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STEEL-BASED APPLICATIONS IN EARTHQUAKE-PRONE AREAS

PRECASTEEL

PREFABRI**CA**TED **ST**EEL STRUCTUR**E**S FOR LOW-RIS**E** BUI**L**DINGS IN SEISMIC AREAS

TECHNICAL SHEET

FERRIERE NORD SpA CONTRIBUTION

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1. Introduction

The following paragraphs explains the main scope of Ferriere Nord SpA (FeNO) contribution on *Precasteel* research, about the analysis of precast double-slab r.c. wall as alternative bracing system in low-rise steel commercial buildings situated in seismic areas, in particular the definition of shear wall configurations and load levels with reference to an innovative simplified pre-design procedure.

One of the parts of the project research that has deeply developed by FeNO was focused on the comparison between reinforced concrete walls solutions towards concentric and eccentric steel bracing systems, underlining their capacity of dissipating seismic energy and consequently the influence in terms of cost of construction.

2. Design objectives

The mentioned simplified design approach has the aim to accelerate and make easier all the decisions that has to be taken about feasibility of a project and, the last but not the least, provide an economic estimation of the investment.

On the basis of a preliminary statistical data analysis, structural configurations were defined fixing geometries (bays length, storey number, floor configuration or roof slope) in order to be consistent with housed activities, industrial or commercial, and to be competitive with concrete market shares. The selected structural solutions for commercial building activities were iteratively designed varying geometrical parameters and resisting static schemes in order to define the optimum steel and steel-concrete composite solutions.

The iterative design of many structures, integrated with the cost analysis, was transformed in a complete performance analysis where structural performance (assessed applying Eurocode design framework) were harmonized with construction costs. The cost model considered information coming from three different countries (Italy - Southern Europe; Germany - Central Europe; Romania - Eastern Europe), in such a way to adopt standardized reference values and to individuate in which national markets some solutions can be competitive or not.

Concerning commercial buildings, the solutions derived from the statistical analysis and from the cost analysis were in general a modular solution in which two main structures were coupled and devoted to different roles:

- a gravity structure to sustain vertical loads;
- a bracing structure to sustain seismic loads.

The refined numerical simulations and the studies for optimizing the structural performance of commercial building solutions where devoted to the assessment of real seismic performance of different horizontal bracing systems. The following structural configurations were analysed:

- commercial buildings equipped with concentrically braced steel frames (UniCAM);
- commercial buildings equipped with eccentrically braced steel frames (UniCAM);
- commercial buildings equipped with prefabricated reinforced concrete walls (FeNO);
- commercial buildings equipped with high dissipative rubber bearings between gravity structure and prefabricated reinforced concrete walls.

The final part of the research was focused on the definition of a design method (procedure) suitable for supporting practitioners and engineers in the use of solutions studied in *Precasteel*, in order to create an innovative and high quality software for the valorisation and utilization of structural solutions herein considered. The automated software became an internet application that every practitioner and engineer can use from its office in order to preliminary design a complete structure for industrial and commercial activities using *Precasteel* solutions. The web application works as a user-friendly graphical interface, that starting from a finite set of parameterized and optimized set of data, supplies the drawings and estimation of the cost of the structure, floors, roof and connections for industrial and commercial buildings.

3. Design inputs

The definition of a pre-design procedure for commercial buildings, that is able to provide designers some solutions about r.c. walls as alternative bracing systems, is based on some hypothesis concerning geometrical parameters and specific load levels:

Geometrical hypothesis:

- wall inter-storey height:

H = 6 - 8 m (one-storey buildings);

H = 4 - 5 - 6 m (two-storey buildings);

- wall width:

B = 8 - 10 - 12 m (one-storey buildings);

B = 4 - 5 - 6 m (two-storey buildings);

- wall thickness: s = 0.20 - 0.25 - 0.30 - 0.35 - 0.40 m.

Load hypothesis:

- maximum base shear horizontal loads (earthquake, wind) for a single r.c. wall: $V_b = 500 - 1000 - 1500 - 2000 \text{ kN};$
- roof/floor dead load:

 G_{1k} = 2.85 kN/m² (floor systems self-weight, see Figure 1);





Figure 1: Typologies of r.c. floor (Predalle) and steel sheeting composite floor adopted.

- super-dead load:
 - $G_{2k} = 1.80 \text{ kN/m}^2;$
- heavy live load:

 $Q_k = 8.00 \text{ kN/m}^2$ (commercial activities);

- standard live load:
 - $Q_k = 5.00 \text{ kN/m}^2$ (commercial activities);
- light live load:

 $Q_k = 2.00 \text{ kN/m}^2 \text{ (snow)};$

- seismicity level (PGA, peak ground acceleration):

 $a_g = 0.08 g$ (low seismicity);

 $a_g = 0.16 g$ (medium seismicity);

 $a_g = 0.32$ g (high seismicity);

- r.c. walls are designed to resist both seismic and wind actions, assuming four different distributions of the storey forces (distributions A, B, C, D, as explained in Figure 2). In the case of wind, the base shear was distributed so that the force applied at the first storey is twice the one applied at the roof level; in the case of seismic actions, by assuming the first vibration mode to be linear, the base shear was distributed according to the following formulas (where *M* represents storey seismic mass):

$$F_{1} = V_{b} \left(\frac{M_{1} \cdot H}{M_{1} \cdot H + 2 \cdot M_{2} \cdot H} \right)$$
$$F_{2} = V_{b} \left(\frac{2 \cdot M_{2} \cdot H}{M_{1} \cdot H + 2 \cdot M_{2} \cdot H} \right)$$



Figure 2: Distribution of horizontal forces.

4. Specific design concept

The definition of the mentioned pre-design method for r.c. walls as alternative bracing systems in steel commercial buildings is based especially on some hypothesis concerning the idealization of the structural behavior:

- simplified static schemes, obtained by extracting substructures with lower complexity but still able to describe the behavior of the whole structure;
- substructures are regular in plant and in elevation, in terms both of the distribution of seismic masses and stiffness;
- floor systems, columns and walls are designed separately considering vertical loads for the first two and horizontal actions (seismic and wind actions) for the third (see Figure 3);



Figure 3: Decoupling of vertical and horizontal loads.

- floor systems are supposed as rigid diaphragms;
- foundation structures are considered and modeled as ideal rigid constraints;
- linear elastic analyses;
- static seismic analyses to pre-design ductile walls (ULS), simplified dynamic seismic analyses to give an estimation about influence area/wall (considering lumped masses for each storey);
- overturning vibration modes are avoided by technical joints (gaps between architectural modules) and a symmetrical disposition of the walls;
- ductile walls are uncoupled (i.e. C or L plan shapes for staircases);
- shear wall deformation is taken into account through a refined wall stiffness model (Timoshenko model);
- limitations imposed by Eurocodes are considered in order to obtain structural performances consistent with standard provisions.

5. Design methodology

In order to obtain the minimum number of seismic-resistant walls, able to withstand assigned base shears V_b and given a specific commercial building area, the following procedure is adopted.

The first vibration mode is assumed to be linear, consistently with the previous storey force distributions adopted, and may be expressed as:

$$a^{T} = \begin{bmatrix} \frac{1}{n} & \dots & \frac{i}{n} & \dots & 1 \end{bmatrix}$$
 $i = 1, \dots, n$ (storey number).

Being K the translational stiffness matrix of the walls and M the mass matrix corresponding to a unit area, the fundamental period T of the system can be estimated from the expression:

$$T = 2\pi \cdot \sqrt{\frac{a \cdot Ma}{a \cdot Ka}} \cdot \sqrt{A}$$

where A is the unknown wall influence area.

The influence area A of the single wall may be evaluated by solving the following nonlinear equation, obtained by equating the assigned V_b to the base shear expected:

$$V_b = A \cdot \frac{(a \cdot Mr)^2}{a \cdot Ma} \cdot S_d(T)$$

where S_d is the design spectrum.

This approach is valid only for type "A", "C" and "D" distribution of static forces (see Figure 4), in which base shear is due to seismic actions; for distribution type "B" the forces are originated by wind and the analysis the influence area A of the single wall is unpredictable because it requires knowing the exact form of the building and the surfaces exposed to wind. The obtained results are referred to the design spectra suggested by *Eurocode* 8 for soil Type B.



Figure 4: Simplified approach to estimate the influence area A of a single wall.

Then, to sum up, the input steps that a designer has to follow are:

- a) fixing the maximum base shear horizontal loads (earthquake, wind) for a single r.c. wall;
- b) choosing the intensity of live load applied to commercial building structures (heavy, standard, light live load);
- c) defining the site seismicity level (PGA, peak ground acceleration);
- d) assuming a distribution of the storey forces (A, B, C or D) with reference to the numbers of the stories and the nature of actions (wind or seismic);
- e) fixing the ductility class of the structure (DCH and DCM for dissipative structures, DCL for r.c. structures that does not dissipate energy under cyclic loads generated by an earthquake);
- f) estimation of behavior factor (q) of the structure with reference to ductility class and geometrical properties of the r.c. wall (storey height, width, thickness).

Considering all the previous described hypothesis and applying the simplified design procedure, according to Eurocodes standards, has been possible to build a database (an abstract, i.e., is reported in Table 1) in which the final *Precasteel* software will be able to provide designer a variety of feasible solutions for r.c. wall systems and the seismic surface of a commercial building that this type of r.c. bracing system is able to sustain.

	INPUT														
Number of storeys	Storey height H	Width B	Thick ness s	Base shear Vb	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor							
	[m]	[m]	(m)	[kN]				1.00							
2	4.00	4.00	0.20	500	С	0.16 g	DCH	4.00							
2	4.00	4.00	0.20	500	C	0.16 g	DCM	3.00							
2	4.00	4.00	0.20	500	С	0.16 g	DCL	1.00							

Table 1: Example of input data and output results for a single r.c. wall.

		j.	OUTPUT			
Surface/ Wall [m²]	Vertical rebars As,bendin g [cm ²]	Horizontal rebars As,shear [cm²/m]	Steel w eight [kg]	Concrete w eight [kg]	Concrete volume [m³]	Precast DL w all surface [m ²]
374	52	6	553	15360	6.40	32
307	52	6	553	15360	6.40	32
156	52	6	553	15360	6.40	32

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6. Details

Pre-design procedure of r.c. walls as bracing systems is easy, intuitive and fast, also in the definition of the structural details suggested and prescribed by Eurocodes, in particular:

- *Eurocode 8* for details about critical regions and confined zones of the walls for ductility classes DCH and DCM;
- *Eurocode 2* for details about low dissipative r.c. structures (DCL) or isolated structures by specific devices.

The following images describes typical structural details for r.c. shear wall system about:

- corner structural detail for r.c. wall bracing system and common plan configurations (see Figure 5);
- structural detail for connection between r.c. wall and r.c. precast floor (see Figure 6);
- structural detail for connection between r.c. wall and its foundation (see Figure 7).



Figure 5: Typical corner structural detail for r.c. wall bracing system and common plan configurations (top view).



STRUCTURAL DETAIL (FLOOR-WALL CONNECTION)

Figure 6: Typical structural detail for connection between r.c. wall and r.c. precast floor (vertical section).



Figure 7: Typical structural detail for connection between r.c. wall and its foundation (vertical section).

Before casting concrete inside the r.c. wall, the precast element must be propped; props must be anchored in a plate able to support their compression and tension stresses. In correspondence of the corner it is necessary to fix the double-slab walls with a steel plate opportunely shaped or with other props (see Figure 8).



Figure 8: Operations of assembling precast r.c. wall.

The cast of the fresh concrete should be supervised to check the upper speed limit of 50 cm/hour, in order to avoid that lateral pressure would be greater than 2500 daN/m^2 . Moreover, the cast must be done in different time, according to the design of lattice girders.

For what concerns structural details about connections between the main steel structure (beams, columns) and r.c. walls, there are two possible ways of detailing:

Connection decoupling horizontal and vertical loads

In this case we need an additional auxiliary beam, that transfers gravity loads towards the main steel columns, so that we can connect our r.c. bracing system to the steel frame decoupling vertical and horizontal loads (see Figure 9).



Figure 9: Typical connection between steel structure and r.c. walls, decoupling horizontal and vertical loads (top view).

Connection for both horizontal and vertical loads

In this case we don't need an additional auxiliary beam and we can connect directly our r.c. bracing system to the steel frame; then, it is possible for the walls support even vertical loads without compromise their seismic behaviour (see Figure 10).



Figure 10: Typical connection between steel structure and r.c. walls for both horizontal and vertical loads.

Connections between steel structure (beams, columns) and r.c. walls as bracing systems could be realized in an easy way by chemical or mechanical anchors, after the erection of the r.c. structure. Another way to realize this kind of joints is the classical bolted connection, shaped and included in the formwork before the concrete pour. If the main structure is isolated by dissipative devices, at each floor there are specific steel joints to prevent hammering between wall systems and floor structures.

7. Comparison between r.c. wall and steel bracing systems

One of the parts of the project research that has deeply developed by FeNO was focused on the comparison between reinforced concrete walls solutions towards concentric and eccentric steel bracing systems.

First of all, the cost model was updated to the current year considering both detailed price analysis and official price lists of the public administrations (this activity was summarized in Table 2), collecting information coming from different countries (Italy - Southern Europe; Germany - Central Europe).

ITEM	UNIT COST	U.M.	NOTE
Concrete for r.c. walls (without formwork)	322.22	€/m ³	C25/30, XC2, S4.
Concrete for r.c. slabs (without formwork)	222.22	€/m ³	C25/30, XC2, S4.
Steel for r.c. structures	1.90	€/kg	
Precast double plate r.c. walls	23.25	€/m²	Included cost of lattice girders, electrowelded meshes and assembling. Excluding fresh concrete cast in place.
Precast r.c. floor (Predalle)	32.99	€/m²	Unpropped solution.
Steel sheeting composite floor	54.57	€/m²	Unpropped solution.
Steel for frame structures	2.74	€/kg	S355, included surface treatments, erection, bolted and welded joints.

Table 2: Update of unit construction costs (Italy - Southern Europe; Germany - Central Europe).

From the complete *Precasteel* database implemented by FeNO (for r.c. wall bracing system) and UniCAM (for steel bracing systems), it is important to understand the convenience on the choice of a specific type of bracing system. Then, it was possible compare different bracing systems in terms of influence area and in terms of total and unit cost, varying geometrical parameters, loads levels and capacity of energy dissipation for each type of bracing system.

In the following comparisons, it is possible notice that r.c. flooring system (Predalle) are always more convenient than steel sheeting floor in terms of cost, therefore this kind of flooring system was assumed as a constant parameter for each evaluation related to the comparisons.

It was possible to observe, the same for distribution A, C or D, that there is a significant trend which make in evidence the main advantages in the choice of r.c. bracing system instead steel bracing system (concentric or eccentric), both in terms of influence area and in terms of unit cost (see Figure 11 and Figure 12, for distribution C).



Figure 11: Comparison in terms of influence area - r.c. bracing system (left) vs. steel concentric bracing system (right).



Figure 12: Comparison in terms of unit cost - r.c. bracing system (top) vs. steel concentric bracing system (bottom).

Moreover, comparing all the possible configurations for r.c. and steel bracing system, it is worth noticing that steel bracing systems do not always resist in the complete range of shear base force $V_b = 500\div2000$ kN, but they are often limited on the upper forces due to design limits in terms of geometry of the commercial steel profiles.

To confirm what FeNO noticed and discovered about the general convenience in the choice of r.c. wall bracing system instead of steel bracing system (concentric or eccentric), in the following Table 3 is exposed the activity of database sampling and comparison results (extracting 72 cases on a population of 972 configurations; see Annex 1, 2, 3 for more extended and complete evaluations) finalized to give an estimation about the mentioned convenience. This activity of database sampling was conducted fixing some parameter about geometry and load levels, to evaluate the most representative bracing configurations:

- wall inter-storey height:
 - H = 6 8 m (one-storey buildings);
 - H = 4 6 m (two-storey buildings);
- wall width:
 - B = 8 m (one-storey buildings);
 - B = 4 m (two-storey buildings);
- seismicity level (PGA, peak ground acceleration):
 - $a_g = 0.16$ g (medium seismicity).

