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**REPORT 1.2.3** 

# BEST PRACTICE REPORT ON METHODS, SKILLS AND COMPETENCES IN RELATION TO CLAY PRODUCTS

## CONSTRUCTION OF LARGE AND SMALL FORMAT WALLS AND BRICK PARTITIONS





Institute of Entrepreneurship Development



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## 1. INTRODUCTION

#### 1. Background

The BIMclay project was born with the purpose of producing and developing didactic materials based on the BIM methodology, which address the challenges related to Life Cycle Analysis (LCA) of clay products, to serve as a training base for professionals in the ceramic sector. To this end, it is necessary to define and compile the most suitable execution systems and placement methods for clay products.

The first task of the BIMclay project "O1. *Establishment of common learning outcomes on clay placement methods, Life Cycle Analysis (LCA) and regulations*" encompasses a number of specific tasks among which we find the elaboration of this report.

This best practice report addresses the establishment of skills and competencies, as well as the definition of the most sustainable and environmentally friendly implementation processes.



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## 2. ENVIRONMENTAL CONSIDERATIONS

The Environmental Product Declarations (EPDs) are the clearest, most rigorous and internationally accepted way to provide the environmental profile of a product throughout its life cycle.

The EPD "*Ladrillos y bloques cerámicos para revestir. Pieza "P" según la Norma UNE-EN* **771-1**" (*Bricks and ceramic blocks for veneering. Part "P" according to the UNE-EN 771-1 Standard*) has been verified and published in AENOR's GlobalEPD program.

The EPD of bricks and ceramic blocks has been carried out according to the LCA methodology with quantified environmental information of their entire life cycle. That is to say, the EPD of bricks and ceramic blocks is of the "cradle to grave" type, as can be seen in the following table, which includes the life cycle stages considered.

Etapa de producto	A1	Suministro de materias primas	х	
	A2	Transporte a fábrica	х	
	Aз	Fabricación	х	
Construcción	A4	Transporte a obra	х	
	A5	Instalación / construcción	х	
Etapa de uso	B1	Uso	х	
	B2	Mantenimiento	х	
	B3	Reparación	х	
	<b>B</b> 4	Sustitución	х	
	B5	Rehabilitación	NR	
	B6	Uso de energía en servicio	х	
	B7	Uso de agua en servicio	х	
Fin de vida	C1	Deconstrucción / demolición	NR	
	C2	Transporte	х	
	Сз	Tratamiento de los residuos	х	
	C4	Eliminación	х	
	D	Potencial de reutilización, recuperación y/o reciclaje	MNE	
X = Módulo incluido en el ACV; NR = Módulo no relevante; MNE = Módulo no evaluado				

This EPD has been developed and verified according to the UNE-EN 15804 and UNE-EN ISO 14025 standards and the Product Category Rules (PCR) for fired clay products used in the construction of AENOR's GlobalEPD programme.



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The EPD functional unit is defined as 1 tonne of brick or ceramic block with an average reference service life of 150 years.

The EPD details the formulation to be used (conversion factor) to transform the functional unit from a ton of brick or ceramic block to a square meter of wall.



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## 3. CONSTRUCTIVE CONSIDERATIONS

The interior wall construction systems with perforated brick, large and small hollow brick and ceramic block comply with the requirements of the Technical Building Code (CTE), paying special attention to the requirements regarding acoustic insulation.

Acoustic insulation in the house is a fundamental requirement and one of the main demands of users. The separating walls between enclosures built with brick and ceramic block guarantee "in situ" sound insulation results of between 50 and 55 dB, which provides a high degree of comfort to the building.

The construction systems of partition walls are classified into the following types:





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The placement of the elastic bands in separating walls, partitions and interior sheets of façade or partition walls, will depend on the type of separating wall in question and on whether or not the building has a requirement for vertical acoustic insulation:





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The ceramic pieces that make up these systems are bricks and blocks of different dimensions and types. Depending on the characteristics of the piece used, the sheet of the wall will have a specific function:

- Perforated brick: used to build the heavy sheets of the 2 or 3 sheet partition walls. Its assembly is similar to the hollow brick of small format.
- Hollow brick: used to build lightweight sheets, panelling and partitions. The hollow bricks can be small or large format (tongued and grooved), a characteristic that conditions the assembly process.
- Ceramic block: it is used to build the heavy sheets of the 2 or 3 sheet partition walls, using only the thickest blocks for the 1 heavy sheet partitions. Their assembly varies depending on whether the pieces are tongued and grooved or rectified.



Perforated brick

Hollow brick small form at



Hollow brick large form at



Ceramic block



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## 4. CONSTRUCTION PROCESS

#### 1. Preparation and stakeout

The width of the wall will be marked irrespective of the linings, whether or not in walls with elastic bands on the base.



