6.5 SUPERBOARD® DECK

This type of application allows mounting a mezzanine slab quickly, since it does not require forging periods for the supporting structure, and it allows exceptionally clean and orderly conditions.

The interposed structure weight and the support structure decrease down to 1/5 of the concrete mezzanine, which makes it ideal for remodeling and space adaptation.

Compatible with any type of structure (wood, metal or concrete), it requires basically, a 610 mm separation framework while supplying an adequate support for imposed loads.

The following procedure was developed together with Acesco, the leading metalworking industry company of Colombia, which manufactures "C" structural shapes with black steel or galvanized steel. Recommendations herein only correspond to this type of structure; however, the estimator engineer can estimate sizing and characteristics of the support framework when materials are from a different manufacturer, with different characteristics, or geometry.

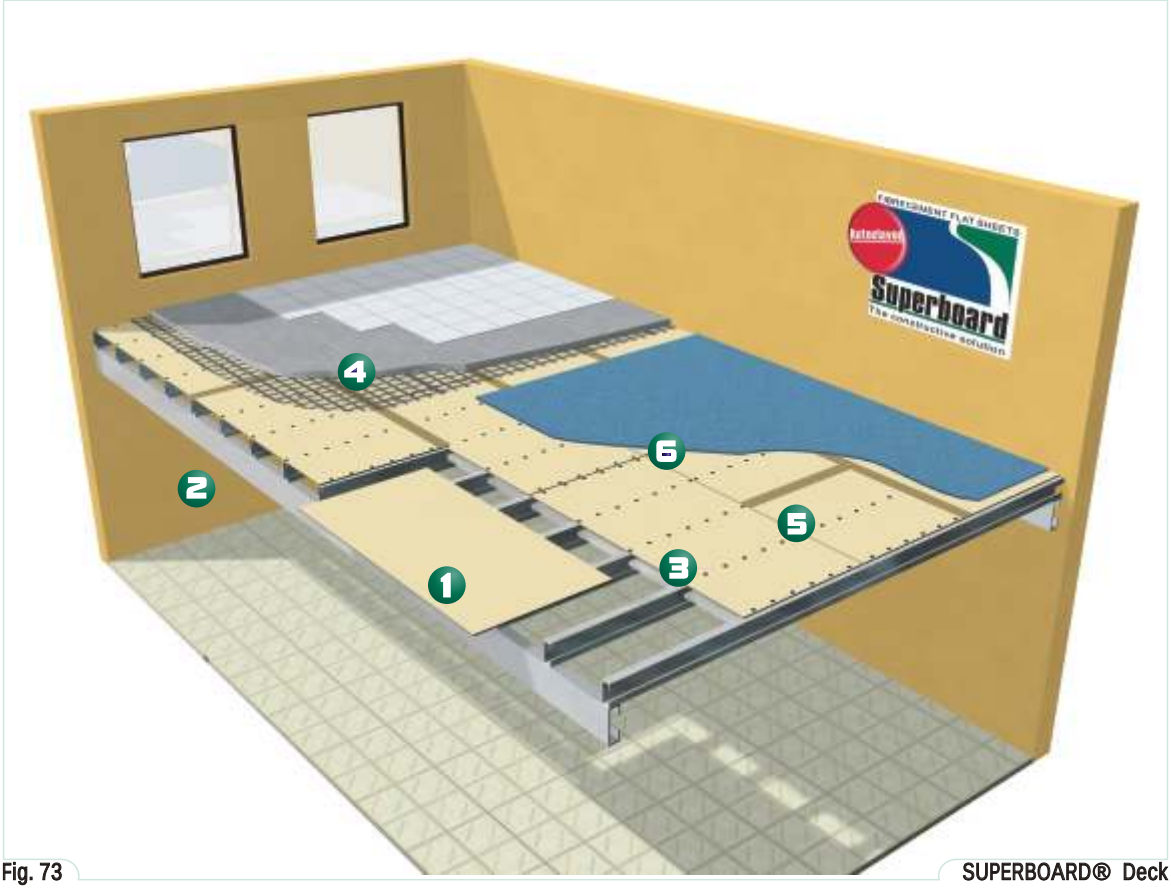

Fig. 73 SUPERBOARD® Deck

1. 14, 17 or 20 mm, SUPERBOARD® sheet according to calculations
2. Steel Structure
3. Screws
4. Rigid Finishings: temperature reinforcement, leveling mortar and final finishing (i.e. ceramics)
5. Optional: joint flexible sealing
6. Flexible Finishing: carpet, vinyl floor, rubber, etc.