	DATABASE SAMPLING - COMPARING ACTIVITY (PARAMETERS: INFLUENCE AREA, UNIT COST) MPARISON n° DISTRIBUTION SEISMICITY (a,) R.C. WALL BRACING SYSTEM BASE SHEAR V ₈ [kN] STEEL BRACING SYSTEM BASE SHEAR V ₈ [kN]														
60140 4 DICON	DICTORNUTION			R.C. WA	LL BRACI	NG SYSTEM			STEEL BRACING SYSTEM						
CONPARISON N	DISTRIBUTION	SEISIVIICITY (ag)	B [m]	H [m]	s [m]	DUCTILITY CLASS	BASE SHEAR V _b [KN]	CONCENTRIC	ECCENTRIC 2 DIAGONALS	ECCENTRIC 1 DIAGONAL					
1	С	0.16 g	4.00	4.00	0.20	DCH	500	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
2	С	0.16 g	4.00	4.00	0.20	DCM	500	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
3	С	0.16 g	4.00	4.00	0.20	DCL	500	R.C. WALL SYSTEM	STEEL BRACING SYSTEM	STEEL BRACING SYSTEM					
4	С	0.16 g	4.00	4.00	0.20	DCH	1000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
5	С	0.16 g	4.00	4.00	0.20	DCM	1000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
6	С	0.16 g	4.00	4.00	0.20	DCL	1000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
7	C	0.16 g	4.00	4.00	0.20	DCH	1500	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
8	С	0.16 g	4.00	4.00	0.20	DCM	1500	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
9	С	0.16 g	4.00	4.00	0.20	DCL	1500	R.C. WALL SYSTEM	STEEL BRACING SYSTEM	R.C. WALL SYSTEM					
10	С	0.16 g	4.00	4.00	0.20	DCH	2000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
11	С	0.16 g	4.00	4.00	0.20	DCM	2000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
12	С	0.16 g	4.00	4.00	0.20	DCL	2000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
13	С	0.16 g	4.00	6.00	0.30	DCH	500	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
14	С	0.16 g	4.00	6.00	0.30	DCM	500	R.C. WALL SYSTEM	R.C. WALL SYSTEM	STEEL BRACING SYSTEM					
15	С	0.16 g	4.00	6.00	0.30	DCL	500	R.C. WALL SYSTEM	STEEL BRACING SYSTEM	STEEL BRACING SYSTEM					
16	С	0.16 g	4.00	6.00	0.30	DCH	1000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
17	С	0.16 g	4.00	6.00	0.30	DCM	1000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
18	С	0.16 g	4.00	6.00	0.30	DCL	1000	R.C. WALL SYSTEM	STEEL BRACING SYSTEM	R.C. WALL SYSTEM					
19	С	0.16 g	4.00	6.00	0.30	DCH	1500	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
20	С	0.16 g	4.00	6.00	0.30	DCM	1500	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
21	С	0.16 g	4.00	6.00	0.30	DCL	1500	R.C. WALL SYSTEM	STEEL BRACING SYSTEM	R.C. WALL SYSTEM					
22	C	0.16 g	4.00	6.00	0.30	DCH	2000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
23	С	0.16 g	4.00	6.00	0.30	DCM	2000	R.C. WALL SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					
24	C	0.16 g	4.00	6.00	0.30	DCL	2000	STEEL BRACING SYSTEM	R.C. WALL SYSTEM	R.C. WALL SYSTEM					

 Table 3: Database sampling and comparison results (distribution C).

The same consideration about comparing activity are valid both for A, C, or D distribution and this fact confirms the significant advantages of choosing r.c. wall bracing system instead steel bracing system, as it can be observed through the analysis of the next pie charts (see Figure 13, for distribution C) that summarized all the comparison results and give an estimation about the efficiency of each bracing system.



Figure 13: Database sampling and comparison - r.c. bracing system vs. steel bracing system (concentric, eccentric).

Through the mentioned procedure, it has been possible achieved some important results and conclusions.

It is worth noticing and it is important to underline the following aspect about the adoption of r.c. walls as bracing systems of a commercial building: reinforced concrete walls solutions are almost always (96%) competitive towards concentric steel bracing systems due to their capacity of dissipating seismic energy, although their fundamental vibration periods are usually shorter; the above consideration is often true (79% and 88%) comparing performances of r.c. walls solutions towards eccentric steel bracing systems, although these ones have a much bigger potential capacity of energy dissipation due to cyclic actions (in particular, seismic actions) but have an upper limit to resist shear forces that does not allowed to adapt them to many different situations.

The main hypothesis of decoupling vertical and horizontal loads in commercial building structures must be strictly respected for steel bracing systems, especially for eccentric ones; in fact, these types of bracing systems are able to dissipate a much bigger energy due to cyclic actions if they support only lateral loads, because vertical loads (gravity or live loads) could compromise the optimal behavior of the seismic link. Vice versa, r.c. walls are able to support also vertical load during an earthquake, without compromise their capacity of dissipating seismic energy and this make in evidence a wider versatility of employing these typology of bracing systems for general structures; moreover, this property of r.c. walls allows designers to reduce the number of steel members (columns, beams and joints, positioned around bracing systems to sustain vertical loads) and then to bring down the total cost estimation of the building.

ANNEX 1

COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS Distribution "A"

COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=8m; H=6m; Vb=500 kN)

Database FENO (r.c. wall bracing system):

	INPUT							OUTPUT						COSTESTIMATION					
Number of storeys	Storey height H	Width B (m)	Thick ness s (m)	Base shear Vb [kN]	Distribution	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall	Vertical rebars As,bendin g [orr/]	Horizontal rebars As.shear [cni ⁷ /m]	Steel weight [kg]	Concrete weight	Concrete volume [m ²]	Precast DL wall surface [m²]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [E]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m=]
- 1	6.00	8,00	0.30	500	A	0,16 g	DCH	3,33	787	24	4	427	34560	14,40	48	32541	49532	41	63
1	6.00	8,00	0.30	500	A	0.16g	DCM	2.50	673	24	4	427	34560	14,40	48	28781	43312 28826	43	64

	11	IPUT					OUTPUT			1.000	COST EST	TIMATION	
B (m)	H [m]	Okt [kN/m²]	əg/g	Vb [kN]	BEAM2	DIAG	col.	A [m ²]	Weight (kg)	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [€]	Unit cost (r.c. fibor) (€/m²)	Unit cost (s.s. floor) (€/m ²)
8.00	8,00	2,00	0.16	500	HE 180 A	HE 220 A	HE 160 A	193	1377	10136	14300	53	74
8.00	6.00	2.00	0.16	500	HE 180 A	HE 220 A	HE 160 A	193	1377	10136	14300	53	74
8.00	6.00	2.00	0.15	500	HE 180 A	HE 220 A	HE 180 A	193	1438	10304	14466	53	75
8,00	6.00	2.00	0.16	500	HE 180 A	HE 220 A	HE 180 A	193	1438	10304	14468	53	75
8.00	6.00	2.00	0.16	500	HE 180 A	HE 220 A	HE200 A	193	1520	10528	14691	55	76
8.00	8.00	2.00	0.16	500	HE 180 A	HE 220 A	HE 220 A	193	1618	10797	14961	56	78

1	11	NPUT	1.000		1		COST ESTIMATION						
в	н	QKI	ag/g	Vb	BEAM2	DIAG	COL		Weight	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit.cost (s.s. floor)
(m)	(m)	[kN/m?]	11	[KN]	11	11	0	[m]	(kg)	[6]	Į€j.	[€/m ²]	[€/m²]
8.00	6.00	2.00	0.16	500	HE 220 B	HE 240 B	HE 160 B	731	2248	30285	46072	41	63
8.00	6.00	2.00	0.16	500	HE 220 B	HE 240 B	HE 160 B	731	2248	30285	46072	41	63
8.00	6.00	2.00	0 16	500	HE 220 B	HE 240 B	HE 180 B	731	2248	30285	46072	41	63
8.00	6.00	2,00	0,16	500	HE 220 B	HE 240 B	HE 180 B	732	2351	30580	46374	42	63
8.00	6.00	2.00	0,16	500	HE 220 B	HE240 B	HE 180 B	732	2351	30580	46374	42	63
8.00	6.00	2 00	0.16	500	HE 220 B	HE 240 B	HE 200 B	732	2472	30921	46722	42	64

		IUN			-	2	OUTPUT				COST EST	IMATION	1
B	H	Qk1 (KVm7)	ag/g	Vb	BEAM2	DIAG	COL	A. [m ²]	Weight Bial	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [E]	Uhit cost (r.c. floor) [€/m ²]	Unit cost (s.s. filoor (€/m ²]
4.00	6.00	2.00	0.16	250	HE 160 M	HE 240 B	HE 320 B	311	2390	15814	23531	54	76
4.00	6.00	2.00	0.16	250	HE 160 M	HE 240 B	HE 340 B	330	2481	17678	24798	54	75
4.00	6.00	2.00	0.16	250	HE 160 M	HE 240 8	HE 340 B	330	2481	17678	24798	54	75
4.00	6.00	2,00	0.16	250	HE 160 M	HE 240 B	HE340 B	330	2481	17670	24798	54	75
4.00	6,00	2.00	0,16	250	HE 160 M	HE 240 B	HE340 B	330	2481	17678	24798	54	75
4.00	6,00	2.00	0,16	250	HE 160 M	HE 240 B	HE340 B	330	2481	17678	24798	54	75



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=8m; H=6m; Vb=1000 kN)

Database FENO (r.c. wall bracing system):

				INPU	T				-			OUTPUT					COSTES	TIMATION	4
Number of	Storey	Width	Thick	Base	Distribution	Seismic/W	Ductility	Behaviou	Surface/	Vertical	Horizontal	Steel	Concrete	Concrete	Precast	Total cost	Total cost	Unit cost	Unit cost
storeys	height H	B	ness s (m)	shear Vb	type	nd action	class	r factor	Wali (m ²]	rebars As,bendin g	rebars As shear	w eight	(kg]	volume	DL wall surface [m²]	(r.c. floor)	(s.s. floor)	(r.c. floor)	(s.s. floor) (€/m=)
1	6.00	8.00	0.20	1000		0.16.0	19234	9.92	1598	40	6	640	24580	14.40	40	57014	00771	37	50
	0,00	0,00	0,30	1000	- ^ -	0.70 g	DUN.	3,33	1530	40	0	010	34300	14,40	40	3/014	90771	-21	39
1	6,00	8,00	0,30	1000	A	0.16 g	DCM	2,50	1256	48	6	618	34560	14,40	48	48351	75450	39	60
	6.00	8,00	0,30	1000	A	0.16 g	DOL	1.00	703	48	6	618	34560	14,40	48	30113	45279	43	64

	11	IPUT			-		OUTPUT			10000	COST EST	IMATION	
B (m)	H [m]	Qkt (KN/m²)	əg/g	Vb [KN]	BEAM2	DIAG	COL	A [m²]	Weight (kg)	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. filoor) (€/m ²]	Unil cost (s.s. floor [€/m²]
8.00	8,00	2,00	0.16	1000	HE 220 A	HE 260 A	HE 160 A	386	1752	17528	25855	45	67
8.00	6.00	2.00	0.16	1000	HE 220 A	HE 260 A	HE 160 A	386	1752	17528	25855	45	67
8.00	6.00	2.00	0.16	1000	HE220 A	HE 250 A	HE 1BO A	386	1814	17695	26022	46	67
8.00	6.00	2.00	0.16	1000	HE 220 A	HE 260 A	HE 180 A	386	1814	17695	26022	46	67
8.00	6.00	2.00	0.16	1000	HE 220 A	HE 260 A	HE200 A	386	1895	17919	26246	46	68
8.00	8.00	2.00	0.16	1000	HE 220 A	HE 260 A	HE 220 A	356	1994	18189	26516	47	69

1	17	NPUT	1				OUTPUT			1.000	COST ES	TIMATION	
8 (m)	8 (m)	Qiki [kN/m²]	ag/g	YB [KN]	BEAM2	DIAG	COL ()	A [m²]	Weight (kg)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m ²]
8.00	6.00	2.00	0.16	1000		1-2-1		144		1.1	1		- 2 -
8.00	6.00	2.00	0.16	1000			10-01	1040		1.200		1.30	1.4.1
8.00	6.00	2.00	0.16	1000	1.541			1140	1.14	in the second	1.000	11000	
8.00	6.00	2.00	0,16	1000	~	~ 1	~	1.4	~	1 ~	\sim	~	
8.00	6.00	2.00	0,16	1000	~	~	×	1	~	1 ~ 1	- × -	~	•
8.00	6.00	2.00	0.16	1000	~			1.1	~	~	~ ~	~	

B H Okrt ag/g Vb BEAM2 D/A G COL A Weight (r.c. flow (r.c. flow) (m) (m) (kVm?) (j (k4) (j (j (j [m] [m] [k] (j (j (j [m] [m] [k] [k] [j] [k] [k]	t Total cost) (s.s. floor) [E]	Unit cost (r.c. floor) (E/m ²]	Unit cost (s.s. floor) [E/m]
4.00 6.00 2.00 0.16 500 H€ 240 M H€ 300 B HE 500 B 692 3870 32897 4.00 6.00 2.00 0.16 500 H€ 240 M H€ 300 B HE 500 B 692 3870 32897			
4.00 6.00 2.00 0.16 500 HE 240 M HE 300 B HE 500 B 692 3670 32897	47842	48	69
	47842	48	69
4.00 6.00 2.00 0.16 500 HE 240 M HE 300 B HE 500 B 692 3670 32897	47842	48	69
4.00 6.00 2.00 0.16 500 HE 240 M HE 300 B HE 550 B 665 3816 32396	40752	49	70
4.00 6.00 2.00 0.16 500 HE240 M HE300 B HE550 B 665 3816 32396	46752	49	70
4.00 6.00 2.00 0.16 500 HE 240 M HE 300 B HE 550 B 665 3816 32398	46752	49	70



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=8m; H=6m; Vb=1500 kN)

Database FENO (r.c. wall bracing system):

				INPU	T				-			DUTPUT					COSTES	TIMATIO	4
Number of	Storey	Width	Thick	Base	Distribution	Seismic/Wi	Ductility	Behaviou	Surface/	Vertical	Horizontal	Steel	Concrete	Concrete	Precast	Total cost	Total cost	Unit cost	Unit cost
storeys	height H	в	ness	shear Vb	type	nd action	class	r factor	Wall	rebars	rebars	weight	weight	volume	DL	(r.c. floor)	(s.s. floor)	(r.c. floor)	(s.s. floor)
		125	8	1000						As bendin	As shear	1000			wall	1000			
		1.1	12.31						1.7	g	12201	1.00			surface	1.1.1		1.000	1.00
	[m]	[m]	[111]	[kN]					[m-]	[om/]	[om/m]	[*9]	[kg]	[us,]	[m]	[E]	E	[€/m²]	[€/m=]
1	6.00	8,00	0,30	1500	A	0.16 g	DCH	3.33	2263	72	9	848	34560	14,40	48	82028	130872	36	58
1	6.00	8,00	0.30	1500	A	0.16 g	DCM	2,50	1795	72	9	848	34560	14,40	48	66574	105308	37	59
1	6.00	8,00	0,30	1500	A	0.16 g	DOL.	1.00	960	72	9	848	34560	14,40	48	39033	59748	41	62

Database UNICAM (steel bracing system - concentric, 2 diagonals): INPUT OUTPUT COST ESTIMATION Total cos Unit cost Total cos Unit cos (s.s. floor .c. floor .c. floo s.s. floo в Qk1 DIAG COL A H ag/g Vb BEAMZ Weight [€/m²] [6] IEI (€/m] [kN/m²] [kN] () 11 [m²] [m] [m] 11 11 [kg] 37391 43 65 24900 8.00 8,00 2,00 0,16 1500 HE 240 A HE 300 A HE 160 A 579 2121 24900 37391 43 65 8.00 6.00 2.00 0.16 1500 HE 240 A HE 300 A HE 160 A 579 2121 25068 37556 43 65 8.00 6.00 2.00 0.16 1500 HE240 A HE300 A HE1B0 A 579 2182 65 25068 37558 43 8,00 6.00 2.00 0.16 1500 HE 240 A HE 300 A HE 180 A 579 2182 65 25291 37782 44 8,00 6.00 2.00 0.16 1500 HE240 A HE300 A HE200 A 579 2263 25561 38051 44 86 8.00 8.00 2.00 0.16 1500 HE240 A HE300 A HE220 A 579 2362