The sights shall be correctly plumbed and flush with the stakeout line. It will be necessary to place a sight in all the changes of direction, encounters with other walls or constructive elements and delimiting the hollows. In some cases, due to the great length of the wall, it may be necessary to interleave intermediate sights.





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#### 2. Dimensions and placement of the elastic bands

#### Wide elastic bands in small format brick partitions

The width of the elastic bands must be <u>larger than the thickness of the uncoated wall</u>, guaranteeing at all times that the brick comes into contact with the construction element from which it is to be disconnected.

For walls with perimeter elastic bands it is recommended that the width of the bands be at least 4 cm larger than the thickness of the uncoated wall, as shown in the picture:



Where elastic bands are fitted and it is necessary to disconnect the linings, the elastic band must be wide enough to protrude at least 1 cm from the thickness of the lining.



The elastic bands must be adhered to the support with plaster paste.

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#### Wide elastic bands in large format brick partitions

The width of the elastic bands must be <u>larger or equal than the thickness of the uncoated wall</u>, guaranteeing at all times that the brick comes into contact with the construction element from which it is to be disconnected.



Where elastic bands are fitted and it is necessary to disconnect the linings, the elastic band must be wide enough to protrude at least 1 cm from the thickness of the lining.



When it is necessary to make a groove on the elastic band for the placement of the rules, this groove will be as small as possible, ensuring that the wall is always supported on the elastic band and does not come into contact with the lower slab.





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The elastic bands must be adhered to the support with plaster glue.

#### 3. Construction of the first line of the wall

The starting of the partitions will be carried out as specified in the project, being able to be carried out on the lower floor slab or on the flooring. The floating floor must be interrupted at the meeting with the separating walls that separate different use units.



Interior partition that starts on the floor (with and without elastic band at the base).



Partition walls that start on the slab.



Internal partition that starts on the floating floor (with and without elastic band at the base).



Partition walls that start on the floating floor.

In walls with elastic bands on the base, regardless of the type of gripping material used for the construction of the wall, the assembly of the first row will be carried out with plaster (small format pieces) or assembly paste (large format pieces). The start of the wall will be carried out by applying bonding paste between the elastic band and the pieces of the first row.

In walls without elastic bands, a continuous bed of cement mortar will be placed on the slab for the placement of the first row. This continuous bed, in order to compensate for any irregularities in the slab, may be thicker than the rest of the tendels.



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#### 4. Construction of the rows

#### 4.1. Small format hollow bricks walls

The placement of the pieces of small format hollow brick is carried out by restregón (technique of placement and dragging of the brick). Abundant grip paste should be applied, verifying that the sores and tendons are full, and that the grip paste has adequately penetrated the voids.



The wall will be executed respecting the law of locking, that is to say, that the horizontal distance between two vertical joints of any two consecutive rows of the factory is greater than 1/4 of the length of the piece, recommending 1/3 of the length of the piece.



The cutting of small-format hollow brick pieces is usually done with the trowel.

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In single hollow brick walls received with cement mortar, it is recommended to place every 5 rows, one row with plaster.



Where an elastic band has been applied, check that there have been no rigid connections with the bonding paste. If they have been produced, they should be removed with the trowel at the end of the day, so that the bonding paste has not hardened excessively and is easy to remove. The breakage of the elastic band when removing the burrs does not affect the good acoustic performance of the system.

#### 4.2. Large format hollow bricks walls

Once the first row has been built, before continuing with the construction of the rest, its flatness will be checked by means of the level. The placement of the large-format hollow brick pieces on the wall is done by gluing, according to the following process:

- Application of the assembly paste on the edge of the pieces of the lower row and on the head of the piece to be placed.
- Position the workpiece by pressing it vertically and laterally so that the assembly paste penetrates into the recesses of the adjacent workpiece.



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The cutting of the pieces transversally will be carried out with a guillotine or with a radial saw. The pieces are cut longitudinally with a trowel or a radial saw.



Sufficient assembly paste shall be applied for the wall execution, verifying that the slots and tendels are full, and that the assembly paste has adequately penetrated the voids. The law of locking between consecutive rows will be maintained:



Where an elastic band has been applied, check that there have been no rigid connections with the bonding paste. If they have been produced, they should be removed with the trowel at the end of the day, so that the bonding paste has not hardened excessively and is easy to remove. The breakage of the elastic band when removing the burrs does not affect the good acoustic performance of the system.



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#### 4.3. Perforated brick or ceramic block walls

The positioning of the pieces is carried out by scrubbing. Abundant bonding paste should be applied, verifying that the slots and tendels are full, and that the bonding paste has penetrated adequately into the holes in the board of the piece. The thickness of slots or vertical joints will be from 1 to 1,5 cm.



