# THE DIGITIZATION OF CERAMIC TILES IN BIM: THE EXPERIENCE OF ITALIAN MANUFACTURERS

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## ABSTRACT

The methodological approach of the BIM (Building Information Model) system provides a shared centralized model with real time information useful to the actors involved in the various phases of the building process. In the process of digitization of the construction sector, building materials play a key role. And if, until today, the emphasis within a BIM model was placed on the geometric-3D-dimensional aspect, now more and more importance is attributed to the organization of the information associated with the materials. This work illustrates the path followed by Confindustria Ceramica, Centro Ceramico and the ceramic tile manufacturers involved in the working group to digitize their products in BIM in a shared, complete, and reliable data structure, delivered in an interoperable format.

## INTRODUCTION

The state of BIM diffusion and adoption in Europe is quite varied and often dependent on the different strategies implemented by individual countries. In Italy, the new D.M. 2 August 2021 amends and updates the 2017 "BIM Decree" on the methods and timing of the gradual introduction of electronic modeling methods and tools for construction and infrastructure.

In particular, the mandatory BIM model is not only a 3D geometry of the structure but must contain all the information relating to the building components and products, including coatings and finishes ("coverings") such as ceramic tiles. The National BIM Report of 2019 shows that 81% of the BIM objects on the market are insufficiently standardized.

For the manufacturers of building materials, BIM objects represent, on the one hand, a legal obligation, but on the other hand they can be a significant improvement in the production, promotion, and marketing of quality products.

The definition process of BIM ceramic tiles regulations is part of this context; these guidelines were developed by the Confindustria Ceramica, by a Working Group of associated companies, Centro Ceramico and other scientific and research institutions, designers and experts.

This specification represents the first example of an interoperable BIM model in this sector.

#### EXPERIMENTAL

The specification's purpose is to define a guideline, dedicated to all Italian manufacturing companies in the ceramic tiles sector, to create and publish the BIM objects of their products. In fact, the specification guarantees object standardization and completeness: since the products of the same type will have the same data sets, the consistency of the information is guaranteed and designers can thus accurately and efficiently compare BIM objects.

The objectives pursued for the definition of the specification were:

- representing the characteristics of ceramic tiles, making them usable for designers and builders in a clear and comprehensive format;

- creating a specific template, developing a true correspondence between the identified property sets, the real specificities of the object-tile and the national and international regulations in force;

- making the model dynamic and implementable over time, coping with the changing needs of users and the always new qualities and properties that distinguish Italian ceramic tiles in the world;

- creating an interoperable model, with ease of application and adaptive to the needs of individual companies and users.

The methodology followed to define the basic criteria of the specification is described below.

## WHAT?

Digitizing the ceramic tile means creating the corresponding BIM object, represented by a 3D geometry and associated information content (metadata).

#### WHO?

The recipients of the specification are ceramic tile manufacturers who intend to digitize their product by communicating its characteristics and values to all the people playing a role in the tile construction process. First of all, it was essential to identify the possible users of the "ceramic tile" BIM object: it is not just architects, designers or end users who select the product during the design phase; other professionals and operators in the construction industry are also recipients of the digitized tile; figures that come into play throughout the entire life cycle of the building, from the foreman to the construction manager, to the maintenance technician. Each of these actors must find, within the template, the information needed to perform their function.

#### HOW?

There is currently no universal standard that sets the criteria and rules for creating and managing BIM objects. In 2014, NBS released NBS BIM Object Standard (BOS) which has become the "de facto" reference. BIM Object Standard (BOS) establishes the standard digitization template of the BIM object through a set of basic properties:

- adoption of a consistent approach to classification;
- applying a standard naming convention for ease of use;
- standardization of approaches to the level of detail and presentation of the object.

The adoption of BOS took place in parallel with the choice of the communication and data exchange standard used in building design and construction. In fact, as established by the D.M. 2 August 2021, regardless of the BIM Authoring software tool used, the digital BIM model must be made available in an interoperable and shareable format; the only language that respects these characteristics is BuildingSmart's IFC.

At the operational level of the working group, the information contents required by the PropertySets of the IFC 4.0 add.2 scheme were evaluated together with the companies, and the information required by the protocol managed by NBS was added to the specification, again with respect to the IFC standard but through the universal classification system UNICLASS-2015. This is an important combination because it determines the correspondence between classes of "software" type (IFC) and classes of the "building" world (UNICLASS-2015). COBIE has also been added: it is an optional but mandatory subset in the United Kingdom and in all Commonwealth countries (plus the United States) which concerns useful information for facility management. Finally, in order to complete and enhance the ceramic tile product from the point of view of its performance characteristics, regarding both technical and environmental sustainability, three specific sheets for the tiles have been created - again according to IFC standards:

- DoPAndProductCertification,
- Environmental Sustainability,
- OtherTechnicalFeatures.

These new Properties Sets contain the essential characteristics provided by the DoP, the certifications in the field of environmental sustainability, and other technical characteristics that are increasingly requested by the market (e.g., antibacterial and antiviral surfaces) that qualify the product.

The "DoPAndProductCertification" sheet contains all information already known to manufacturers, as they are the data reported in the declaration of performance and for the CE marking: the reference to the harmonized standard EN 14411, the DoP number, the essential characteristics provided for in Annex ZA.

The "Environmental Sustainability" sheet adds to the properties on the environmental indicators provided by the Pset of the IFC standard, all the certificates such as the Ecolabel or EPD, or self / declarations or simple values of parameters or assertions concerning environmental, product and corporate.

In the last sheet "OtherTechnicalFeatures" have been grouped the main dimensional, physical and performance characteristics in addition to those required by the CE marking that are part of the ISO 10545 package, plus other characteristics only occasionally required - such as thermal conductivity, Mohs hardness, or light reflectance value, but also photocatalytic and antibacterial characteristics - that, if already known of the manufacturer, can be enhanced. In addition to identifying these parameters, the working group has worked to ensure clear guidelines relating to the different levels of mandatory parameters, especially in the IFC area. As for the rest of the parameterization, the company itself will decide whether to implement and enhance the object or not.

# CONCLUSIONS

The drafting of the tiles specification in the ceramic sector is an important result in the digitization process that is affecting the world of construction.

Despite the complexity and variety of possible choices, the chosen orientation to be on interoperability standards already established in the Anglo-Saxon market guarantees the solidity, flexibility, and applicability of the proposed BIM Package model.

As of today, the specification has been submitted to the appropriate UNI (Italian standardization body) technical committee to be able to evaluate any future implementations and evolutions.



Fig. 1 Ceramic tile digitization: process, scheme and criteria

### REFERENCES

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