	11	NPUT					OUTPUT			1.000	COST EST	TIMATION	1
B	.н (m)	Qiki [k]Vm²]	ag/g	V D (kN)	BEAMZ	DIAG	COL	A	Weight	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) (E/m ²]	Unit cost (s.s. floor) [€/m ²]
frið	tea	Towned 1	11	Pa 4	A.L.	11	11	1.1	1.41			1.00	
8.00	6.00	2.00	0.16	1500			1.61	1.1	- X - C	1.240		1	
8.00	6.00	2.00	0.16	1500		1.0		-	- (+C) :	1.240			-
8.00	6.00	2.00	0.16	1500			- Ye	11.00	1.14	1.040		1.04	· · · · ·
8.00	6.00	2.00	0,16	1500	~	~	× .	1.1	~	\sim	\sim	~	
8.00	6.00	2.00	0,16	1500	~	\sim	×	1	~	1 ~ .	- × -	~	•
8.00	6.00	2.00	0.16	1500		1		1		~		~	

	11	IPUT			-		DUTPUT)	COST EST	IMATION	1
B (m)	H (m)	Qk1 [kN/m²]	ag/g	Vb [kN]	BEAM2	DIAG	COL	A. [m ²]	Weight (kg)	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor [E/m ²]
4.00	6.00	2.00	0.16	1500		- 14	1.141.1		- 741 -	1.14.1-1		114.01	
4.00	6.00	2.00	0.16	1500		1.9							÷
4.00	6.00	2.00	0.16	1500	1.1.1	+2	1.2	1.2-	- la	1.121		1.1.2.	
4.00	6,00	2.00	0,16	1500.		The CT	180	Toes 1	1.5	1.161	190.00		
4.00	6,00	2.00	0.16	1500		- Saliti	- Tech	1.4	e a.	1.10	Tennet		
4.00	6.00	2.00	0.16	1500		1.541.0	181	1.44	i i a i i	1. 196	1. 190-00	1.000	



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=8m; H=6m; Vb=2000 kN)

Database FENO (r.c. wall bracing system):

				INPU	T				-			OUTPUT					COSTES	TIMATION	4
Number of	Storey	Width	Thick	Base	Distribution	Seismic/Wi	Ductility	Behaviou	Surface/	Vertical	Horizontal	Steel	Concrete	Concrete	Precast	Total cost	Total cost	Unit cost	Unit cost
storeys	height H	в	ness	shear Vb	type	nd action	class	rfactor	Wall	rebars	rebars	weight	weight	volume	DL	(r.c. floor)	(s.s. floor)	(r.c. floor)	(s.s. floor)
		125	8							As,bendin	As shear	0.000			wall	1.			
	1.20	1.5.5	10.01						1.77	g	1.20	100	1000		suiface				
	Im	(m)	[m]	[kN]					[m]	[om/]	[om/m]	[kg]	[kg]	[m]	[m]	[e]	E	[€/m²]	[€/m ²]
- 1	6.00	8,00	0,30	2000	A	0.16 g	DCH	3.33	2987	96	12	1078	34560	14,40	48	106329	170785	36	57
1	6.00	8,00	0.30	2000	A	0.16 g	DCM	2,50	2305	96	12	1078	34560	14,40	48	83832	133571	36	58
1	6.00	8,00	0,30	2000	A	0.16 g	DCL	1.00	1195	96	12	1078	34560	14,40	48	47207	72985	40	61

Database UNICAM (steel bracing system - concentric, 2 diagonals): INPUT OUTPUT COST ESTIMATION Total cos Unit cost Total cos Unit cos .c. floor (s.s. floor .c. floo s.s. floo в Qk1 BEAM2 DIAG COL A H ag/g Vb Weight [6] iei (€/m?) [€/m²] [kN/m²] [kN] () 11 [m²]. [m] [m] 11 11 [kg] 42 64 32552 49207 8.00 8,00 2,00 0,16 2000 HE 280 A HE 360 A HE 160 A 772 2591 32552 49207 42 64 8.00 6.00 2.00 0.16 2000 HE 280 A HE 360 A HE 160 A 772 2591 32720 49374 42 64 HE 280 A HE 360 A HE 180 A 8.00 6.00 2.00 0.16 2000 772 2652 64 32720 49374 42 8,00 6.00 2.00 0.16 2000 HE 280 A HE 360 A HE 160 A 772 2652 64 32944 49596 43 8,00 6.00 2.00 0.16 2000 HE 280 A HE 360 A HE 200 A 772 2734 33213 49867 43 65 8.00 8.00 2.00 0.18 2000 HE280 A HE380 A HE220 A 772 2832

10000	11	NPUT					OUTPUT			1.000	COST EST	TIMATION	
18 (m)	H (m)	Qiki [kN/m²]	ag/g	VB [KN]	BEAM2	DIAG	COL	A [m ²]	Weight [kg]	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) (E/m ²]	Unit cost (s.s. floor) (€/m ²]
8.00	6.00	2.00	0.16	2000	1.1.1	1.1		1.4	1	1.1	- × -	-	1.1
8.00	6.00	2.00	0.16	2000		-		1040	- e :	1.000	1.4		1.4.1
8.00	6.00	2.00	0.16	2000	2.0547			11.00	1.14	1.000		1.000	
8.00	6.00	2.00	0,16	2000	~	~	× .	1	~	\sim	_ × _	~	
8.00	6.00	2.00	0,16	2000	~	\sim	×		~	1 ~ 1	- × -	~	~
8.00	6.00	2.00	0.16	2000	~	1.00		1	~	~	~ ~	~	

	11	IPUT			-		DUTPUT)	COST EST	IMATION	1
B (m)	H (m)	Qk1 [kN/m²]	ag/g	Vb [kN]	BEAM2	DIAG	COL	A. [m ²]	Weight (kg)	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor [E/m ²]
4.00	6.00	2.00	0.16	2000	1.14.73	- 14	1.14		- 74	1.14.1-1		11401	
4.00	6.00	2.00	0.16	2000		1.9							-
4.00	6.00	2.00	0.16	2000	1200	+2	1.2	2	la la	1.121		1.1.2.	× .
4.00	6,00	2,00	0,16	2000		The CT	180	Total 1	1.5	1.161	190.00		
4.00	6,00	2.00	0.16	2000		- 5a 11	194	1.4	e a.	191	1 Percent		
4.00	6.00	2.00	0.16	2000		1.541.0	181	1.4	i i a	1. 196	1. 190-00	1.000	



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=8m; H=8m; Vb=500 kN)

Database FENO (r.c. wall bracing system):

				INPU	r .				-			OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H	Wdth B	Thick ness s	Base shear Vb	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall	Vertical rebars As,bendin g	Horizontal rebars As.shear	Steel weight	Concrete w eight	Concrete volume	Precast DL wall surface	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit cost (s.s. floor)
	Im	(m)	[m]	(kN)					[m]	[cm²]	[omi/m]	[kg]	(kg)	[m]	[m]]	[e]	j€]	[€/m²]	[€/m²]
1	8.00	8,00	0.40	500	A	0.16 g	DCH	4.00	876	32	4	693	61440	25,60	64	39940	58839	46	67
1	8.00	8,00	0.40	500	A	0.16 g	DCM	3,00	731	32	4	693	61440	25.60	64	35172	50951	48	70
1.	8.00	8.00	0,40	500	A	0.16 g	DCL	1.00	384	32	4	693	61440	25.60	64	23723	32012	62	83

	11	IPUT					OUTPUT			1000000)	COST EST	TIMATION	
B [m]	H [m]	Qkt (kN/m²)	əg/g	Vb [kN]	BEAM2	DIAG	00L	A [m²]	Weight [kg]	Tatal cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. filor) (€/m ²)	Unit cost (s.s. floor) [€/m²]
8.00	8.00	2,00	0.16	500	HE 180 A	HE 260 A	HE 220 A	193	2312	12698	16861	66	87
8.00	8.00	2.00	0.16	500	HE 180 A	HE 260 A	HE 220 A	193	2312	12698	16861	66	87
8.00	8.00	2.00	0.16	500	HE 180 A	HE 250 A	HE 220 A	193	2312	12698	16861	66	87
8,00	8.00	2.00	0.15	500	HE 180 A	HE 260 A	HE 220 A	193	2312	12698	16861	66	87
8,00	8.00	2.00	0.16	500	HE 180 A	HE 260 A	HE 220 A	193	2312	12698	16861	66	87
8.00	8.00	2.00	0.16	500	HE 180 A	HE 260 A	HE 240 A	193	2469	13128	17291	68	90

1	11	NPUT	1.000				OUTPUT			1.000	COST EST	TIMATION	
				WB.	BEAM	Diag			laborati	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit cost (s.s. floor)
(m)	(m)	[kN/m?]	ag/g	(RN)	II	()	11	[m]	(kg)	[6]	(e)	[6/m ²]	[€/m²]
8.00	8.00	2.00	0.16	500	HE 180 M	HE 300 B	HE 180 B	595	3583	29433	42267	49	71
8.00	8.00	2.00	0.16	500	HE 180 M	HE 300 B	HE 200 B	595	3745	29886	42728	50	72
8.00	8.00	2.00	0.16	500	HE 180 M	HE 300 B	HE 200 B	595	3745	29886	42728	50	72
8.00	00.6	2.00	0,16	500	HE 180 M	HE 300 B	HE 220 B	595	3908	30342	43169	51	73
8.00	8.00	2.00	0,16	500	HE 180 M	HE 300 B	HE 220 B	595	3908	30342	43169	51	73
8.00	8.00	2.00	0.16	500	HE 180 M	HE 300 B	HE 220 B	595	3908	30342	43189	51	73

	IN	IPUT			-		OUTPUT			(COST EST	IMATION	1
B	H	Qk1 (kWm²)	ag/g	Vb	BEAM2	D/AG	COL	A. [m ²]	Weight.	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [E]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor (E/m ²)
4.00	8.00	2.00	0.16	250	HE 200 M	HE 300 B	HE 450 B	398	4159	24514	33098	62	83
4.00	8.00	2.00	0.16	250	HE 200 M	HE 300 B	HE 450 B	398	4159	24514	33098	62	83
4.00	8.00	2.00	0.16	250	HE 200 M	HE 300 B	HE 450 B	398	4159	24514	33098	62	83
4.00	8.00	2.00	0.16	250	HE 200 M	HE 300 B	HE 450 B	.198	4159	24514	33090	02	60
4.00	8.00	2.00	0.16	250	HE 200 M	HE 300 B	HE 450 B	398	4159	24514	33098	62	83
4.00	8.00	2.00	0.16	250	HE 200 M	HE 300 B	HE 500 B	423	4418	26055	35184	62	83



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=8m; H=8m; Vb=1000 kN)

Database FENO (r.c. wall bracing system):

				INPU	T				-			OUTPUT					COSTES	TIMATION	4
Number of	Storey	Width	Thick	Base	Distribution	Seismic/W	Ductility	Behaviou	Surface/	Vertical	Horizontal	Steel	Concrete	Concrete	Precast	Total cost	Total cost	Unit cost	Unit cost
storeys	height H	в	ness	shear Vb	type	nd action	class	rfactor	Wall	rebars	rebars	weight	weight	volume	DL	(r.c. floor)	(s.s. floor)	(r.c. floor)	(s.s. floor)
		100	8							As bendin	As shear	1000			wall				
		1.00	1.00							g	1000				suirace			1000	
	[m]	(m)	[111]	(kN)					[115]	[0m]	[0m/m]	[*9]	fkgl	[62,]	[112]	lel	E	[€/m²]	[€/m*]
- 1	8.00	8,00	0,40	1000	A	0.16 g	DCH	4.00	1784	64	6	999	61440	25,60	64	70476	108970	40	61
3 - J	8.00	8,00	0.40	1000	A	0.16 g	DCM	3,00	1394	64	6	999	61440	25.60	64	57604	87679	41	63
	8.00	8,00	0,40	1000	A	0.16 g	DCL.	1.00	658	64	6	999	61440	25.60	64	33336	47534	51	72

	11	IPUT					OUTPUT			(FT - 5)	COST EST	IMATION	
B (m)	H [m]	Qkt (KN/m²)	əg/g	Vb [KN]	BEAM2	DIAG	00L	A [m²]	Weight (Kg)	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) (€/m ²]	Unil cost (s.s. floor (€/m²)
8.00	8.00	2,00	0.16	1000	HE 220 A	HE 320 A	HE 220 A	386	2958	20831	29158	54	76
8.00	8.00	2.00	0.16	1000	HE 220 A	HE 320 A	HE 220 A	386	2958	20831	29158	54	76
8.00	8.00	2.00	0.16	1000	HE 220 A	HE 320 A	HE 220 A	386	2958	20831	29158	54	76
8.00	8.00	2.00	0.16	1000	HE 220 A	HE 320 A	HE 220 A	386	2958	20831	29158	54	76
8.00	8.00	2.00	0.16	1000	HE 220 A	HE 320 A	HE 220 A	386	2958	20831	29158	54	76
8.00	8.00	2.00	0.16	1000	HE 220 A	HE 320 A	HE 240 A	356	3115	21260	29588	55	77

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

Der Les uniferration all setting and setti

	17	NPUT	1			-	OUTPUT			1.000	COST ES	TIMATION	1
B (m)	н (m)	Qiki [kN/m²]	ag/g	YB [KN]	BEAM2	DIAG	COL ()	A [m²]	Weight (kg)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) (E/m ²]	Unit cost (s.s. floor) [€/m ²]
8.00	8.00	2.00	0.16	1000		1-2-1		154		1.1	- × -		
8.00	8.00	2.00	0.16	1000			10-01	1040		1.20		1 - A.	1.4.1
8.00	8.00	2.00	0.16	1000	1997 L			1140	1.1.4	Print 1		11000	·
8.00	8.00	2.00	0,16	1000	~	~ 1	~	1.1	~	1 ~	- ×	~	
8.00	8.00	2.00	0,16	1000	~	\sim	×		~	1 ~ .	× .	~	•
8.00	8.00	2.00	0.16	1000	~	1.00		1		~	~	~	

	11	IPUT			-		DUTPUT				COST EST	IMATION	1.
в	н	Qk1	ag/g	Vb	BEAM2	DIAG	COL	A	Weight	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit cost (s.s. floor
(m)	(m)	[Kowm-]	11	(kN)	0	11	()	[m·]	[kg]	Ici	[e]	found	Icault
4.00	8.00	2.00	0.16	500	HE 500 A	HE 650 B	HE 550 M	467	7008	34604	44682	74	96
4.00	8.00	2.00	0.16	500	HE 500 A	HE 650 B	HE 550 M	467	7008	34604	44682	74	96
4.00	8.00	2.00	0.16	500	HE 500 A	HE 650 B	HE 550 M	467	7008	34604	44682	74	96
4.00	8.00	2.00	0.16	500	HE 500 A	HE 650 B	HE 550 M	467	7008	34004	44682	74	90
4.00	8.00	2.00	0,16	500	HE 500 A	HE 650 B	HE 600 M	443	7125	34133	43683	77	99
4.00	8.00	2.00	0.16	500	HE 500 A	HE 600 B	HE 650 M	456	7140	34595	44430	76	98



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=8m; H=8m; Vb=1500 kN)

Database FENO (r.c. wall bracing system):