The wall will be executed respecting the law of locking, that is to say, that the horizontal distance between two vertical joints of any two consecutive rows, is greater than 1/4 of the length of the piece, recommending 1/3 of the length of the piece.



The cutting of perforated brick pieces is usually done with the trowel. The use of pieces cut to a length of less than 1/3 of the length of the piece should be avoided.



#### 5. Union wall and upper forged

Whenever possible, the walls shall be joined to the upper slab on both sides. In cases where the wall can only be joined on one side, at least 80% of the wall thickness shall be filled. On sheets with elastic bands at the top, the filling will be made against the elastic band without covering it.

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The filling will be carried out with plaster paste, in the case of small format pieces, or with plasterbased glue finishing paste, in the case of large format pieces. The wall should not be joined to the upper slab before 48 hours have elapsed.

#### 6. Wall grouting

Once the wall has been built, it will be grouted, recesses for the anchoring of the carpentry, etc. The grouting will generally be carried out with plaster, in the case of small format pieces, or with plaster-based glue finishing paste, in the case of large format pieces.



In large format brick partitions, when the assembly paste has set, the surface will be brushed with the scraper, removing the excess material.



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#### 7. Placement of absorbent material

In 2 or 3 sheet separators, the absorbent material shall be placed well fixed to the first sheet of the separating wall and filling the entire surface of the separating wall. The fixing of the mineral wool may be carried out by means of mortar or plaster, applied on the wall or on the mineral wool, or by means of mechanical fixings, following the manufacturer's instructions at all times.



#### 8. Formation of voids

It is recommended to place at least 4 anchors per rail on the doors and 2 anchors per rail on the windows. It is recommended to place the anchorage higher than 5-10 cm from the upper corner of the crossbar, in the case of small format pieces, and 10-15 cm, in the case of large format pieces. In the case of doors in small format walls, it is recommended to place the anchorage lower than 5 cm from the floor, being able to increase this distance up to 10 cm if the crossbar has nailed ends. In large format walls, the lower anchorage is recommended to be placed at a maximum of 10 cm from the floor, being able to reach up to 20 cm if the crossbar has nailed ends. It is recommended to place elastic bands, both in the lintel and in the upper section of the beams up to the first anchorage.



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When a wall with a door is to be received to a wall perpendicular to the same one, existing little distance between the pre-frame of the door and the perpendicular factory, the way of execution of the encounter will vary depending on the distance.

Execution when the distance from the pre-frame to the factory perpendicular is less than 5 cm:



Execution when the distance from the pre-frame to the factory perpendicular is greater than 5 cm:



In large-format hollow brick partitions, the piece of the upper vertex of the lintel shall be placed in such a way that:

- The support of the piece on the crossbar is not less than 15 cm.
- The support of the piece on the lower yarn of the factory is not less than ½ of the length of the piece.
- The support of the piece on the bottom row of the wall is not less than ½ of the length of the piece.



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#### 9. Encounters between partitions

Execution of the rigid connection by means of locking between partitions of pieces of the same format: the pieces of the two partitions to be joined will be made by grating them in alternate rows.



Execution of the rigid union to test between meetings of pieces of different format: the union to testa will be realized placing the "factory cut" of the pieces in the zone of the encounter, and applying abundant paste of grip in the encounter. When the coverings are applied, it will be necessary to place a reinforcing mesh in the area of the encounter.



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<u>Connection by vertical elastic banding</u>: the elastic bands will be glued to the wall using plaster or plaster glue. Once the wall has been mounted, check that no rigid connections have been made with the bonding paste. When the coatings are applied, the disconnection between them must be maintained.



#### 10. Encounter of the partitions with the pillars

#### Encounter of the interior partitions with the pillars

Whenever possible, it is recommended to box the pillars to which the partitions are attached, incorporating an elastic material. If it is not possible to box the pillar, it will be necessary to place a reinforcement band on the cladding.



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#### Encounter of the partition walls with the pillars

In the separating walls of 2 or 3 leaves, the walls of hollow brick will attack to the pillars placing elastic band. Whenever possible, it is recommended to box the pillar with brick, wrapping it previously with the same material as the elastic band. If it is not possible to box the pillar, it will be necessary to disconnect the wall covering and the pillar.



#### 11. Placement of a false ceiling

In the encounter of the separators with the upper forging, when this is of vaults and has a false ceiling, a continuous sealing material shall be applied to the upper forging. This material may be applied before or after the wall is lifted. When the joists run parallel to the spacer, the sealing material shall be applied from joist to joist. When the joists run perpendicular to the spacer, the sealing material shall be applied in a width of 60-80 cm



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#### 12. Chase and wall recess

The chase shall be horizontal or vertical, in no case shall they be drawn diagonally. They shall be made with an electric scraper and only one of the brick partitions shall be broken. In the partition that are going to lodge many facilities or tubes of greater dimensions (kitchens and baths), it is recommended to use walls of greater thickness. Horizontal rubbing, if unavoidable, should be carried out in the upper area of the wall so as not to destabilise it. In the case of large format walls, horizontal cuts should be made, whenever possible, breaking only the joint between the piece and the piece.