Cine Colombia - Bogotá

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Montessori School - Bogotá

Plaza de las Américas Shopping Mall - Bogotá

6.5.1 SYSTEM COMPONENTS

SUPERBOARD® Sheets

This type of application requires using SUPERBOARD® sheets of 14, 17 or 20 mm of thickness. SUPERBOARD® sheets mechanical resistance values are clearly shown in chapter 4 .4 *Physical and Mechanical Properties of* SUPERBOARD® *Sheets.*

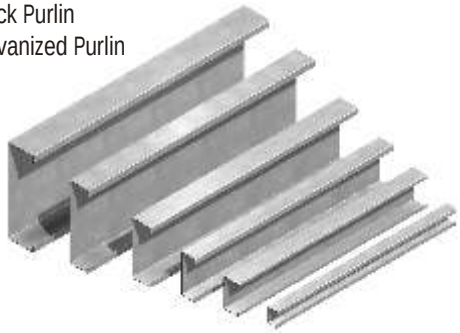
Acesco "C" Shape

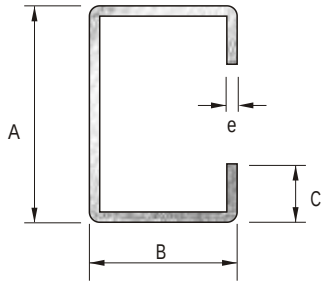
These shapes meet normative regulation ASTM A570-Degree 33. They offer an fy = 23.2kg/mm² and an fu = 36.6kg/mm², and a minimum 22% lengthening, thus meeting minimum requirements as specified in normative regulation NSR-98 (Seismic Resistance Design Norm valid for Colombia).

"C" Structural Shape Complete Section, Mechanical Characteristics

Reference	Thickness (mm)	Gauge #	A (mm)	B (mm)	C (mm)	Weight (kg/ml)
PHR C 60 x 40 x 3.0mm	3.0	11	60	40	14	3.58
PHR C 60 x 40 x 2.5mm	2.5	12	60	40	14	2.98
PHR / PAG C 60 x 40 x 1.9mm	1.9	14	60	40	14	2.27
PHR / PAG C 60 x 40 x 1.5mm	1.5	16	60	40	14	1.79
PHR / PAG C 60 x 40 x 1.2mm	1.2	18	60	40	14	1.43
PHR / PAG C 60 x 40 x 0.9mm	0.9	20	60	40	14	1.07
PHR C 120 x 60 x 3.0mm	3.0	11	120	60	13	5.72
PHR C 120 x 60 x 2.5mm	2.5	12	120	60	13	4.77
PHR / PAG C 120 x 60 x 1.9mm	1.9	14	120	60	13	3.62
PHR / PAG C 120 x 60 x 1.5mm	1.5	16	120	60	13	2.86
PHR / PAG C 120 x 60 x1.2mm	1.2	18	120	60	13	2.29
PHR / PAG C 120 x 60 x 0.9mm	0.9	20	120	60	13	1.72
PHR C 160 x 60 x 3.0mm	3.0	11	160	60	20	7.16
PHR C 160 x 60 x 2.5mm	2.5	12	160	60	20	5.97
PHR /PAG C 160 x 60 x 1.9mm	1.9	14	160	60	20	4.53
PHR / PAG C 160 x 60 x 1.5mm	1.5	16	160	60	20	3.58
PHR / PAG C 160 x 60 x 1.2mm	1.2	18	160	60	20	2.86
PHR C 220 x 80 x 3.0mm	3.0	11	220	80	20	9.54
PHR C 220 x 80 x 2.5mm	2.5	12	220	80	20	7.95
PHR /PAG C 220 x 80 x 1.9mm	1.9	14	220	80	20	6.04
PHR / PAG C 220 x 80 x 1.5mm	1.5	16	220	80	20	4.77
PHR / PAG C 220 x 80 x 1.2mm	1.2	18	220	80	20	3.82
PHR C 305 x 80 x 3.0mm	3.0	11	305	80	25	11.78
PHR C 305 x 80 x 2.5mm	2.5	12	305	80	25	9.81
PHR / PAG C 305 x 80 x 1.9mm	1.9	14	305	80	25	7.46
PHR / PAG C 305 x 80 x 1.5mm	1.5	16	305	80	25	5.86
PHR C 355 x 110 x 3.0mm	3.0	11	355	110	25	14.32
PHR C 355 x 110 x 2.5mm	2.5	12	355	110	25	11.93
PHR / PAG C 355 x 110 x 1.9mm	1.9	14	355	110	25	9.07