				INPU	T				-			OUTPUT					COSTES	TIMATIO	4
Number of	Storey	Width	Thick	Base	Distribution	Seismic/Wi	Ductility	Behaviou	Surface/	Vertical	Horizontal	Steel	Concrete	Concrete	Precast	Total cost	Total cost	Unit cost	Unit cost
storeys	height H	в	ness	shear Vb	type	nd action	class	r factor	Wall	rebars	rebars	weight	weight	volume	DL	(r.c. floor)	(s.s. floor)	(r.c. floor)	(s.s. floor)
	Ini	(mi	s	TENI	-				Imil	As bendin g	As shear	Ikal	(ke)	Imili	w all surface	10	167	Gimit	167/mil
	P.4	1.4	Trad	trad				0.0	Tour	Termit	Territoria	1-91	1761	furt	fort	Iel	P.I	fermit	Found
- 1-	8.00	8,00	0,40	1500	A	0.16 g	DCH	4.00	2688	96	9	1357	61440	25,60	64	100988	158999	38	59
1	8.00	8,00	0.40	1500	A	0.16 g	DCM	3,00	2020	96	9	1357	61440	25,60	64	78953	122548	39	61
1	8.00	8,00	0.40	1500	A	0.16 g	DCL	1.00	896	96	9	1357	61440	25.60	64	41867	61201	47	68

Database UNICAM (steel bracing system - concentric, 2 diagonals): INPUT OUTPUT COST ESTIMATION Total cos Unit cost s.s. floor Total cos Unit cos .c. floor (s.s. floor c. floo в Qk1 BEAM2 DIAG COL H ag/g Vb A Weight [6] (E) (€/m?) [€/m²] [kN/m²] [kN] () 11 [m²] [m] [m] 11 11 [kg] 51 73 29585 42076 8.00 8.00 2,00 0,16 1500 HE 240 A HE 360 B HE 220 A 579 3831 29585 42076 51 73 8.00 8.00 2.00 0.16 1500 HE 240 A HE 360 B HE 220 A 579 3831 29585 42076 51 73 8.00 8.00 2.00 0.16 1500 HE240 A HE360 B HE220 A 579 3831 73 29585 42076 51 8,00 8.00 2.00 0,15 1500 HE 240 A HE 360 B HE 220 A 579 3831 73 29585 42076 51 8,00 8.00 2.00 0.16 1500 HE 240 A HE 360 B HE 220 A 579 3831 30015 42505 52 73 8.00 8.00 2.00 0.16 1500 HE240 A HE360 B HE240 A 579 3987

10000	11	NPUT					OUTPUT			1.000	COST EST	TIMATION	١
B	.н (m)	Qiki [kN/m²]	ag/g	V D (kN)	BEAM2	DIAG	COL	A	Weight	Total cost (r.c. floor) [6]	Total cost (5,5. floor) [6]	Unit cost (r.c. floor) (E/m ²]	Unit cost (s.s. floor) [€/m ²]
1-14	1			6.5.9			3.4		1.41	-			
8.00	8.00	2.00	0.16	1500				1.1		1.20			
8.00	8.00	2.00	0.16	1500		100		1.00	(H) (H)	12-01		>	
8.00	8.00	2.00	0.16	1500			- Ye	11.00	1.1.4	1 Dec 1		1.04	
8.00	8.00	2.00	0,16	1500	\sim	~	× .	1	~	- ×	_ × _	~	
8.00	8.00	2.00	0,16	1500	~	\sim	×		~		- × -	~	•
8.00	8.00	2.00	0.16	1500	· · · · ·	1		1		~		~	

	11	IPUT			-		DUTPUT)	COST EST	IMATION	1
B (m)	H (m)	Qk1 [kN/m²]	ag/g	Vb [kN]	BEAM2	DAG	COL	A. [m ²]	Weight (kg)	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor [E/m ²]
4.00	8.00	2.00	0.16	1500		- 14	1.1.1		- 74	1414		114.01	
4.00	8.00	2.00	0.16	1500		1.14				1.41			-
4.00	8.00	2.00	0.16	1500		+2		2	- la			4.4	- ×
4.00	8.00	2.00	0,16	1500.		The C	180	Toes 1	1.5	1.161	190.00		
4.00	8.00	2.00	0.16	1500		- 5a **	1.0	1.4	e a.	1.00	Tennin		
4.00	8.00	2.00	0.16	1500		1.54	1.0	1.1	- ia - i	1. 10	1.140.00		



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=8m; H=8m; Vb=2000 kN)

Database FENO (r.c. wall bracing system):

				INPU	·				-			OUTPUT					COSTES	TIMATION	
Number of storeys	Storey height H	Width B (m)	Thick ness s [m]	Base shear Vb (kN)	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m ²]	Vertical rebars As,bendin g [orm ²]	Horizontal rebars As.shear [omi/mi]	Steel weight [kg]	Concrete weight [kg]	Concrete volume [m²]	Precast DL wall surface [m ²]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m=]
1	8.00	8,00	0,40	2000	A	0.16 g	DCH	4.00	3584	128	12	1716	61440	25,60	64	131227	208574	37	58
1	8.00	8,00	0.40	2000	A	0.16 g	DCM	3,00	2688	128	12	1716	61440	25.60	64	101669	159680	38	59
	8.00	8,00	0,40	2000	A	0.16 g	DOL.	1.00	1113	128	12	1716	61440	25.60	64	49695	73703	45	66

	11	IPUT				(OUTPUT			10000	COST EST	IMATION	
B [m]	H [m]	Qkt (kN/m²)	əg/g	Vb [KN]	BEAM2	DIAG	00L	A [m²]	Weight (Kg)	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) (€/m ²]	Unil cost (s.s. floor [€/m²]
8.00	8.00	2,00	0.16	2000	HE 280 A	HE 280 M	HE 220 A	772	4800	38605	55259	50	72
8.00	8.00	2.00	0.16	2000	HE 280 A	HE 280 M	HE 220 A	772	4800	38605	55259	50	72
8.00	8.00	2.00	0.16	2000	HE 280 A	HE 280 M	HE 220 A	772	4800	38605	55259	50	72
8.00	8.00	2.00	0.16	2000	HE 280 A	HE 280 M	HE 220 A	772	4800	38605	55259	50	72
8.00	8.00	2.00	0.16	2000	HE 280 A	HE 280 M	HE 220 A	772	4800	38605	55259	50	72
8.00	8.00	2.00	0.16	2000	HE 280 A	HE 280 M	HE 240 A	772	4957	39034	55688	51	72

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

Der Les uniferration all setting and setti

	11	NPUT				1000	OUTPUT			1.000	COST EST	TIMATION	
в (m)	18 (m)	Giki [kN/m²]	ag/g	VB [KN]	BEAM2	DAG	COL []	A [m ²]	Weight [kg]	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) (E/m ²]	Unit cost (s.s. floor) [€/m ²]
8.00	8.00	2.00	0.16	2000		1.2.1		1.4	1.2	1. 20			1.4.1
8.00	8.00	2.00	0.16	2000		100	10-01	to-in-		1.2-0		1 - A.	1.4.1
8.00	8.00	2.00	0.16	2000	1.1547	1.14		1140	1.1411	1.000	1.000	11000	·
8.00	8.00	2.00	0,16	2000	~	~	× .	1	~	\sim	_ × _	~	
8.00	8.00	2.00	0,16	2000	~	~	×		~	1 ~ .	- × -	~	•
8.00	8.00	2.00	0.16	2000				1	~	~	~	~	

	11	IPUT			-		DUTPUT)	COST EST	IMATION	1
B (m)	H (m)	Qk1 [kN/m²]	ag/g	Vb [kN]	BEAM2	DAG	COL	A. [m ²]	Weight (kg)	Total cost (r.c. floor) [6]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/m²]	Unit cos (s.s. floor [E/m]
4.00	8.00	2.00	0.16	2000	1.14.73	- 14	1.141.1		- 74	1.14.1-1		11401	
4.00	8.00	2.00	0.16	2000		1.14							÷ .
4.00	8.00	2.00	0.16	2000	1.12	+2	1.1	2	la la	1.121		1.1.2.	× .
4.00	8.00	2,00	0,16	2000		The C	180	Tree 1	18	1.000	190.00		-
4.00	8.00	2.00	0,16	2000		- 5a 11	18	1.4	e a.	191	1 Ten III		
4.00	8.00	2.00	0.16	2000		1.541.0	18	1.4	i i a	1. 196	a Terrar	1.1.1.1	



ANNEX 2

COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS **Distribution "C"**

COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=4m; Vb=500 kN)

Database FENO (r.c. wall bracing system):

1				INPU	I							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H (m)	Width B (mj	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g [cmi]	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m ²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m²]
2	4.00	4.00	0.20	500	C	0.16 g	DCH	4.00	374	52	6	553	15360	6.40	32	16190	24257	43	65
2	4.00	4.00	0.20	500	C	0.16 g	DCM	3.00	307	52	6	553	15360	6,40	32	13970	20585	46	67
2	4.00	4.00	0.20	500	с	0.16 g	DCL.	1.00	156	52	8	553	15360	6,40	32	9002	12367	58	79

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	17	IPUT	1.00	100		1000	-	OUT	PUT				1	COST ES	TIMATIO	N
8 (m)	H	Qk1 [kNm7]	ag/g	V6 [KN]	BEAM2	BEAM	DIAG2	DIAG1	COL2	COL1	A [m ²]	Weight [kg]	Total cost (r.c. floor) (€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/nr]
4.00	4.00	5,00	0.16	500	HE 100 A	HE 100 A	HE 160 A	HE 180 A	HE 120 A	HE 180 A	98	1166	6422	8532	66	87
4.00	4,00	5.00	0.16	500	HE 100 A	HE 100 A	HE 160 A	HE 180 A	HE 120 A	HE 180 A	98	1166	6422	8532	66	87
4,00	4,00	5,00	0.16	500	HE 100 A	HE 100 A	HE 160 A	HE 180 A	HE 120 A	HE 180 A	98	1166	6422	-0532	66	87
4.00	4,00	5.00	0.16	500	HE 100 A	HE 100 A	HE 160 A	HE 180 A	HE 120 A	HE 200 A	98	1221	6571	8682	67	89
4.00	4.00	5.00	0.16	500	HE 100 A	HE 100 A	HE 160 A	HE 180 A	HE 140 A	HE 200 A	98	1259	6676	8787	68	90
4.00	4,00	5,00	0,16	500	HE 100 A	HE 100 A	HE 160 A	HE 180 A	HE 140 A	HE 200 A	98	1259	6676	6787	68	90

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT		×	-			OUT	PUT				-	COST ES	TIMATIO	N
B	H	Qk1 [kN/m7]	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit ()	A [m ²]	Weight (kg)	Total cost (r.c. floor) (€j	Total cost (s.s. floor) [€]	Unit cost (r.c. floar) [€/m²].	Unit cost (s.s. floor) [€/m²]
8.00	4.00	5.00	0.18	500	HE 180 B	HE 1BO B	HE 180 B	HE 220 B	HE 120 B	HE 180 B	278	2763	16750	22756	60	82
8.00	4.00	5.00	0.16	500	HE 180 B	HE 180 B	HE 180 B	HE 220 B	HE 120 B	HE 180 B	278	2763	16750	22756	60	82
8.00	4.00	5.00	0.16	500	HE 180 B	HE 180 B	HE 180 B	HE 220 B	HE 140 B	HE 180 B	278	2819	16903	22909	61	82
8.00	4.00	5.00	0.16	500	HE 180 B	HE 180 B	HE 180 B	HE 220 B	HE 140 B	HE 200 B	278	-2900	17118	23120	62	-83,
8.00	4.00	5.00	0.16	500	HE 180 B	HE 100 B	HE 180 B	HE 220 B	HE 160 B	HE200 B	278	2971	17313	23316	62	84
8.00	4.00	5.00	0.16	500	HE 180 B	HE 180 B	HE 180 B	HE 220 B	HE 160 B	HE 220 B	278	3053	17533	23532	63	85

	11	NPUT			-			OUT	PUT				1	COST ES	TIMATIO	N
в	н	Qk1	ag/g	Vb	link2	link1	diag2	diag1	pil2	pi1	A	Weight	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit cost (s.s. floor)
[m]	(m)	[kN/m ²]	IL	[kN]	11	()	11	0	11	11	[m]	[kg]	[€]	[€]	[€/m ²]	[€/m]
4.00	4.00	5.00	0.16	500	HE 140 M	HE 300 B	HE 200 B	HE 260 B	HE 300 B	HE 320 B	467	3461	24878	34952	53	75
4.00	4.00	5.00	0.16	500	HE 140 M	HE 300 B	HE 200 B	HE 260 B	HE 300 B	HE 320 B	467	3461	24878	34952	53	75
4.00	4.00	5.00	0.16	500	HE 140 M	HE 300 B	HE 200 B	HE 260 B	HE 300 B	HE 320 B	467	3461	24878	34952	53	75
4.00	4.00	5.00	0.16	500	HE 140 M	HE 300 B	HE 200 B	HE 260 B	HE 300 B	HE 320 B	467	3461	24878	34952	53	75
4.00	4.00	5.00	0.16	500	HE 140 M	HE 300 B	HE 200 B	HE 260 B	HE 300 B	HE 340 B	467	3521	25061	35147	54	75
4.00	4,00	5,00	0,16	500	HE 140 M	HE 300 B	HE 200 B	HE 260 B	HE 300 B	HE 340 B	467	3521	25061	35147	54	75



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=4m; Vb=1000 kN)

Database FENO (r.c. wall bracing system):

1				INPU	0							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H [m]	Width B (m)	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g (cmi)	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume [m ⁱ]	Precast DL w all surface [m²]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m]	Unit cost (s.s. floor) [€/m²]
2	4.00	4.00	0.20	1000	C	0.16 g	DCH	4.00	761	104	12	1036	15360	6.40	32	29891	46321	39	61
2	4.00	4.00	0.20	1000	C	0.16 g	DCM	3.00	582	104	12	1036	15360	6,40	32	23976	36537	41	63
2	4.00	4.00	0.20	1000	c	0.16 g	DCL	1.00	266	104	12	1036	15360	6.40	32	13551	19292	51	73

Database UNICAM (steel bracing system - concentric, 2 diagonals):

1000	17	IPUT		100		1000		OUT	PUT				10000	COST ES	TIMATIO	N.
8 (m)	H	Qk1 [kNm7]	ag/g	Vb [kN]	BEAM2	BEAM	DIAG2	DIAG1	COL2	COLT	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/nr]
4.00	4.00	5.00	0.16	1000	HE 140 A	HE 140 A	HE 200 A	HE 240 A	HE 120 A	HE200 A	196	1613	10871	15093	56	77
4.00	4.00	5.00	0.16	1000	HE 140 A	HE 140 A	HE 200 A	HE 240 A	HE 120 A	HE 200 A	196	1613	10871	15093	56	17
4,00	4,00	5,00	0.16	1000	HE 140 A	HE 140 A	HE 200 A	HE 240 A	HE 120 A	HE 220 A	196	1678	11051	15273	56	78
4.00	4,00	5.00	0.16	1000	HE 140 A	HE 140 A	HE 200 A	HE 240 A	HE 120 A	HE 220 A	196	1678	11051	15273	56	78
4.00	4.00	5.00	0.16	1000	HE140 A	HE 140 A	HE 200 A	HE 240 A	HE 140 A	HE 220 A	196	1717	11156	15378	57	79
4.00	4,00	5.00	0.16	1000	HE 140 A	HE 140 A	HE 200 A	HE 240 A	HE 140 A	HE 240 A	196	1795	11371	15593	58	80

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT						OUT	PUT				-	COST ES	TIMATIO	N
B (m)	H	Qk1 [kN/m7]	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit ()	A [m ²]	Weight (kg.)	Total cost (r.c. floor) (€)	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m²]
8.00	4.00	5.00	0.16	1000	HE 200 B	HE 180 M	HE 220 B	HE 260 B	HE 120 B	HE 180 B	497	3595	26243	36969	53	74
8.00	4.00	5.00	0.16	1000	HE 200 B	HE 180 M	HE 220 B	HE 260 B	HE 140 B	HE 200 B	496	3732	26598	37311	54	75
8.00	4.00	5.00	0.16	1000	HE 200 B	HE 180 M	HE 220 B	HE 260 B	HE 140 B	HE200 B	496	3732	26598	37311	54	75
8.00	4.00	5.00	0.16	1000	HE 200 B	HE 180 M	HE 220 B	HE 260 B	HE 140 B	HE 220 B	496	3814	26808	37511	54	76
8.00	4.00	5.00	0.16	1000	HE 200 B	HE 180 M	HE 220 B	HE 260 B	HE 160 B	HE 220 B	496	3885	27003	37707	54	76
8.00	4.00	5.00	0.16	1000	HE 200 B	HE 180 M	HE 220 8	HE 260 B	HE 160 B	HE 240 B	496	3978	27247	37943	55	77

