CERAMICS IN URBAN FURNITURE: DESIGN, DEVELOPMENT AND INNOVATION

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ABSTRACT

The work conducted by ALICER has pursued the design and development of new lines of innovative products in the urban furniture sector, featuring ceramics as surface finish. This approach seeks to extend the presence of ceramics in sectors such as that of urban furniture and, at the same time, to open up a new market for ceramics.

The present paper describes the creative process followed in developing a programme of urban furniture designated the 'Humus Collection', featuring ceramics. A project called 'Outdoor bench with radiant heating' is also presented.

1. INTRODUCTION

The use of ceramics has traditionally been exclusively limited to flooring and wall cladding, and although pioneering companies in the ceramic sector have developed new products in recent years for new uses of ceramics, such as ventilated curtain walls, filtering floorings or the incorporation of photovoltaic cells into ceramic products, we are faced with an especially difficult period for commercial expansion, which requires due reflection with regard to the target market and, particularly, to the end-user of our products. In this sense for instance, certain competing products with inferior performance features to those of ceramics are observed to have a greater market share in applications in facades, and urban or public spaces.

The present paper sets out the results achieved, as well as the process followed in the study, design and development of a line of innovative products in urban furniture, in which ceramics feature as the predominant material.

To be noted is the multidisciplinary character of the study, since it combines, on the one hand, the technical and functional requirements of expert companies in urban furniture and, on the other, new technologies such as laser cutting and water-jet cutting, concrete substrates and, finally, the incorporation and machining of ceramic material. This has been the reason for the collaboration of five companies (COARCE, S.L., DICOLASER, S.L, INDUESMALT, S.L., MOBIPARK, S.L., R. HERVÁS S.A. and TECNIMPORT, S.L.) from different sectors, united by a single aim: the design of a new line of innovative and technologically different products from those currently found in the market.

2. STARTING OBJECTIVES

The following projects pursued the design and development of new lines of innovative products in the urban furniture sector, featuring ceramics as surface finish, which required the cooperation of companies from different sectors. With this approach it was sought to extend the presence of ceramics in sectors eager for new materials, such as that of urban furniture, while at the same time opening up a new market for ceramics.

Initially, the characteristics that were thought to be fundamental to equip the project with an appealing, own identity, were as follows: having a multidisciplinary character, creating a interaction between different materials, using the most noteworthy characteristics of each of these materials and incorporating a highly technological, new material such as ceramics into the urban furniture sector.

3. PRESENTATION OF RESULTS

As a result of the process followed in carrying out the projects, this paper presents two of the most notable lines developed. The presentation of the results will help understand the creation process followed, since reference will be made to these results throughout the text. Two examples are involved, which evidence the concerns of the project, as we shall observe below:

Humus Collection. Family of urban furniture.

The Humus Collection comprises a programme of urban furniture, consisting of various benches: an individual bench, longitudinal bench with and without a back,

and an ischiatic bench; and a wastebasket, all of these items in the same design line, inspired by the formal appearance of fungi.

Outdoor bench with radiant heating.

The outdoor bench with radiant heating is a combination of new technologies applied to radiant heating systems, together with the benefit of ceramics as a heat-accumulating material. The bench with radiant heating improves the basic functions of public benches by providing the comfort of a warm surface out of doors, in very adverse climatic conditions, with rapid drying of the bench surface after a rainy day or dawn frost. In this case, the project was simply carried out without developing any prototypes or manufacturing processes.

4. DESIGN PROCESS

The design process described in this paper is the process followed in the creation of the Humus Collection; at certain points the description refers to the project of the outdoor bench with radiant heating, in aspects common to both projects.

PHASE 1. Pre-project: Compiling information, Analysis of the compiled information and product conceptualisation, Projectional keys and Sketching.

PHASE 2. Project. Product design. Definition of details.

PHASE 3. Forms of fabrication in collaboration with companies.

PHASE 4. End products.

4.1. PHASE 1. PRE-PROJECT

In the pre-project phase we defined and specified the general and particular characteristics of the product to be designed, formalising the solution to a sufficient degree to enable representing its formal and functional appearance as closely as possible to that of the end product.

4.1.1. Compiling information

The objective of the first phase involved compiling the information needed to determine the main lines to be followed in both the management and development of the project, such as the definition of the set of products to be designed (characteristics, users, market, etc.). The information search focused, on the one hand, on the ceramic sector, the furniture sector, the urban furniture sector and other sectors relating to the manufacture and development phases. On the other hand, the search focused on new materials and processes from other sectors and new tools that offered other possibilities for transformation.

