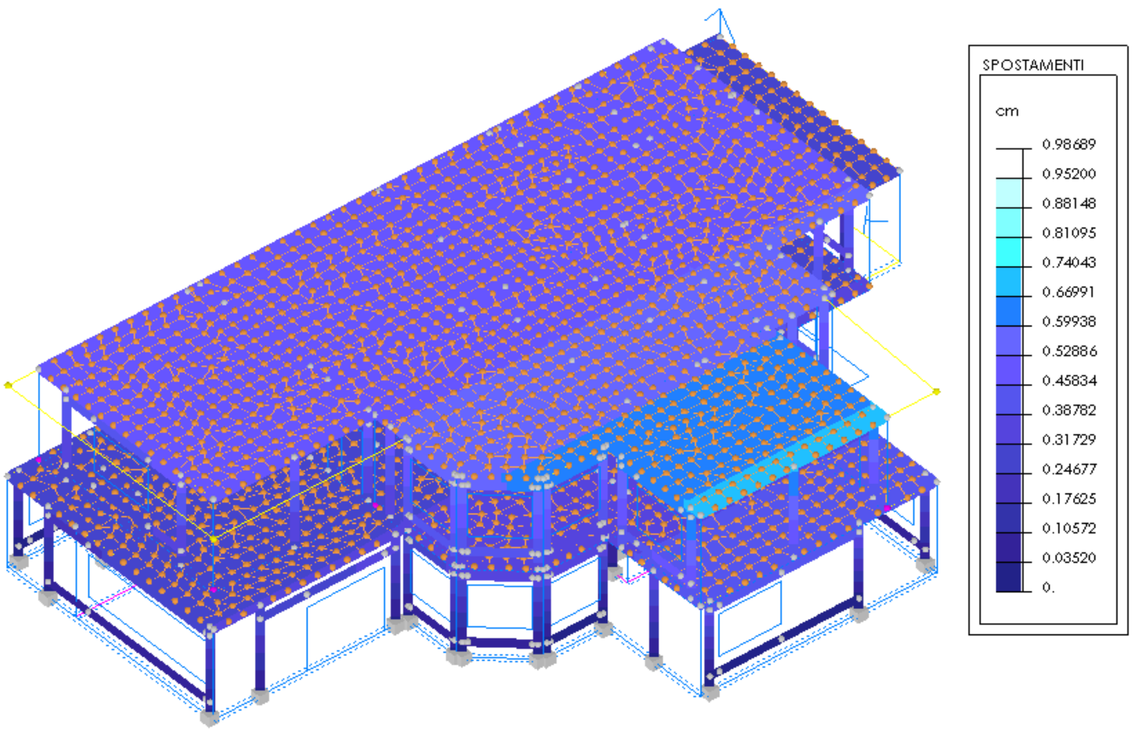
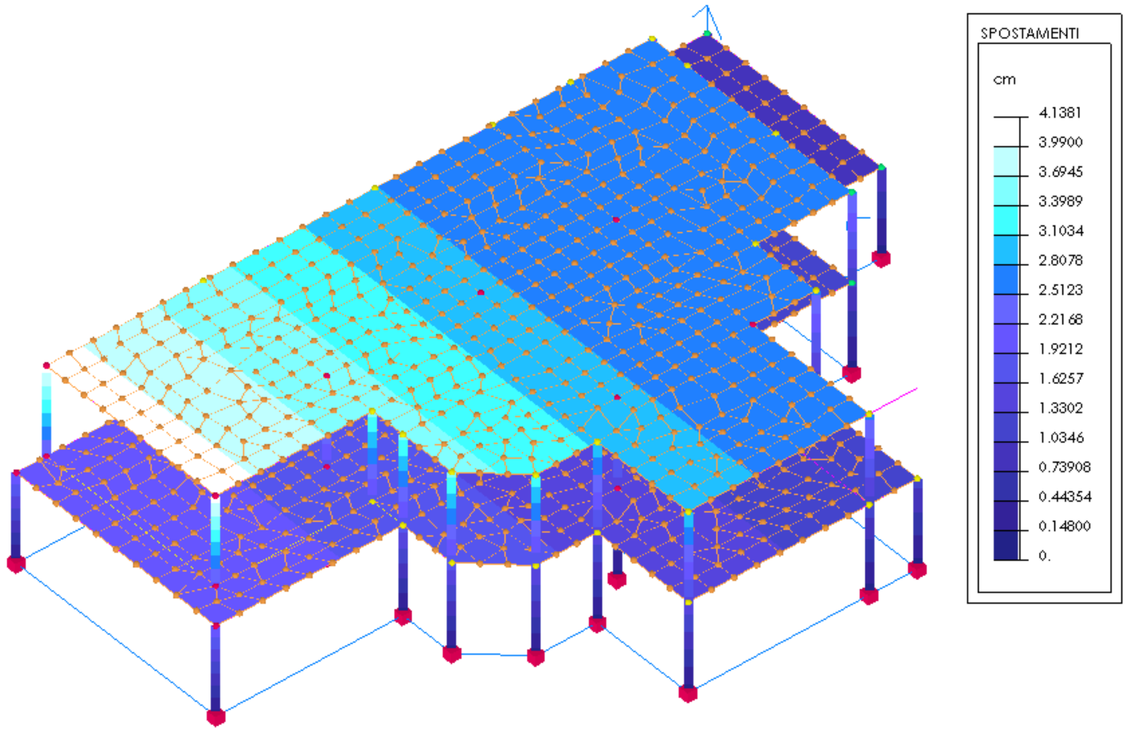
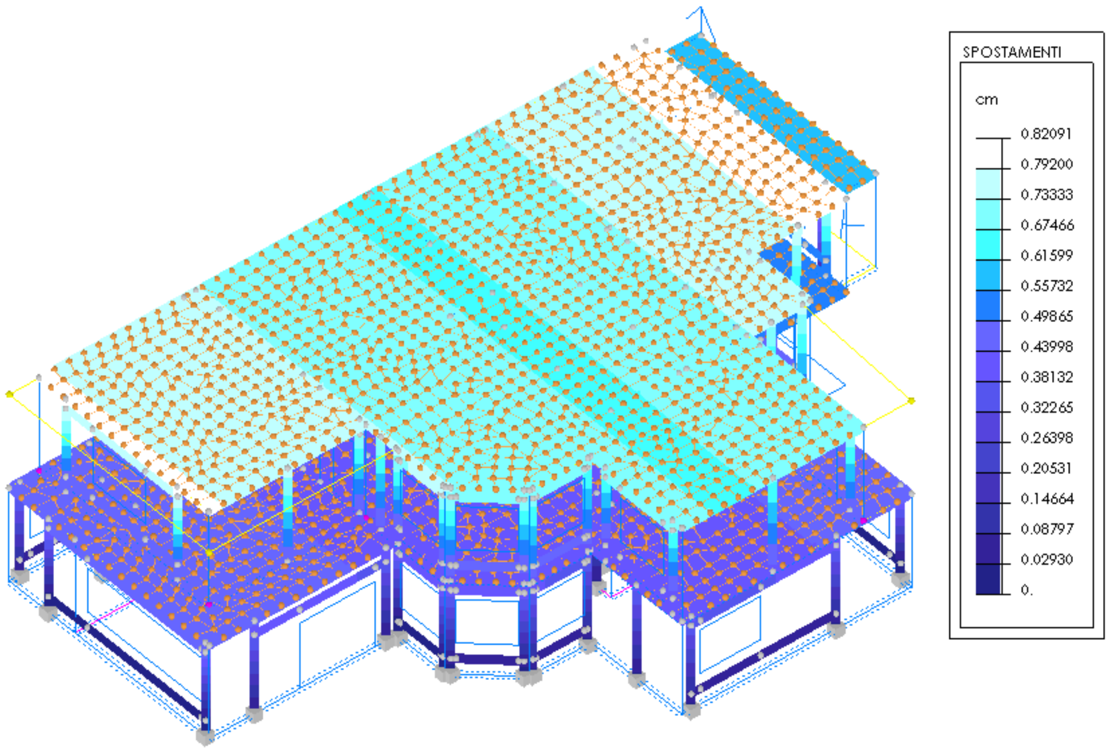


Direction y

A


SPOSTAMENTI
cm
4.1381
3.9900
3.6945
3.3989
3.1034
2.8078
2.5123
2.2168
1.9212
1.6257
1.3302
1.0346
0.73908
0.44354
0.14800
0.

B


SPOSTAMENTI
cm
0.82091
0.79200
0.73333
0.67466
0.61599
0.55732
0.49865
0.43998
0.38132
0.32265
0.26398
0.20531
0.14664
0.08797
0.02930
0.

CONCLUSION

From the studies and analytical calculation summarized above using comparative diagrams shows that the structure with walls Silicawood® leads deformations and displacements significantly smaller than in the same building with reinforced concrete columns (ranging from 2.8 cm to 0.9 in the x direction, and from 4.1 to 0.8 in the y direction). This fact shows that, in addition to greater structural safety of the building itself, are also guaranteed more elements of stability to things contained in buildings such as furniture, libraries, various objects.