	11	NPUT			-			OUT	PUT				1	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m ²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2 []	pit []	A [m]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m]
4.00	4.00	5.00	0.16	1000		1.000	-	191		-	~	-	-	-	-	-
4.00	4.00	5.00	0.16	1000		181		1.81		-	~	~	-	~	- 201	1.14
4.00	4.00	5.00	0.18	1000	-	liberi.	1.561	21	× .	-	~ ~	-		-		1 recti
4.00	4.00	5.00	0.16	1000		1.00	1.00		-	1.00		10.04		1000	1.1	1.00
4.00	4.00	5.00	12,18	1000	S	111471	1.0	1.00	1.81	-		1.1	1.4.5	1.2.1		1.6.1
4.00	4,00	5,00	0.16	1000	-		8	1947	1	100	1.1		~	1.00		1-81





COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=4m; Vb=1500 kN)

Database FENO (r.c. wall bracing system):

1				INPU	0							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H [m]	Width B (m)	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin [[cmi]]	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m²]
2	4.00	4.00	0.20	1500	C	0.16 g	DCH	4.00	1142	155	18	1519	15360	6.40	32	43366	68012	38	60
2	4.00	4.00	0.20	1500	C	0.16 g	DCM	3.00	857	155	18	1519	15360	6,40	32	33948	52432	40	61
2	4.00	4.00	0.20	1500	c	0.16 g	DCL	1.00	361	155	18	1519	15360	6,40	32	17617	25418	49	70

Database UNICAM (steel bracing system - concentric, 2 diagonals):

1000	IN	IPUT		100		1000		OUT	PUT				1	COST ES	TIMATIO	N
8 (m)	H	Qk1 [kNm7]	ag/g	Vb [kN]	BEAM2	BEAM	DIAG2	DIAG1	COL2	COL1	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floar) [€/m²]	Unit cost (s.s. floor) [€/nr]
4.00	4.00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 120 A	HE 220 A	293	1888	14853	21185	51	72
4.00	4.00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 120 A	HE 220 A	293	1888	14853	21185	51	72
4,00	4,00	5,00	0,16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 120 A	HE 240 A	293	1967	15067	21400	51	73
4.00	4,00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 120 A	HE 240 A	293	1967	15067	21400	51	73
4.00	4.00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 140 A	HE240 A	293	2005	15173	21505	52	73
4.00	4,00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 140 A	HE 240 A	293	2005	15173	21505	52	73

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT		A	1	-		OUT	PUT				-	COST ES	TIMATIO	N
B	H	Qk1	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit	A	Weight	Total cost (r.c. floor) (€)	Total cost (s.s. floor) I€I	Unit cost (r.c. floor) (6/m ²)	Unit cost (s.s. floor)
8.00	4.00	5.00	0.18	1500	HE 260 B	HE 340 B	HE 240 B	HE 300 B	HE 140 B	HE 200 B	1200	4731	52558	78467	-44	85
8.00	4.00	5.00	0.16	1500	HE 260 B	HE 340 B	HE 240 B	HE 300 B	HE 140 B	HE 200 B	1200	4731	52558	78467	-44	65
8.00	4.00	5.00	0.16	1500	HE 260 B	HE 340 B	HE 240 B	HE 300 B	HE 140 B	HE 220 B	1198	4812	52698	78552	-44	66
8.00	4.00	5.00	0.16	1500	HE 260 B	HE 340 B	HE 240 B	HE 300 B	HE 150 B	HE 220 B	1198	4884	52893	78747	-44	66
8.00	4.00	5.00	0.16	1500	HE 260 B	HE340 B	HE240 B	HE 300 B	HE 160 B	HE 240 B	1195	4977	53078	78886	44	66
8.00	4.00	5.00	0.16	1500	HE 260 B	HE 340 B	HE 240 8	HE 300 B	HE 160 B	HE 240 B	1196	4977	53078	78886	44	66

	11	NPUT			-			OUT	PUT				1	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2	pit []	A [m]	Weight (kg)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m²]
4.00	4.00	5.00	0.16	1500		1.000	-	1.01		-	-	-	1000	-	-	-
4.00	4.00	5.00	0.16	1500		1.81	~	181		-	-	-	-	~	~	1.14
4.00	4.00	5.00	0.18	1500	-	liberi.	1.561	21	× .	-		-		-		1 recti
4.00	4.00	5.00	0.16	1500		1.00	1.00		1.00	-		10.04	1000	1.00	-	1.00
4.00	4.00	5.00	0,18	1500	5	111471	1.0	1.00	1.81	-		1.1	1.4.5	1 2 1	-	1.8.1
4.00	4,00	5,00	0,16	1500	1000	1.1811	8	100	1.000	1000		1.1	1000	100		1.00





COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=4m; Vb=2000 kN)

Database FENO (r.c. wall bracing system):

1				INPU	I							OUTPUT					COSTES	TIMATION	
Number of storeys	Storey height H [m]	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m ²]	Vertical rebars As,bendin g [cmi]	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/m]	Unit cost (s.s. floor) [€/m²]
2	4.00	4.00	0.20	2000	C	0.16 g	DCH	4.00	1523	207	.24	2002	15360	6.40	32	56841	89703	37	59
2	4.00	4.00	0.20	2000	C	0.16 g	DCM	3.00	1142	207	24	2002	15360	6,40	32	44284	68930	39	60
2	4.00	4.00	0.20	2000	c	0.16 g	DCL	1.00	448	207	-24	2002	15360	6,40	32	21397	31071	48	69

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	IN	IPUT		100		1000		OUT	PUT				10000	COST ES	TIMATIO	N.
8 (m)	H	Qk1 [kNm7]	ag/g	Vb [KN]	BEAM2	BEAM1	DIAG2	DIAG1	COL2	COL1	A [m]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floar) [E/m ²]	Linit cost (s.s. floor) [E/m]
4.00	4.00	5.00	0.16	2000	HE 200 A	HE 200 A	HE 260 A	HE 300 A	HE 120 A	HE 240 A	391	2380	19425	27869	50	71
4.00	4.00	5.00	0.16	2000	HE 200 A	HE 200 A	HE 260 A	HE 300 A	HE 120 A	HE240 A	391	2380	19425	27869	50	71
4,00	4,00	5,00	0.16	2000	HE 200 A	HE 200 A	HE 260 A	HE 300 A	HE 120 A	HE 260 A	391	2443	19590	28042	50	72
4.00	4,00	5.00	0.16	2000	HE 200 A	HE 200 A	HE 260 A	HE 300 A	HE 120 A	HE 260 A	391	2443	19598	28042	50	72
4.00	4.00	5.00	0.16	2000	HE 200 A	HE 200 A	HE 260 A	HE 300 A	HE 140 A	HE 260 A	391	2481	19703	28147	50	72
4.00	4,00	5.00	0.16	2000	HE 200 A	HE 200 A	HE 260 A	HE 300 A	HE 140 A	HE 260 A	391	2481	19703	26147	50	72

1	1	NPUT		Sec. 10.		-		OUT	PUT				-	COST ES	TIMATIO	N
B	H	Qk1 [kN/m ²]	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit ()	A Imi I	Weight (kg T	Total cost (r.c. floor) (€)	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) (€/m²)	Unit cost (s.s. floor) [€/m]
8.00	4.00	5.00	0.18	2000					34			1.51				
0.00	4.00	5.00	0.10	2000	-	-				-	-	-	-	-		
8.00	4.00	5.00	0.16	2000	- e - 1	1.1 81.1	1.1811	1.181	1.81	-	1.1911	2.1	8	1.10	1.1	1.1
8.00	4.00	5.00	0.16	2000	- e	i her i	- 19 T	1.161	-			- 3×		1 1 E	141	1.4
8.00	4.00	5.00	0.16	2000	- e	11.411	1.1.4	1.0		-				÷		1.1
8.00	4.00	5.00	0.16	2000	-	l deb 1	1.0	1.545	-	in a f						1.00
8.00	4.00	5.00	0.16	2000			1. 2. 1		1.0.1	- 14 ¹ -						1.12

	11	IPUT						OUT	PUT				1	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m ²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2 []	pit []	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m²]
4.00	4.00	5.00	0.16	2000	-	1.000	-	1	-	-	-			-	-	-
4.00	4.00	5.00	0.16	2000		1.81	1.2	181		-	~	~	-	-		1.14
4.00	4.00	5.00	0.18	2000		libel.	1.55	211	*	-	~	~		-		1 met
4.00	4.00	5.00	0.16	2000			1.00		-	-		10.04	1000	1.00		1.1.60
4.00	4.00	5.00	0,18	2000	-	11.4.7.1	1121		1.4	-		1.1	1.2.5	1 2 1	-	1.6.1
4.00	4,00	5,00	0,16	2000	the second se	1.1611		1911	1 and 1	1000	1.1	1.1	-	1.0	1.0	1000





Unit cost

[fm]

90

90

89

89

80

87

27977

5050

37229

65

(5.5. floor

COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=6m; Vb=500 kN)

Database FENO (r.c. wall bracing system):

1				INPU	0							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H [m]	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g (cmi)	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m7]	Unit cost (s.s. floor) [€/m²]
2	6.00	4.00	0.30	500	¢	0.16 g	DCH	4.00	381	78	6	1132	34560	14.40	48	20465	28680	54	75
2	6.00	4.00	0.30	500	C	0.16 g	DCM	3.00	292	78	6	1132	34560	14.40	48	17546	23851	60	82
2	5.00	4.00	0.30	500	c	0.16 g	DCL.	1.00	135	78	ß	1132	34560	14.40	48	12345	15248	92	113

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	17	IPUT		100		1000	-	OUT	PUT				1.000	COST ES	TIMATIO	N
8 [m]	H (m)	Qk1 [kNm7]	ag/g 11	Vb [KN]	BEAM2	BEAM1	DIAG2	DIAG1	COL2	COL1	A [m]	Weight [kg]	Total cost (r.c. floor) (E]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [Em?]	Unit cost (s.s. floor) [€/m]
4.00	6,00	5.00	0.16	500	HE 100 A	HE 100 A	HE 220 A	HE 240 A	HE 160 A	HE 220 A	98	2506	10092	12203	103	125
4.00	6.00	5.00	0.16	500	HE 100 A	HE 100 A	HE 220 A	HE 240 A	HE 160 A	HE 240 A	98	2624	10415	12525	106	128
4,00	6,00	5,00	0.16	500	HE 100 A	HE 100 A	HE 220 A	HE 240 A	HE 160 A	HE 240 A	98	2624	10415	12525	106	126
4.00	6,00	5.00	0.16	500	HE 100 A	HE 100 A	HE 220 A	HE 240 A	HE 160 A	HE 240 A	98	2624	10415	12525	106	128
4.00	6.00	5.00	0.16	500	HE 100 A	HE 100 A	HE 220 A	HE 240 A	HE 160 A	HE240 A	98	2624	10415	12525	106	128
4.00	6,00	5.00	0.16	500	HE 100 A	HE 100 A	HE 220 A	HE 240 A	HE 180 A	HE 260 A	98	2780	10842	12953	111	132

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

4.00

6,00 5,00 0,16

1	11	NPUT			1			OUT	PUT				-	COST ES	TIMATIO	N
B (m)	H	Qk1 [kN/m7]	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit ()	A [m=]	Weight [kg]	Total cost (r.c. floor) (€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m ²]
8.00	6.00	5.00	0.16	500	HE 180 B	HE 220 B	HE 220 B	HE 240 B	HE 140 B	HE 220 B	345	4409	23445	30882	68	90
8.00	6.00	5.00	0.16	500	HE 180 B	HE 220 B	HE 220 B	HE 240 B	HE 160 B	HE 220 B	345	4516	23738	31174	69	90
8.00	6.00	5.00	0.16	500	HE 180 B	HE 220 B	HE 220 B	HE 240 B	HE 160 B	HE 220 B	345	4516	23738	31174	69	90
8.00	6.00	5.00	0.16	500	HE 180 B	HE 220 B	HE 220 B	HE240.B	HE 180 B	HE 240 B	344	4/59	24392	31820	71	92
8.00	6,00	5.00	0.16	500	HE 180 B	HE 220 B	HE 220 B	HE 240 B	HE 100 B	HE 260 B	344	4877	24706	32128	72	93
8.00	6.00	5.00	0.16	500	HE 180 B	HE 220 B	HE 220 8	HE 240 B	HE 200 B	HE 260 B	344	4999	25038	32460	73	94

Database UNICAM (steel bracing system - eccentric, 1 diagonal): OUTPUT COST ESTIMATION Unit cost (r.c. floor) [€/m²] Total cos Total cost н в Qkt ag/g Vb link2 link1 diag2 diag1 pil2 pit A Weight (r.c. floor s.s. fle [€] [€] [kN/m²] [m] Imi TI [KN] 11 11 11 0 11 11 [m] [kg] 69 5.00 0.16 HE 360 B HE 240 B HE 300 B HE 100 B HE 550 B 25877 34024 4.00 500 HE 240 B 377 6,00 4900 34024 25877 69 4.00 6.00 5.00 0.16 500 HE 240 B HE360 B HE240 B HE300 B HE100 B HE 550 B 377 4900 27221 35979 67 4,00 6.00 5.00 0,16 500 HE 240 B HE 360 B HE 240 B HE 300 B HE 100 B HE 600 B 406 5050 27221 35979 67 4.00 6.00 5.00 0.16 500 HE 240 B HE 360 B HE 240 B HE 300 B HE 100 B HE 500 B 406 5050 27221 35979 67 4.00 6.00 5.00 0.16 500 HE240 B HE350 B HE240 B HE300 B HE100 B HE600 B 406 5050



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=6m; Vb=1000 kN)

Database FENO (r.c. wall bracing system):

1				INPU								OUTPUT				10.000	COSTES	IIMATION	11
Number of	Storey	Width	Thick	Base	Distribution	Seismic/Wi	Ductility	Behaviou	Surface/	Vertical	Horizontal	Steel	Concrete	Concrete	Precast	Total cost	Total cost	Unit cost	Unit cost
storeys	height H	B	s (m)	shear Vb	type	nd action	class	r factor	(m²)	rebars As,bendin g [cm7]	rebars As,shear [cmi/mi	w eight	(ka)	volume	DL wall surface (m ²)	(r.c. floor)	(s.s. floor)	(r.c. floor)	(s.s. floor) (€/m²)
2	8.00	4.00	0.30	1000	C	0.16.0	DCH	4.00	761	155	12	2106	34580	14.40	AR	34873	51304	46	67
	0.00	4.90	0.00	1000	~	0.100	(Delt)	4.00	101	100	14	2100	01000	14.40	40	01010	01004		
2	6.00	4.00	0.30	1000	C	0.16 g	DCM	3.00	571	155	12	2106	34560	14.40	48	28594	40917	50	72
2	5.00	4.00	0.30	1000	c	0.16 g	DCL	1.00	227	155	12	2106	34560	14.40	48	17241	22137	76	98

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	17	IPUT		100				OUT	PUT				1	COST ES	TIMATIO	N
8 [m]	H (m)	Qk1 [kNm7]	ag/g	Vb [KN]	BEAM2	BEAM1	DIAG2	DIAG1	COL2	COL1	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [E/m ²]	Unit cost (s.s. floor) [€/m]
4.00	6,00	5.00	0.16	1000	HE 140 A	HE 140 A	HE 260 A	HE 300 A	HE 160 A	HE 260 A	196	3360	15660	19881	80	102
4.00	6.00	5.00	0.16	1000	HE 140 A	HE 140 A	HE 260 A	HE 300 A	HE 160 A	HE 260 A	196	3360	15660	19881	80	102
4,00	6,00	5,00	0.16	1000	HE 140 A	HE 140 A	HE 260 A	HE 300 A	HE 160 A	HE 280 A	196	3459	15929	20151	81	103
4.00	6.00	5.00	0.16	1000	HE 140 A	HE 140 A	HE 260 A	HE 300 A	HE 160 A	HE 280 A	196	3459	15929	20151	81	103
4.00	6.00	5.00	0.16	1000	HE 140 A	HE 140 A	HE 260 A	HE 300 A	HE 160 A	HE 280 A	196	3459	15929	20151	81	103
4.00	6,00	5.00	0.16	1000	HE 140 A	HE 140 A	HE 260 A	HE 300 A	HE 180 A	HE 300 A	196	3663	16488	20710	84	106