PHR Black Purlin
PAG Galvanized Purlin





How to interpret sizing given in the previous table

Fig. 74 **"C" shapes**

6.5.1.1 Design Analysis

Large Steel Beams: The designing of thin plate shapes, is based on the limit point method which consists on sizing cold steel structural components in order for no applicable limit point to exceed when the structure is submitted to any proper combination of loads. Two applicable limit points are considered according to title F.6 in NSR 98:

- *Required Resistance Limit Point:* In order to support extreme loads during the structure's lifespan, in which the design is satisfactory when required resistances for designated nominal loads multiplied by the corresponding load increase coefficients, are less or equal then the design resistance for each structural component.

- *Load Capacity Limit Point:* In order to fulfill its purpose during its lifespan, functioning is considered to be satisfactory if a nominal structure response, caused by applicable nominal loads does not surpass admissible or acceptable values for the response.

SUPERBOARD® fibre cement Sheets: Each application must be designed for live, dead, specific and impact loads which will finally be imposed affected by a number 2 security coefficient.

SUPERBOARD DECK

6.5.2 DECK CONSTRUCTION

NSR-98 recommendations must be followed in terms of allowed deflection (d < L/240) offered by the estimator, according to material mechanical characteristics.

Sheets must be distributed with their longest side perpendicular to the joist's direction. This direction offers the highest resistance to bending, due to the orientation of fibers during manufacturing. Sheets must have their corrugated side facing up, in order to guarantee more adherence of the floor finishing adhesive product. Sheet joints, corresponding to the 2440 mm sides must remain supported over a PHR C 60 x 40 x 1.5 mm shape and screwed to the previously mentioned fastening elements, distributed every 150 mm or 200 mm.

Fastening SUPERBOARD® sheets to the joists must be done with self-perforating and self-countersinking # 8 drill bit tip screws of at least 1 ½ " in length; distributed every 300 to 400 mm and using an electric screwdriver. Sheets must be distributed in locked courses so that there is not any concentrated effort over a non-continuous surface.

When sheets will receive a flexible finishing; such are the cases of vinyl or rubber floors, it is suggested to whet the joint by using a grinding machine therefore reducing differences in height between the sheets. This procedure is unnecessary when a leveling mortar coat is emptied or when rigid finishing floors such as ceramics or marble or stoneware are installed. In this case, carry on the following instructions:

a) Place a temperature reinforcement consisting on a linked or electrically welded mesh preferably, on the SUPERBOARD® surface, separated from the surface by 5 to 10 mm (Fastening screws from the sheet to the steel framing, can remain lifted in this proportion in order for the mesh to tie onto them. It is necessary for this purpose, to guarantee that screws have penetrated at least three steps within the thickness of the plate forming the shapes).

b) SUPERBOARD® sheets should be wet without saturating them with water, preventing them from getting humidity from the mortar blend, and affecting its forging process and resulting resistance.

c) Place a mortar coat of approximately 25mm or 30mm.

d) The floor finishing must be installed according to the manufacturer's specifications.

e) In case of applying only one mortar for the floor, spread onto 2440x2440 panels in order to avoid rupture or contraction due to forging.

6.5.3 ASESCO "C" SHAPES AND SUPERBOARD® DECK SIZING

The following table allows sizing support framing and SUPERBOARD® sheets in respect to imposed dead and live loads, and the joist support lights.