Vertical chases shall be as far away as possible from encounters with other partitions, ensuring that this distance is not less than 25 cm. The "sewing" of vertical chases should be avoided.



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Vertical chases shall be kept as far away as possible from door or window openings, ensuring that this distance is not less than 15 cm. When the register boxes are to be placed in the vicinity of the doors, avoid placing them on the diagonal defined from the vertex of the piece cut by a pistol and the upper opposite vertex of the piece.



In partitions with elastic bands, the massif of the installations will be interrupted at the meeting of the wall with the lower and upper slabs. The closing and sealing of the chases will be carried out with plaster or cement mortar (small format pieces) or with plaster glue finishing paste (large format pieces), leaving them flush with the partition wall. In the interior partitions the coincidence



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of chases by the two faces of the same sheet will be avoided. The minimum separation between parallel chases on the opposite sides of the partition will be 20 cm.



#### 13. Execution of the disconnection of the coatings

In the case of joints where an elastic band has been placed at the meeting of a factory with another construction element, the factory cladding must be disconnected from the cladding of the other construction element in order to avoid rigid joining.

#### Execution of the disconnection of the linings at the base of the walls with elastic bands

If the factory starts on the floor slab, in order to ensure the correct disconnection of the plaster, given that the floating floor will be executed later and the flooring will be installed, it is recommended to apply the covering up to a few centimetres above the lower floor slab. For this purpose, a master floor can be removed 2-3 cm from the lower floor slab. If the wall starts on the floating floor, it is recommended to apply plaster up to the elastic band.



## Execution of the disconnection of the coverings at the top and/or at the sides of the walls with elastic bands:



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The disconnection of the coatings can be carried out following two procedures:

- <u>Cutting with the trowel</u>: once the plaster lining of the partition wall and the lining of the adjacent wall (upper slab or wall) have been applied, a cut is made in the plaster, supporting the trowel on the wall until the elastic band is reached. The breakage of the band when making the cut does not affect the good acoustic performance of the system.



- <u>Maintaining disconnection during plaster application</u>: during the whole process of applying the plasters, they shall be applied against the elastic band, so that the disconnection between the lining of the partition wall and that of the adjacent wall is maintained. After application of the linings, the elastic band is uncovered.



Prior to the application of the finishing paint, a paper tape is placed at the end of the joint once the coatings have been disconnected. For the placement of the paper tape, joint paste will be applied to both sides of the disconnection, avoiding that the paste penetrates in the cut or covers the elastic band, in order not to connect the coatings rigidly. Once the tape has been applied, a thin film of joint paste should be applied to it so that the paint can be applied to it.



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# 5. SUMMARY OF THE STEPS TO BE FOLLOWED IN THE CONSTRUCTION PROCESS

- 1. Preparation and re-staging of partitions and placement of sights.
- 2. Placement of the EEPS elastic bands of those walls that carry them. The base band will be placed and in the encounters with vertical walls where necessary.
- 3. Installation of door and window frames.
- 4. Removal of the partitions as specified in the project, correctly meeting the slab, the floating slab and the anti-impact sheet.
- 5. Execution of the partitions, according to the assembly rules established for the small format brick or the large format brick, as the case may be. In the case of walls with several leaves, one of the two leaves or the main leaf is lifted first.
- 6. Carry out correctly the encounters between the different partitions, set out the pieces appropriately around the gaps and resolve the encounters with pillars according to the rules of execution.
- 7. Assembly of the EEPS elastic band at the encounter with the upper forging in the partitions that carry it. Retouching of the partition against the forging or upper band.
- 8. Placement of absorbent material on two or three sheet partition walls.
- 9. On two or three sheet partition walls, placement of elastic bands and sights of the second sheet or brick panelling, where necessary.
- 10. Execution of the partitions, according to the corresponding assembly rules, correct execution of the matches, placement of the elastic band in the encounter with the upper forging, where appropriate, and upper refilling of the partitions.
- 11. Grouting of the partitions and brushing of the surface, removing excess material.
- 12. Realization of chases and recesses according to the rules of execution established for the pieces of small format or of great format, according to correspondence.
- 13. Application of the coatings, carrying out the disconnection between the plasters of adjacent elements separated by elastic band.
- 14. Previous preparation to the painting of the disconnected joints, by placing a strip of paper with joint paste.

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