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT			-			OUT	PUT				-	COST ES	TIMATIO	N
B	H	Qk1 [kN/m ²]	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit ()	A Imř I	Weight	Total cost (r.c. floor) (1)	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [6/m²]	Unit cost (s.s. floor) [@m ²]
8.00	6.00	5.00	0.16	1000	HE 260 B	HE 340 B	HE 260 B	HE 320 B	HE 160 B	HE 240 B	916	6404	47753	87517	52	74
8.00	6.00	5.00	0.16	1000	HE 260 B	HE 340 B	HE 260 B	HE 320 B	HE 160 B	HE 240 B	916	6404	47753	67517	52	74
8.00	6.00	5.00	0.16	1000	HE 260 B	HE 340 B	HE 260 B	HE 320 B	HE 180 B	HE 260 B	914	6625	48299	68024	53	74
8.00	6.00	5.00	0.16	1000	HE 260 B	HE 340 B	HE 260 B	HE 320 B	HE 180 B	HE 260 B	914	6625	48299	68024	53	74
8.00	6,00	5.00	0.16	1000	HE 260 B	HE340 B	HE 260 B	HE 320 B	HE 200 B	HE 280 B	912	6865	48909	68602	54	75
8.00	6.00	5.00	0.16	1000	HE 260 B	HE 340 B	HE 260 B	HE 320 B	HE 200 B	HE 280 B	912	6865	48909	68602	54	75

	11	NPUT						OUT	PUT				1	COST ES	TIMATIO	N
B	H	Qk1 [kN/m ²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2	pit []	A [m]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m ²]
4.00	6,00	5.00	0.16	1000		1.000	-	1.01	-	-	-	-	1000	-	-	-
4.00	6.00	5.00	0.16	1000		1.81	~	181		-	-	-	-	~	~	1.14
4.00	6.00	5.00	0.18	1000	-	liberi.	1.581	21	× .	-		-		-		1 recti
4.00	6.00	5.00	0.16	1000		1.00	1.00		1.8.1	-		10.04	1000	1.00	-	1.00
4,00	6.00	5.00	12,16	1000	-	1.4	1.0	1	1.8	-	-		1.4.5	1 8 1	1	1.8.1
4.00	6,00	5,00	0,16	1000	-	1.1811	8	100	1000	1000		1.1	1000	100		1.00





COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=6m; Vb=1500 kN)

Database FENO (r.c. wall bracing system):

1				INPU								UUIPUI				10.000	COSTES	IIMATION	11
Number of	Storey	Width	Thick	Base	Distribution	Seismic/Wi	Ductility	Behaviou	Surface/	Vertical	Horizontal	Steel	Concrete	Concrete	Precast	Total cost	Total cost	Unit cost	Unit cost
storeys	height H	B	s (m)	shear Vb	type	nd action	class	r factor	(m²)	rebars As,bendin g [cm ²]	rebars As,shear Icmi/mi	weight	(kg)	volume	DL wall surface (m?)	(r.c. floor)	(s.s. floor)	(r.c. floor)	(s.s. floor) (€/m²)
2	6.00	4.00	0.30	1500	c	0.16 a	DCH	4.00	1142	233	18	3080	34560	14.40	48	49281	73927	43	65
2	8.00	4.00	0.30	1500	C	0.15.0	DOM	3.00	857	233	18	3080	34560	14.40	48	30862	58347	47	68
	8.00	1.00	0.00	1000		0.109	These states	1 00	0.07	000	10	0000	04500	14.40	-10	04745	(100000		00
1	5.00	4.00	0.30	1500	C	0.169	DOL	1.00	306	233	18	3080	34560	14.40	48	21/15	28328	1	

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	11	IPUT		100		1000	-	OUT	PUT				1	COST ES	TIMATION	N.
8	H	Qk1 [kNm7]	ag/g	Vb [kN]	BEAM2	BEAMI	DIAG2	DIAG1	COL2	COL1	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floar) [€/m²]	Unit cost (s.s. floor) [€/nテ]
4.00	6,00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 300 A	HE 400 A	HE 160 A	HE300 A	302	4386	21982	28502	73	94
4.00	6,00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 300 A	HE 400 A	HE 160 A	HE 300 A	302	4386	21982	28502	73	94
4.00	6,00	5,00	0,16	1500	HE 160 A	HE 180 A	HE 300 A	HE 400 A	HE 160 A	HE300 A	302	4386	21902	28502	73	94
4.00	6,00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 300 A	HE 400 A	HE 160 A	HE 300 A	302	4388	21982	28502	73	94
4.00	6.00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 300 A	HE-400 A	HE 160 A	HE 320 A	298	4498	22162	28600	74	96
4.00	6,00	5.00	0.16	1500	HE 160 A	HE 180 A	HE 300 A	HE 400 A	HE 180 A	HE 320 A	298	4559	22330	28768	75	96

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT		A	1	-		OUT	PUT		-		-	COST ES	TIMATIO	N
В	Ĥ	Qk1	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit	A	Weight	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit cost (s.s. floor)
្រា	[m]	[eraint]	11	IKNI	11	11	11-	- 11	11	11	fue 1	[xg]	1-1	194	Terul.	Tent.
8.00	6.00	5.00	0.18	1500	HE 320 B	HE 450 B	HE 300 B	HE 500 B	HE 160 B	HE 260 B	1437	8265	70036	101044	-49	70
8.00	6.00	5.00	0.16	1500	HE 320 B	HE 450 B	HE 300 B	HE SOO B	HE 180 B	HE 280 B	1463	8489	71521	103100	-49	70
8.00	6.00	5.00	0.16	1500	HE 320 B	HE 450 B	HE 300 B	HE 500 B	HE 180 B	HE 280 B	1463	8489	71521	103100	-49	70
8.00	6.00	5.00	0.16	1500	HE 320 B	HE 450 B	HE 300 B	HE 500 B	HE 180 B	HE 280 B	1463	8489	71521	103100	49	70
8.00	6,00	5.00	0.16	1500	HE 320 B	HE 450 B	HE 300 B	HE 500 B	HE 200 B	HE 300 B	1492	8778	73280	105492	49	71
8.00	6.00	5.00	0.16	1500	HE 320 B	HE 450 B	HE 300 B	HE 500 B	HE 200 B	HE 300 B	1492	8778	73280	105492	49	71

Database UNICAM (steel bracing system - eccentric, 1 diagonal):

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n

	11	NPUT		-				OUT	PUT				1	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m ²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2 []	pit []	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m²]
4.00	6,00	5.00	0.16	1500	-	1.00	-	1		-	-	-	-	-	-	-
4.00	6.00	5.00	0.16	1500	2	181		1.81		-	~	~	-	-		1.14
4.00	6.00	5.00	0.18	1500		ti per i	1.581	21	× 1	-	~ ~	-		-	· · ·	1 recti
4.00	6.00	5.00	0.16	1500	- e-	1.00	1.00		-	-		10.19		1.00	-	1.1
4.00	6.00	5.00	0.16	1500	-	1.4	1.0	1		~	÷		- A. S.	1 8 1	1	1.5.1
4.00	6,00	5,00	0,16	1500	100	1.1811	8	100	100	100		1.1	1000	100		1.00



STEEL BRACING SYSTEM (ECCENTRIC, 2 DIAGONALS) STEEL BRACING SYSTEM (ECCENTRIC, 1 DIAGONAL)

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COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=6m; Vb=2000 kN)

Database FENO (r.c. wall bracing system):

1				INPU	·							OUTPUT					COSTES	TIMATION	
Number of storeys	Storey height H [m]	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m ²]	Vertical rebars As,bendin g (cmi)	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m ²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m²]
2	6.00	4.00	0.30	2000	C	0.16 g	DCH	4.00	1523	311	.24	4054	34560	14.40	48	63689	96550	42	63
2	6.00	4.00	0.30	2000	C	0.16 g	DCM	3.00	1142	311	24	4054	34560	14.40	48	51131	75777	45	66
2	6.00	4.00	0.30	2000	c	0.16 g	DCL.	1.00	381	311	24	4054	34560	14.40	48	26016	34231	68	90

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	17	IPUT		100		1000	-	OUT	PUT				1	COST ES	TIMATIO	N
8 (m)	H	Qk1 [kNm7]	ag/g	Vb [kN]	BEAM2	BEAM1	DIAG2	DIAG1	COL2	COL1	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m]	Unit cost (s.s. floor) [€/nr]
4.00	6.00	5.00	0,16	2000	HE 200 A	HE 200 A	HE 340 A	HE 450 B	HE 160 A	HE340 A	413	5454	28561	37471	69	91
4.00	6.00	5.00	0.16	2000	HE 200 A	HE 200 A	HE 340 A	HE 450 B	HE 160 A	HE 340 A	413	5454	28561	37471	69	91
4,00	6,00	5,00	0.16	2000	HE 200 A	HE 200 A	HE 340 A	HE 450 B	HE 160 A	HE 340 A	413	5454	20561	37471	69	91
4.00	6,00	5.00	0.16	2000	HE 200 A	HE 200 A	HE 340 A	HE 450 B	HE 160 A	HE 360 A	409	5538	28682	37520	70	92
4.00	6.00	5.00	0.16	2000	HE 200 A	HE 200 A	HE MOA	HE 450 B	HE 160 A	HE 300 B	407	5598	28778	37571	71	92
4.00	6,00	5,00	0,16	2000	HE 200 A	HE 200 A	HE 340 A	HE 450 B	HE 180 A	HE 300 B	407	5660	28945	37738	71	93

1	1	NPUT		-		-		OUT	PUT		-			COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m ²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2 ()	pit ()	A [m ²]	Weight (kg]	Total cost (r.c. floor) (€)	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m²]
8.00	6.00	5.00	0.18	2000	-	1.761	1.0611	287							-	1.00
8.00	6.00	5.00	0.16	2000	- e 11	1 ar r	1 1	1.81				1.4		1.121	the second	1000
8.00	6,00	5.00	0.16	2000		in the m	i har i	1.16			- 3-	1 a.		1.16	14	1.4.7
8.00	6.00	5.00	0.16	2000	- e -	In the second	in the second	1.00		-		-		÷		1.1.1
8.00	6,00	5.00	0.16	2000		de al	1.0	1.545	-	1.01		-				1.00
8.00	6.00	5.00	0.16	2000			1.12.1		1.0.1							1.1.1

	11	IPUT						OUT	PUT				1	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m ²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2 []	pit []	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor [€/m]
4.00	6,00	5.00	0.16	2000		1.000	-	1	-	-	-			-	-	-
4.00	6.00	5.00	0.16	2000	- ×	1.81	1.2	181		-	~	~	-	-		1.16
4.00	6.00	5.00	0.18	2000	5 1	libel.	1.55	211	*	-	~	~		-		1.140
4.00	6.00	5.00	0.16	2000	- 6-1		1.00		-	-		10.04	1000	1000		1.00
4.00	6.00	5.00	0,18	2000	-	1.4.7.1	1121	1		~		1.1	1.2.5	1 2 1	-	1.6.1
4.00	6,00	5,00	0,16	2000	1000	1.16671	100	100	1.000	1000	1.1	1.1	-	1000	100	1.00





ANNEX 3

COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS Distribution "D"

COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=4m; Vb=500 kN)

Database FENO (r.c. wall bracing system):

1				INPU	I							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H (m)	Width B (mj	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g [cmi]	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m ²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m7]	Unit cost (s.s. floor) [€/m²]
2	4.00	4.00	0.20	500	D	0.16 g	DCH	4.00	326	49	6	533	15360	6.40	32	14571	21604	45	66
2	4.00	4.00	0.20	500	D	0.16 g	DCM	3.00	269	49	6	533	15360	6,40	32	12690	18493	47	69
2	4.00	4.00	0.20	500	D	0.16 g	DCL.	1.00	138	49	ß	533	15360	6,40	32	8380	11364	61	82

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	17	IPUT		-		1000	-	OUT	PUT				1	COST ES	TIMATIO	N.
8 (m)	H	Qk1 [kNm7]	ag/g	V6 IKNI	BEAM2	BEAM1	DIAG2	DIAG1	COL2	COLT	A	Weight	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor). [€/m]	Unit cost (s.s. floor) [€/m]
4.00	4.00	8.00	0.16	500	HE 100 A	HE 120 A	HE 160 A	HE 180 A	HE 120 A	HE 180 A	75	1179	5721	7350	76	97
4.00	4.00	8.00	0.16	500	HE 100 A	HE 120 A	HE 160 A	HE 180 A	HE 120 A	HE 180 A	75	1179	5721	7350	76	97
4,00	4,00	8,00	0.16	500	HE 100 A	HE 120 A	HE 160 A	HE 180 A	HE 120 A	HE 180 A	75	1179	5721	7350	76	97
4.00	4.00	8.00	0.16	500	HE 100 A	HE 120 A	HE 160 A	HE 180 A	HE 120 A	HE 200 A	75	1233	5870	7500	78	99
4.00	4.00	8.00	0.16	500	HE 100 A	HE 120 A	HE 160 A	HE 180 A	HE 140 A	HE 200 A	75	1272	5975	7605	79	101
4.00	4,00	8.00	0,16	500	HE 100 A	HE 120 A	HE 160 A	HE 180 A	HE 140 A	HE 220 A	75	1337	6155	7785	82	103

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT			-			OUT	PUT				-	COST ES	TIMATIO	N
B (m)	H	Qk1 [kN/m7]	ag/g	Vb [KN]	link2	link1	diag2	diag1	pil2	pit ()	A [m ²]	Weight [kg]	Total cost (r.c. floor) (€]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [@m ²]
8.00	4.00	8.00	0.16	500	HE 180 B	HE 180 B	HE 180 B	HE 220 B	HE 120 B	HE 180 B	212	2763	14548	19114	69	90
8.00	4.00	8.00	0.16	500	HE 180 B	HE 180 B	HE 180 B	HE 220 B	HE 120 B	HE 180 B	212	2763	14548	19114	69	90
8.00	4.00	8.00	0.16	500	HE 180 B	HE 180 B	HE 180 B	HE 220 B	HE 140 B	HE200 B	211	2900	14919	19482	71	92
8.00	4.00	8.00	0.16	500	HE 180 B	HE 180 B	HE 180 B	HE 220 B	HE 140 B	HE 200 B	211	2900	14010	19482	71	92
8.00	4,00	8.00	0.16	500	HE 180 B	HE 100 B	HE 180 B	HE 220 B	HE 160 B	HE 220 B	211	3053	15335	19897	73	94
8.00	4.00	8.00	0.16	500	HE 180 B	HE 180 B	HE 180 B	HE 220 B	HE 160 B	HE 240 B	211	3146	15589	20149	74	95

Database UNICAM (steel bracing system - eccentric, 1 diagonal): OUTPUT COST ESTIMATION Unit cost (r.c. floor) [€/m²] 57 Total cos Total cos Unit cost н в Qkt ag/g Vb link2 link1 diag2 diag1 pil2 pit A Weight (r.c. floor s.s. flo (s.s. floor [€] [€] [€/m²] [kN/m²] [m] Imi TI [KN] 11 11 11 0 11 11 [m] [kg] 78 8.00 0.16 HE 180 B HE 300 B HE 200 B HE 260 B HE 280 B HE 340 B 22091 30519 4.00 500 4.00 390 3362 22091 30519 57 78 4.00 4.00 8.00 0.16 500 HE 180 B HE 300 B HE 200 B HE 260 B HE 280 B HE 340 B 390 3362 31400 56 78 22690 4.00 4.00 8.00 0,16 500 HE 180 B HE 300 B HE 200 B HE 260 B HE 280 B HE 360 B 404 3423 22690 31400 56 78 4.00 4.00 8.00 0.16 500 HE 180 B HE 300 B HE 200 B HE 260 B HE 280 B HE 360 B 404 3423 22690 31400 56 78 4.00 4.00 8.00 0.16 500 HE180 B HE300 B HE200 B HE260 B HE280 B HE380 B 404 3423 23770 32994 56 11 500 HE 180 B HE 300 B HE 200 B HE 260 B HE 280 B HE 400 B 427 3531 4.00 4,00 8,00 0,16