Note: It does not consider point loads over 80 kg, nor impact loads. In case of having occasional loads over the previously mentioned value, it is suggested to support them on a flat, rigid and non-deformable surface in order to distribute them in a lower value or one equal to properly distributed loads considered in the Live Load (CV) table, affecting them with a number 2 security value. In case impact loads are involved, a check up must be done in consideration of the resistance offered by SUPERBOARD® sheets for this type of load, as mentioned in table 4.3 *Physical and Mechanical Properties of the* SUPERBOARD® *sheet.* In any of both cases an electrically welded or hen-house type reinforced mesh is necessary, according to point 6.5.2 *Deck Construction.*

Note: This table doesn't consider the interior wall loads.

CALCULATION TABLE FOR SUPERBOARD® DECK - ACESCO SHAPES

CM: Dead Loads		CM: Live loads	Reference
CM1	SUPERBOARD® sheet weight and light finishing (carpet, rubber plates, etc)	CV1 180 kg/m² Homes CV2 200 kg/m² Offices CV3 350 kg/m² Small store CV4 500 kg/m² Lightweight warehouses CV5 1000 kg/m² Heavyweight warehouses	Light: separation between ACESCO beam supports ACS: ACESCO shape type SB: SUPERBOARD® sheet type: 14-17-20 mm
CM2	SUPERBOARD® sheet weight and mortar finishing plus ceramic tiling approximately (120kg/m²)		

Live Load kg/m²			CV1			CV2			CV3		CV4		CV5
Distance between shapes (m)			0.407	0.488	0.610	0.407	0.488	0.610	0.407	0.488	0.407	0.488	0.407
Beam span =3.0m	CM1	SB	14 mm	14 mm	17 mm	14 mm	17 mm	20 mm	17 mm	17 mm	17 mm	20 mm	20 mm
		ACS	C120X60-1.2	C120X60-1.2	C120X60-1.5	C120X60-1.2	C120X60-1.5	C120X60-1.5	C120X60-1.9 C160X60-1.2	C120X60-2.5 C160X60-1.2	C120X60-2.5 C160X60-1.5	C120X60-3.0 C220X80-1.2	C160X60-3.0 C220X80-1.9
	CM2	SB	14 mm	17 mm	17 mm	14 mm	17 mm		17 mm	20 mm	20 mm		
		ACS	C120X60-1.5	C120X60-1.9 C160X60-1.2	C120X60-1.9 C160X60-1.2	C120X60-1.5	C120X60-1.9 C160X60-1.2		C120X60-2.5 C160X60-1.5	C120X60-2.5 C160X60-1.5	C120X60-3.0 C220X80-1.2		
Beam span = 4.0m	CM1	SB	14 mm	14 mm	17 mm	14 mm	17 mm	20 mm	17 mm	17 mm	17 mm	20 mm	20 mm
		ACS	C120X60-1.9 C160X60-1.2	C120X60-2.5 C160X60-1.5	C120X60-3.0 C220X80-1.2	C120X60-1.9 C160X60-1.2	C120X60-2.5 C160X60-1.5	C120X60-3.0 C220X80-1.2	C160X60-2.5 C220X80-1.2	C160X60-2.5 C220X80-1.5	C160X60-3.0 C220X80-1.9	C220X80-1.9	C220X80-3.0 C305X80-1.9
	CM2	SB	14 mm	17 mm	17 mm	14 mm	17 mm		17 mm	20 mm	20 mm		
		ACS	C120X60-2.5 C160X60-1.5	C120X60-3.0 C220X80-1.2	C160X60-2.5 C220X80-1.5	C120X60-3.0 C220X80-1.2	C160X60-2.5 C220X80-1.2		C160X60-2.5 C220X80-1.5	C160X60-3.0 C220X80-1.9	C220X80-1.9		
Beam span = 5.0m	CM1	SB	14 mm	14 mm	17 mm	14 mm	17 mm	20 mm	17 mm	17 mm	17 mm	20 mm	20 mm
		ACS	C120X60-3.0 C220X80-1.2	C160X60-2.5 C220X80-1.5	C160X60-3.0 C220X80-1.5	C160X60-2.5 C220X80-1.2	C160X60-2.5 C220X80-1.5	C220X80-1.9	C220X80-1.9	C220X80-2.5 C305X80-1.5	C220X80-2.5 C305X80-1.5	C220X80-3.0 C305X80-1.9	C305X80-3.0
	CM2	SB	14 mm	14 mm	17 mm	14 mm	17 mm		17 mm	20 mm	20 mm		
		ACS	C160X60-3.0 C220X80-1.5	C220X80-1.9	C220X80-2.5 C305X80-1.5	C160X60-3.0 C220X80-1.9	C220X80-1.9		C220X80-2.5 C305X80-1.5	C220X80-2.5 C305X80-1.9	C220X80-3.0 C305X80-1.9		
Beam span = 6.0m	CM1	SB	14 mm	14 mm	17 mm	14 mm	17 mm	20 mm	17 mm	17 mm	17 mm	20 mm	20 mm
		ACS	C220X80-1.9	C220X80-1.9	C220X80-2.5 C305X80-1.5	C220X80-1.9	C220X80-1.9	C220X80-2.5 C305X80-1.5	C220X80-3.0 C305X80-1.9	C305X80-1.9	C305X80-2.5 C355X110-1.9	C305X80-3.0 C355X110-1.9	C355X110-3.0
	CM2	SB	14 mm	17 mm	17 mm	14 mm	17 mm		17 mm	20 mm	20 mm		
		ACS	C220X80-2.5 C305X80-1.5	C220X80-2.5 C305X80-1.5	C305X80-1.9	C220X80-2.5 C305X80-1.5	C220X80-3.0 C305X80-1.9		C305X80-2.5 C355X110-1.9	C305X80-2.5 C355X110-1.9	C305X80-3.0 C355X110-1.9		