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=4m; Vb=1000 kN)

Database FENO (r.c. wall bracing system):

1				INPU	0							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H [m]	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g (cmil)	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume [m ⁱ]	Precast DL w all surface (m²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m²]
2	4.00	4.00	0.20	1000	D	0.16 g	DCH	4.00	665	.97	12	996	15360	6.40	32	26631	40979	40	62
2	4.00	4.00	0.20	1000	D	0.16 g	DCM	3.00	511	97	12	996	15360	6,40	32	21563	32596	42	64
2	4.00	4.00	0.20	1000	D	0.16 g	DCL	1.00	236	07	12	996	15360	6.40	32	12490	17586	53	74

Database UNICAM (steel bracing system - concentric, 2 diagonals):

10000	17	NPUT	1.00	100		1000	-	OUT	PUT				1	COST ES	TIMATIO	N
8 Imi	H	Qk1 [kNm7]	ag/g	V6 IkNI	BEAN2	BEAMI	DIAG2	DIAG1	COL2	COL1	A [m]	Weight	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floar) [€/m]	Unit cost (s.s. floor) [€/n7]
4.00	4.00	8.00	0.16	1000	HE 140 A	HE 160 A	HE 200 A	HE 240 A	HE 120 A	HE200 A	151	1636	9463	12722	63	84
4.00	4.00	8.00	0.16	1000	HE 140 A	HE 160 A	HE 200 A	HE 240 A	HE 120 A	HE 200 A	151	1636	9463	12722	63	84
4.00	4,00	8,00	0.16	1000	HE 140 A	HE 160 A	HE 200 A	HE 240 A	HE 120 A	HE 220 A	151	1701	9642	12901	64	85
4.00	4,00	8.00	0.16	1000	HE 140 A	HE 160 A	HE 200 A	HE 240 A	HE 120 A	HE 220 A	151	1701	9642	12901	64	85
4.00	4.00	8.00	0.16	1000	HE 140 A	HE 160 A	HE 200 A	HE 240 A	HE 140 A	HE 220 A	151	1740	9748	13007	65	86
4.00	4,00	8.00	0.16	1000	HE 140 A	HE 160 A	HE 200 A	HE 240 A	HE 140 A	HE 240 A	151	1818	9962	13221	66	88

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT		A	1			OUT	PUT			_	-	COST ES	TIMATIO	N
B	Ĥ	Qk1	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit	A	Weight	Total cost (r.c. floor) (E)	Total cost (s.s. floor) IEI	Unit cost (r.c. floor) (6/m ²)	Unit cost (s.s. floor)
[11]	100	[srain]	11	Teral	11	11	11	LI LI	11		para.	[89]	21778	29924	58	79
8.00	4.00	00.0	0.18	1000	HE 180 B	HE 180 M	HE 200 B	HE 200 B	HE 120 B	HE 180 B	3//	3405				14
8.00	4.00	8.00	0.16	1000	HE 180 B	HE 180 M	HE 200 B	HE 260 B	HE 120 B	HE 200 B	377	3486	21988	30126	58	80
8.00	4.00	8.00	0.16	1000	HE 180 B	HE 180 M	HE 200 B	HE 260 B	HE 140 B	HE200 B	377	3542	22141	30279	59	80
8.00	4.00	8.00	0.16	1000	HE 180 B	HE 180 M	HE 200 B	HE 260 B	HE 140 B	HE 220 B	3/7	3623	22356	30489	59	81
8.00	4,00	8.00	0.16	1000	HE 180 B	HE 180 M	HE 200 B	HE 260 B	HE 160 B	HE 220 B	377	3694	22551	30684	60	81
8.00	4.00	8.00	0.16	1000	HE 180 B	HE 180 M	HE 200 B	HE 260 B	HE 160 B	HE 240 B	377	3789	22901	30929	61	82

	11	NPUT		-				OUT	PUT				1	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2 []	pit []	A [m]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m]
4.00	4.00	8.00	0.16	1000		1.00	-	1	-	-	~	-	-	-	-	-
4.00	4.00	8.00	0.16	1000		181		1.81		-	~	~	-	~		1.14
4.00	4.00	8.00	0.18	1000		liberi.	1.561	21	*	-	~ ~	-		-		1 rection
4.00	4.00	8.00	0.16	1000		1.00	1.00		1.4	-		10.04	1000	1.00	-	1.00
4.00	4.00	00.8	12,16	1000	-	1.4	1.0	1		~	÷		- A. S.	1 8 1	1	1.5.1
4.00	4,00	8,00	0.16	1000	100		8	1947	1		1.1		-	1.00		1.00





COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=4m; Vb=1500 kN)

Database FENO (r.c. wall bracing system):

1				INPU	0							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H [m]	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g (cmi)	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/mī]	Unit cost (s.s. floor) [€/m²]
2	4.00	4.00	0.20	1500	D	0.16 g	DCH	4.00	997	146	18	1459	15360	6.40	32	38477	59999	39	60
2	4.00	4.00	0.20	1500	D	0.16 g	DCM	3.00	748	146	18	1459	15360	6,40	32	30252	46394	40	62
2	4.00	4.00	0.20	1500	D	0.16 g	DCL	1.00	321	146	18	1459	15360	6.40	32	16172	23102	50	72

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	IN	IPUT		100		1000		OUT	PUT				10000	COST ES	TIMATIO	N.
8 [m]	H	Qk1 [kNm7]	ag/g	Vb [kN]	BEAM2	BEAM	DIAG2	DIAG1	COL2	COL1	A [nř]	Weight [kg]	Total cost (r.c. floor) (€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floar) [€/m]	Unit cost (s.s. floor) [€/nr]
4.00	4.00	8.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 120 A	HE 220 A	226	1888	12646	17534	56	77
4.00	4.00	8.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 120 A	HE 220 A	226	1888	12646	17534	56	17
4,00	4,00	8,00	0,16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 120 A	HE 220 A	226	1888	12646	17534	56	77
4.00	4,00	8.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 120 A	HE 240 A	226	1967	12860	17749	57	78
4.00	4.00	8.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 140 A	HE240 A	226	2005	12966	17854	57	79
4.00	4,00	8.00	0.16	1500	HE 160 A	HE 180 A	HE 220 A	HE 260 A	HE 140 A	HE 240 A	226	2005	12966	17854	57	79

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

-	11	NPUT						OUT	PUT				-	COST ES	TIMATIO	N
В	Ĥ	Qk1	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit	A	Weight	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit cost (s.s. floor)
្រា	[m]	[eraint]	11	[KN]	11	11	11		11	11	fue 1	[Kg]	Tel	194	Term I.	Term 1
8.00	4.00	8.00	0.16	1500	HE 220 B	HE 340 B	HE 240 B	HE 300 B	HE 120 B	HE 200 B	848	4503	40316	58623	-48	69
8.00	4.00	8.00	0.16	1500	HE 220 B	HE 340 B	HE 240 B	HE 300 B	HE 140 B	HE200 B	849	4559	40496	56821	-48	69
8.00	4.00	8.00	0.16	1500	HE 220 B	HE 340 B	HE 240 B	HE 300 B	HE 140 B	HE 220 B	865	4640	41263	59944	-48	69
8.00	4.00	8.00	0.16	1500	HE 220 B	HE 340 B	HE 240 B	HE 300 B	HE 140 B	HE 220 B	865	4640	41263	50044	-48	-69
8.00	4,00	8.00	0.16	1500	HE220 B	1E340B	HE240 B	HE 300 B	HE 160 B	HE 240 B	881	4805	42215	61223	48	70.
8.00	4.00	8.00	0.16	1500	HE 220 B	HE 340 B	HE 240 8	HE 300 B	HE 160 B	HE 260 B	890	4884	42740	61951	48	70

Database UNICAM (steel bracing system - eccentric, 1 diagonal):

o

	11	NPUT		-				OUT	PUT				1	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2 []	pit []	A [m]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m]
4.00	4.00	8.00	0.16	1500	-	1.00	-	191		-	-	-	-	-	-	-
4.00	4.00	8.00	0.16	1500		181		1.81		-	~	~	-	~		1.14
4.00	4.00	8.00	0.16	1500		ti per i	1.581	21	× 1		~	-	-	-	· · ·	1 recti
4.00	4.00	8.00	0.16	1500	- e-	1.00	1.00		1.00	-		10.19	-	1000	-	1.1
4.00	4.00	00.8	12,16	1500	-	1.4	1.0	1		-	÷		- A	1 8 1	1	1.5.1
4.00	4,00	8.00	0,16	1500	100	1.1811	8	100	1.000	1000		1.1	100	1811		1.00





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COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=4m; Vb=2000 kN)

Database FENO (r.c. wall bracing system):

1				INPU	I							OUTPUT				1.	COSTES	TIMATION	
Number of storeys	Storey height H [m]	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin [[cmi]]	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m²]
2	4.00	4.00	0.20	2000	D	0.16 g	DCH	4.00	1330	194	24	1922	15360	6.40	32	50322	79019	38	59
2	4.00	4.00	0.20	2000	D	0.16 g	DCM	3.00	997	194	24	1922	15360	6,40	32	39356	60879	39	61
2	4.00	4.00	0.20	2000	D	0.16 g	DCL	1.00	398	194	24	1922	15360	6,40	32	19600	28198	49	71

Database UNICAM (steel bracing system - concentric, 2 diagonals):

100000	11	IPUT		100		1000		OUT	PUT				1000	COST ES	TIMATIO	N
8 (m)	H	Qk1 [kNm7]	ag/g	Vb [kN]	BEAM2	BEAM1	DIAG2	DIAG1	COL2	COL1	A [nr]	Weight [kg]	Total cost (r.c. floor) (€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floar) [€/m]	Unit cost (s.s. floor) [€/nテ]
4.00	4.00	8.00	0.16	2000	HE 180 A	HE 220 A	HE 240 A	HE 300 A	HE 120 A	HE 240 A	302	2315	16304	22822	54	76
4.00	4,00	8.00	0.16	2000	HE 180 A	HE 220 A	HE 240 A	HE 300 A	HE 120 A	HE 240 A	302	2315	16304	22822	54	76
4,00	4,00	8,00	0.16	2000	HE 180 A	HE 220 A	HE 240 A	HE 300 A	HE 120 A	HE 240 A	.302	2315	16304	22822	54	76
4.00	4.00	8.00	0.16	2000	HE 180 A	HE 220 A	HE 240 A	HE 300 A	HE 120 A	HE 260 A	302	2378	16477	22995	55	76
4.00	4.00	8.00	0.16	2000	HE 180 A	HE 220 A	HE 240 A	HE 300 A	HE 140 A	HE 260 A	302	2416	18582	23101	55	76
4.00	4,00	8.00	0.16	2000	HE 180 A	HE 220 A	HE 240 A	HE 300 A	HE 140 A	HE 260 A	302	2416	16582	23101	55	76

1	1	NPUT		-				OUT	PUT				-	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pit2	pit ()	A [m ²]	Weight (kg]	Total cost (r.c. floor) (€j	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m]
8.00	4.00	5.00	0.16	2000	-	1.061	1.00	287					-	-		1.00
8.00	4.00	5.00	0.16	2000	- A 11	I Lac I	1.001	1.81				1.41	1.0	1.10	-	1.1.4
8.00	4.00	5.00	0.16	2000		i her i	i la li	167	-	1.00	- 3-	in Gen	-	1.16	140	1 - e. T
8.00	4.00	5.00	0.16	2000		11.41.1	1.000	1.00	-	-				÷		1.1.1
8.00	4.00	5.00	0.16	2000	-	l deb 1	1.0	1.545	-	Test.						-
8.00	4.00	5.00	0.16	2000			1.12.1		1.12	1.12						200

	11	IPUT						OUT	PUT				1	COST ES	TIMATIO	N
B (mj	H (m)	Qk1 [kN/m ²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2 []	pit []	A [m]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor [€/m ²]
4.00	4.00	5.00	0.16	2000	-	1.000	-	1	-	-	-	-		-	-	-
4.00	4.00	5.00	0.16	2000		1.81	1	181		-	~	~	-	-		1.16
4.00	4.00	5.00	0.18	2000		libel.	1.551	211	*	-	~	-		-	- m. 1	1 me
4.00	4.00	5.00	0.16	2000			1.00		-	-		10.04	1000	1000		1.1.4
4.00	4.00	5.00	0,18	2000	-	1.4.7.1	1.0		1.4	-		1.1	1.4.5	1 2 1		1.6.1
4.00	4,00	5,00	0.16	2000	the second se	1.16671	1 mm 1	1911	1 and 1	1000	1.1	1.11	-	1000	181	1.00





COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=6m; Vb=500 kN)

Database FENO (r.c. wall bracing system):

1				INPU	I							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g [cm ²]	Horizontal rebars As,shear [cmi/mj	Steel weight [kg]	Concrete weight [kg]	Concrete volume	Precast DL w all surface [m ²]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m]	Unit cost (s.s. floor) [€/m²]
2	6.00	4.00	0.30	500	D	0.16 g	DCH	4.00	332	73	6	1087	34560	14.40	48	18770	25932	57	78
2	6.00	4.00	0.30	500	D	0.16 g	DCM	3.00	257	73	6	1087	34560	14.40	48	16286	21824	63	85
2	5.00	4.00	0.30	500	D	0.16 g	DCL	1.00	119	73	6	1087	34560	14.40	48	11761	14338	98	120

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	17	IPUT		100		1000		OUT	PUT				1	COST ES	TIMATIO	N
8 (m)	H (m)	Qk1 [kNm7]	ag/g	Vb [KN]	BEAM2	BEAM1	DIAG2	DIAG1	COL2	COL1	A [m]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [Em?]	Linit cost (s.s. floor) [€/nr]
4.00	6,00	8.00	0.16	500	HE 100 A	HE120 A	HE 200 A	HE 240 A	HE 160 A	HE 220 A	75	2415	9108	10737	121	142
4.00	6,00	8.00	0.16	500	HE 100 A	HE 120 A	HE 200 A	HE 240 A	HE 160 A	HE 220 A	75	2415	9108	10737	121	142
4,00	6,00	8,00	0.16	500	HE 100 A	HE 120 A	HE 200 A	HE 240 A	HE 160 A	HE 240 A	75	2533	9430	11059	125	146
4.00	6,00	8.00	0.16	500	HE 100 A	HE 120 A	HE 200 A	HE 240 A	HE 160 A	HE 240 A	75	2533	9430	11059	125	146
4.00	6.00	8.00	0.16	500	HE 100 A	HE 120 A	HE 200 A	HE 240 A	HE 160 A	HE260 A	75	2627	9689	11319	128	150
4.00	6,00	8,00	0,16	500	HE 100 A	HE 120 A	HE 200 A	HE 240 A	HE 180 A	HE 260 A	75	2689	9857	11487	131	152

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT			1			OUT	PUT				-	COST ES	TIMATIO	N
B	H	Qk1	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit	A	Weight	Total cost (r.c. floor)	Total cost (s.s. floor) I€I	Unit cost (r.c. floor) (6/m ²)	Unit cost (s.s. floor)
ful	1 full	fersion	11	fixed	11	11	11	0	11	11	fuel	[kg]	00040	00044	20	00
8.00	6.00	8.00	0.16	500	HE 180 B	HE 220 B	HE 200 B	HE 240 B	HE 140 B	HE 220 B	262	4266	20348	20014	76	98
8.00	6.00	8.00	0.16	500	HE 180 B	HE 220 B	HE 200 B	HE 240 B	HE 160 B	HE 220 B	262	4373	20641	26307	79	100
8.00	6.00	8.00	0.16	500	HE 180 B	HE 220 B	HE 200 B	HE 240 B	HE 160 B	HE 240 B	262	4513	21018	26678	80	102
8.00	6.00	8.00	0.16	500	HE 180 B	HE 220 B	HE 200 B	HE240 B	HE 180 B	HE 240 B	262	4617	21300	20061	81	103
8.00	6,00	8.00	0.16	500	HE 180 B	HE 220 B	HE 200 B	HE 240 B	HE 100 B	HE 260 B	262	4734	21618	27275	82	104
8.00	6.00	8.00	0.16	500	HE 180 B	HE 220 B	HE 200 B	HE 240 B	HE 200 B	HE 280 B	262	4975	22274	27929	815	107

	11	NPUT			-			OUT	PUT				1	COST ES	TIMATIO	N
в	н	Qk1	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit	A	Weight	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit cost (s.s. floor)
[m]	(m)	[kN/m ²]	II	[kN]	11	()	11	0	11	11	[m]	[kg]	[€]	[€]	[€/m-]	[€/m ²]
4.00	6,00	8.00	0.16	500	HE 220 B	HE 400 A	HE 240 B	HE 300 B	HE 300 B	HE 500 B	346	5799	27297	34762	79	101
4.00	6.00	8.00	0.16	500	HE 220 B	HE 400 A	HE 240 B	HE 300 B	HE 300 B	HE 550 B	363	5945	28272	36112	78	99
4.00	6.00	8.00	0.16	500	HE 220 B	HE 400 A	HE 240 B	HE 300 B	HE 300 B	HE 550 B	363	5945	28272	36112	78	98
4.00	6.00	8.00	0.16	500	HE 220 B	HE 400 A	HE 240 B	HE 300 B	HE 320 B	HE 550 B	365	6060	28632	36503	79	100
4.00	6.00	00.8	0.16	500	HE 220 B	HE 400 A	HE 240 B	HE 300 B	HE 320 B	HE 600 B	381	6210	29579	37800	78	00
4.00	8,00	8.00	0,16	500	HE 220 B	HE 400 A	HE 240 B	HE 300 B	HE 320 B	HE 600 B	381	6210	29579	37800	78	98



COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=6m; Vb=1000 kN)

Database FENO (r.c. wall bracing system):

1				INPU	·							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g (cmi)	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface [m ²]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [6]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m²]
2	6.00	4.00	0.30	1000	D	0.16 g	DCH	4.00	665	146	12	2016	34560	14.40	48	31518	45866	47	69
2	6.00	4.00	0.30	1000	D	0.16 g	DCM	3.00	499	146	12	2016	34560	14.40	48	26035	36796	52	74
2	5.00	4.00	0.30	1000	D	0.16 g	DCL	1.00	202	146	12	2016	34560	14.40	48	16237	20588	81	102

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	IN	IPUT		100		1000	-	OUT	PUT				1	COST ES	TIMATIO	N
8 (m)	H	Qk1 [kNm7]	ag/g	Vb [KN]	BEAM2	BEAM1	DIAG2	DIAG1	COL2	COL1	A [m ²]	Weight [kg]	Total cost (r.c. floor) (E]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [E/m ²]	Unit cost (s.s. floor) [€/nr]
4.00	6,00	8.00	0.16	1000	HE 140 A	HE 160 A	HE 240 A	HE 300 A	HE 160 A	HE 260 A	151	3283	13977	17236	93	114
4.00	6,00	8.00	0.16	1000	HE 140 A	HE 160 A	HE 240 A	HE 300 A	HE 160 A	HE 260 A	151	3283	13977	17236	93	114
4.00	6,00	8,00	0.16	1000	HE 140 A	HE 160 A	HE 240 A	HE 300 A	HE 160 A	HE 260 A	151	3283	13977	17236	93	114
4.00	6,00	8.00	0.16	1000	HE 140 A	HE 160 A	HE 240 A	HE 300 A	HE 160 A	HE 280 A	151	3382	14247	17506	94	116
4.00	6.00	8.00	0.16	1000	HE140 A	HE 160 A	HE 240 A	HE 300 A	HE 160 A	HE 280 A	151	3382	14247	17506	94	116
4.00	6,00	8.00	0.16	1000	HE 140 A	HE 160 A	HE 240 A	HE 300 A	HE 180 A	HE 300 A	151	3586	14806	18065	98	120

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT		A	1			OUT	PUT				-	COST ES	TIMATIO	N
в	Ĥ.	Qk1	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit	A	Weight	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit cost (s.s. floor)
(m)	lmi	[kN/mr]	II.	[RN]	11	11	11	11	11	11	[m]	[kg]	(c)	[e]	Terust.	Terust.
8.00	6.00	8.00	0.16	1000	HE 220 B	HE340 B	HE 240 B	HE 300 B	HE 160 B	HE 240 B	672	5955	38473	52971	57	79
8.00	6.00	8.00	0.16	1000	HE 220 B	HE 340 B	HE 240 B	HE 300 B	HE 160 B	HE 240 B	672	5955	38473	52971	57	79
8.00	6.00	8.00	0.16	1000	HE 220 B	HE 340 B	HE 240 B	HE 300 B	HE 160 B	HE 260 B	671	6073	38763	53238	58	79
8.00	6.00	8.00	0.16	1000	HE 220 B	HE 340 B	HE 240 B	HE300 B	HE 180 B	HE 260 B	671	61/6	39045	53521	58	80
8.00	6,00	8.00	0.16	1000	HE 220 B	HE340 B	HE 240 B	HE 300 B	HE 100 B	HE 280 B	670	6296	39346	53804	59	80.
8.00	6.00	8.00	0.16	1000	HE 220 B	HE 340 B	HE 240 8	HE 300 B	HE 200 B	HE 300 B	669	6585	40109	54547	60	82

	11	NPUT		-				OUT	PUT				1	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m ²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2 []	pit []	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m²]
4.00	6,00	5.00	0.16	1000	-	1.00	-	1	-	-	-	-	-	-	-	-
4.00	6.00	5.00	0.16	1000		181		1.81		-	~	~	-	-		1.14
4.00	6.00	5.00	0.18	1000	-	ti per i	1.581	21	× 1	-	~ ~	-		-	· · ·	1 recti
4.00	6.00	5.00	0.16	1000		1.00	1.00		1.00	-		10.19		1.00	-	1.1
4.00	6.00	5.00	12,16	1000	-	1.4	1.0	1		-	÷		- A. (1 8 1	1	1.5.1
4.00	6,00	5,00	0,16	1000	-	1.1811	8	100	1.000			1.1	1000	100		1.00





COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=6m; Vb=1500 kN)

Database FENO (r.c. wall bracing system):

1				INPU	0							OUTPUT					COSTES	TIMATION	
Number of storeys	Storey height H	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g (cm²]	Horizontal rebars As,shear [cmi/m]	Steel weight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m]	Unit cost (s.s. floor) [€/m²]
2	6.00	4.00	0.30	1500	D	0.16 g	DCH	4.00	997	219	18	2944	34560	14.40	48	44248	65771	44	66
2	6.00	4.00	0.30	1500	D	0.16 g	DCM	3.00	748	219	18	2944	34560	14.40	48	36024	52166	48	70
2	0.00	4.00	0.30	1500	D	0.16 g	DCL	1.00	272	219	18	2944	34560	14.40	48	20339	26219	75	96

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	17	IPUT		100				OUT	PUT				1	COST ES	TIMATIO	N
8 (m)	H	Qk1 [kNm7]	ag/g	Vb [kN]	BEAM2	BEAM1	DIAG2	DIAG1	COL2	COL1	A [nř]	Weight [kg]	Total cost (r.c. floor) (E)	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/nテ]
4.00	6,00	8,00	0.16	1500	HE 160 A	HE 180 A	HE 280 A	HE 400 A	HE 160 A	HE 280 A	226	4093	18685	23574	82	104
4.00	6.00	8.00	0.16	1500	HE 160 A	HE 180 A	HE 280 A	HE 400 A	HE 160 A	HE 280 A	226	4093	18685	23574	82	104
4,00	6,00	8,00	0,16	1500	HE 160 A	HE 180 A	HE 280 A	HE 400 A	HE 160 A	HE 300 A	226	4236	19077	23965	-84	106
4.00	6.00	8.00	0.16	1500	HE 160 A	HE 180 A	HE 280 A	HE 400 A	HE 160 A	HE 300 A	226	4238	19077	23965	84	106
4.00	6.00	8.00	0.16	1500	HE 160 A	HE 180 A	HE 280 A	HE-400 A	HE 160 A	HE 300 A	226	4236	19077	23965	84	106
4.00	6,00	8.00	0.16	1500	HE 160 A	HE 180 A	HE 280 A	HE 400 A	HE 180 A	HE 320 A	226	4408	19550	24439	66	108

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

1	11	NPUT		A	1	-		OUT	PUT		-		-	COST ES	TIMATIO	N
В	Ĥ	Qk1	ag/g	Vb	link2	link1	diag2	diag1	pil2	pit	A	Weight	Total cost (r.c. floor)	Total cost (s.s. floor)	Unit cost (r.c. floor)	Unit cost (s.s. floor)
្រា	lmi	[kN/mr]	11	[KN]	11	11	11	U	- 11	11	[u.]	[kg]	Le1	le1	Texuel	feauel.
8.00	6.00	8.00	0.16	1500	HE 200 M	HE 450 B	HE 280 B	HE 500 B	HE 160 B	HE 260 B	750	7878	46333	62527	62	83
8.00	6.00	8.00	0.16	1500	HE 200 M	HE 450 B	HE 280 B	HE 500 B	HE 160 B	HE 260 B	750	7878	46333	62527	62	83
8.00	6.00	8.00	0.16	1500	HE 200 M	HE 450 B	HE 280 B	HE 500 B	HE 180 B	HE 280 B	766	8101	47450	63974	62	84
8.00	6.00	8.00	0.16	1500	HE 200 M	HE 450 B	HE 280 B	HE SOO B	HE 180 B	HE 280 B	766	8101	47450	63974	62	84
8.00	6,00	8.00	0.16	1500	HE 200 M	HE 450 B	HE 280 B	HE 500 B	HE 200 B	HE 300 B	782	8390	48799	65687	62	84
8.00	6.00	8.00	0.16	1500	HE 200 M	HE 450 B	HE 280 B	HE SOO B	HE 200 B	HE 300 B	782	8390	48799	65687	62	84

Database UNICAM (steel bracing system - eccentric, 1 diagonal):

25

n

	11	NPUT		-				OUT	PUT				1	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2	pit []	A [m ²]	Weight (kg)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m]
4.00	6,00	8.00	0.16	1500	-	1.000	-	191		-	-	-	-	-	-	-
4.00	6.00	8.00	0.16	1500		181		1.81		-	~	~	-	~		1.14
4.00	6.00	8.00	0.16	1500	- 1	ti per i	1.581	21	× 1		~	-	-	-	· · ·	1.00
4.00	6.00	8.00	0.16	1500	in en	1.00	1.00		1.00	-		10.04		1.00	-	-
4.00	6.90	00.8	12,16	1500	-	1.4	1.0	1		-	÷		- A	1 8 1	1	1.5.1
4.00	6,00	8.00	0,16	1500	100	1.1811	8	100	1.000	1000		1.1	100	1811		1.00



.0

COMPARISON BETWEEN R.C. WALL AND STEEL BRACING SYSTEMS (B=4m; H=6m; Vb=2000 kN)

Database FENO (r.c. wall bracing system):

1				INPU	I							OUTPUT					COSTES	TIMATION	4
Number of storeys	Storey height H [m]	Width B [m]	Thick ness s [m]	Base shear Vb [kN]	Distribution type	Seismic/Wi nd action	Ductility class	Behaviou r factor	Surface/ Wall [m²]	Vertical rebars As,bendin g [cmi]	Horizontal rebars As,shear [cmi/m]	Steel w eight [kg]	Concrete weight (kg)	Concrete volume	Precast DL w all surface (m²)	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m²]	Unit cost (s.s. floor) [€/m²]
2	6.00	4.00	0.30	2000	D	0.16 g	DCH	4.00	1330	291	.24	3873	34560	14.40	48	56979	85676	43	64
2	6.00	4.00	0.30	2000	D	0.16 g	DCM	3.00	997	291	24	3873	34560	14.40	48	46013	67536	46	68
2	5.00	4.00	0.30	2000	D	0.16 g	DCL	1.00	337	291	-24	3873	34560	14.40	48	24221	31487	72	94

Database UNICAM (steel bracing system - concentric, 2 diagonals):

	IN	IPUT		100		1000		OUT	PUT				1000000	COST ES	TIMATIO	N
8 [m]	H	Qk1 [kNm7]	ag/g	Vb [kN]	BEAM2	BEAM	DIAG2	DIAG1	COL2	COL1	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floar) [€/m²]	Unit cost (s.s. floor) [€/nr]
4.00	6,00	8.00	0.16	2000	HE 180 A	HE 220 A	HE 300 A	HE 450 B	HE 160 A	HE300 A	302	5048	23794	30312	79	100
4.00	6.00	8.00	0.16	2000	HE 180 A	HE 220 A	HE 300 A	HE 450 B	HE 160 A	HE 300 A	302	5048	23794	30312	79	100
4,00	6,00	8,00	0.16	2000	HE 180 A	HE 220 A	HE 300 A	HE 450 B	HE 160 A	HE320 A	.302	5160	24100	30618	00	101
4.00	6,00	8.00	0.16	2000	HE 180 A	HE 220 A	HE 300 A	HE 450 B	HE 160 A	HE 320 A	302	5160	24100	30618	80	101
4.00	6.00	8.00	0.16	2000	HE 180 A	HE 220 A	HE 300 A	HE 450 B	HE 160 A	HE340 A	302	5249	24343	30861	81	102
4.00	6,00	8.00	0,16	2000	HE 180 A	HE 220 A	HE 300 A	HE 450 B	HE 180 A	HE 360 A	302	5394	24741	31259	82	104

Database UNICAM (steel bracing system - eccentric, 2 diagonals):

Unit cost [6/m2]

n

-	1	NPUT		Sec. 10.	-			OUT	PUT		_	_	-	COST ES	TIMATIO	N
B (m)	H (m)	Qk1 [kN/m ²]	ag/g	Vb [kN]	link2	link1	diag2	diag1	pil2	pilt ()	A [m ²]	Weight (kg]	Total cost (r.c. floor) (€j	Total cost (s.s. floor) [€]	Unit cost (r.c. floar) [€/m²]	Unit cost (s.s. floor) [€/m]
8.00	6.00	8.00	0.18	2000	-	1.761	1.0611	1.287						-		1.00
8.00	6.00	8.00	0.16	2000	- 6 H	l a r	1.001	1.81				1.4		1.10	-	11.00
8.00	6,00	8.00	0.16	2000		i har i	i la li	167	-	1.00	- 3-	5 G =	-	1.16	140	1 - e. T
8.00	6.00	8.00	0.16	2000		In the second	in the second	1.00		-		-		e e		1.1.1
8.00	6,00	8.00	0.16	2000		1.4-5.1	1.0	1.45		Text						1.00
8.00	6.00	8.00	0.16	2000			1. 2. 1		1.0.1							

	11	NPUT						OUT	PUT				1	COST ES	TIMATIO	N
B (mj	H (m)	Qk1 [kN/m ²]	ag/g	Vb [KN]	link2	link1	diag2	diag1	pil2 []	pit []	A [m ²]	Weight [kg]	Total cost (r.c. floor) [€]	Total cost (s.s. floor) [€]	Unit cost (r.c. floor) [€/m ²]	Unit cost (s.s. floor) [€/m²]
4.00	6,00	8.00	0.16	2000	-	1.00	-	1	-	-	-		1.0	-	-	
4.00	6.00	8.00	0.16	2000	- ×	1.81		181		-	~	~	-	-	- 201	1.14
4.00	6.00	8.00	0.18	2000	5 1	libel.	1.581	21	*	-	~	~		-		1.1
4.00	6.00	8.00	0.16	2000	- 6-1		1.00		-	-		10.04	1.0	1.00	1.1	1.00
4.00	6.00	00.8	0,18	2000	-	1.4.7.1	1.0	1.00		~		1.1	1.4.5	1 8 1		1.6.1
4.00	8.00	8.00	0,16	2000	1.00	1.1811	100	100	1000	1.0		1	-			1-6-1





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