NOTES

Shapes must be in a simple section with a brace at L/2

Where two ACESCO(ACS) solutions are presented, this refers to the least expensive option(bottom) or the lowest height option (Upper). I.e.

1. C160x60-xx corresponds to the smallest shape or the one with the highest gauge.
2. C220x80-xx corresponds to the least expensive shape.

Blank cells correspond to situations in which requests surpass the sheet or shape capacities.

ACESCO shape nomenclature:

Example: C160x60-3,0:

C = "C" type simple shape
160 = shape height in mm
60 = shape width in mm
3,0 = shape thickness in mm

INSTRUCTIONS

1. Refer to a row in which you find a line equal or higher than the one with the problem.
2. Locate the sub-row corresponding to the correct CM - Dead load, depending on the type of finishing.
3. Locate the CV- Live load column, depending on the construction.
4. A separation between beams is defined and the corresponding solution found.

It is possible to find several answers to one single problem, in said case decide on what best fits the builder.

Example:

Deck for a home with a 3,80m support span, distance between beams is of 0.407m and finishing carpet.

1. Column L = 4.0m
2. CM = CM1 = Weight proper to the lightweight finishing sheet.
3. CV = CV1 = Load for homes
4. Separation between shapes = 0.407m

Solution: SUPERBOARD® 14mm sheet, simple C120x60 -1,9 or 160x60-1,2 ACESCO shape every 4,07m with a brace at L/2

6.5.3.1 Live Load Values

Libraries (book deposits)	500 kg/m²
Hospitals (Operating rooms):	400 kg/m²
Rooms with fixed seating accommodations:	300 kg/m²
Garages:	250 kg/m²
Libraries(Rooms):	200 kg/m²
Schools:	200 kg/m²
Hospital (Rooms):	200 kg/m²
Hotels:	200 kg/m²
Offices:	200 kg/m²
Homes:	180 kg/m²

Note: In order to determine the live load, in case you cannot find an exact value in the previous table, you must base on the immediately higher value.

6.5.3.2 Example

Let's assume a deck will be built for an office (200kg/m² live load according to NSR 98), and it will have ceramic applied on a mortar(Load 72 kg/m2 according to NSR 98). The space between which the deck will be built has a 3.5m light.

According to the Dead Load table: CM, we select CM2 (which corresponds to mortar plus tiling finish).

On the live load section: CV. We select CV 2 (corresponding to the required use: Offices).

Considering the Span = 4.0m column (you must consider the span value equal or higher than required) and the sub column CM2, we look for the intersection with row CV2 and find the following possibilities for deck application:

A SUPERBOARD® 14 mm sheet supported on C120 x 60 3.0 mm, or see C120 x 80 x 1.2 mm Acesco shapes separated by 4.07 m from each other.

A brace must be installed for all cases (the shape must have the same characteristics as those used to support SUPERBOARD® sheets) in the middle of the span (L/2) on the support shapes.