4.1.2. Analysis of the compiled information and product conceptualisation

As a conclusion to the information compilation, an analysis report was prepared, providing all the necessary details needed to be fully acquainted with the new tendencies in the different sectors, particularly in that of urban furniture.

The first part of the analysis report provides an exhaustive study of the companies in the urban furniture sector, identifying those that have an outstanding product in some of the following groups of characteristics and variables: modern design, combination of materials, organic shapes, original arrangements and ease of assembly.

The second part analyses the latest tendencies in architecture, interior design, furniture and ceramics, on both a national and international level, ending with a series of general conclusions on the various, most noteworthy features of these tendencies; pop aesthetics, organic decorative aspects, mobility, finishes and interventions, influence of architecture, design and recycling, etc.

4.1.3. Projectional keys

The projectional keys acted as a working hypothesis for the 'theoretical philosophy of the project'. The keys were based on the analysis made, with a view to developing a design for everybody, which then led to introducing the concept of universal design.

Universal design encompasses a number of guidelines that allow creating products and environments designed to be usable by as many people as possible, without requiring adaptation or specialisation. However, it is necessary to take into account that other issues also play a role in design, such as cost, the culture in which the items will be used, the environment, etc., which must not be neglected. The keys were defined in the following terms:

- The introduction of the organic lines. In the analysis report it was considered that the trends in architecture and town planning referred constantly to organic design, favouring surfaces with a double curvature rather than flat surfaces.
- Visual influences of technological advances. The final result should be a reflection of the technology used in production.
- The incorporation of new functions for the ceramic material. Ceramics should be the protagonist, occupying the places of privilege in the formation of the furniture.
- Functional pieces. Characterising elements with more than one function, when possible; this allows multiplying the application possibilities with the same elements. At the same time, achieving modularity in the furniture elements to facilitate fabrication, transport, and assembly on site.
- Flexible furniture that affords possibilities for selecting ways of use. For this, European regulations for children were taken into account, in addition to the restrictions and constraints for handicapped persons.
- Design must minimise risks and the adverse consequences of involuntary actions or accidents. For this, in particular, the danger of entrapments was taken into account, avoiding gaps and preventing slipping by using non-slip surface finishes.
- Ergonomic dimensions, considering the size of the body, the position and posture, or the mobility of the user. The general dimensions established for benches were: seat height *40-45 cm*, seat depth *42-50 cm*, back seat angle *95º*-

100º, seat inclination *8º-10º* and back inclination *15º*. The dimensions for ischiatic support: seat height *70 cm*. The dimensions for wastebaskets: opening height *60-80 cm* in wastebaskets with proyection to the ground, opening height *60-90 cm* in vertically suspended wastebaskets, recommended diameter *30-45 cm*.

4.1.4. Sketching

Stage dedicated to making schematic sketches on the basis of which it was attempted to materialise all those features gathered and analysed in the previous phases. After each draught process, internal meetings were held that helped delimit the fields of action or lines of work. The stage concluded with the realisation of some product lines, which were discussed with the participating companies, not in order to discard lines of action, but to fuse the most positive characteristics in a single work.

Initial product lines:

- Updating of existing typologies. Reinterpreting the forms of traditional furniture, with the contribution of modern design and ceramic material. The seat and the back of machined ceramics were supported by a metallic structure made up of metal side pieces, cut with a laser system. The furniture elements form a modular system that enables connecting several modules and, thus, can respond to multiple situations with different demands. (Figure 1)

Figure 1. Representative bench of the line 'Updating existing typologies'.

Materials: AISI 316 steel structure and fittings.
Cladding: doubled porcelain tile (the same piece is used to make the back and the seat).

- Micro-elements. This was a proposal that solved items of furniture with a single type of module, 40 cm long. These modules were assembled and tied together by means of steel braces, in elements of curved or straight shapes. (Figure 2)

Figure 2. Representative bench of the line 'Micro-elements'.

Materials: AISI 316 steel support and fittings, and reinforced concrete core.
Cladding: doubled porcelain tile (the same piece is used to make the back and the seat).

- Glass anchorings. This line was based on the use of mechanical elements proper to the construction of glass facades and curtain walls. These anchorings were used to tie the formed ceramic tile corresponding to the seat to a metallic structure equivalent to the legs of the bench. (Figure 3)

Figure 3. Representative bench of the line 'Glass anchorings'.

Materials: AISI 316 steel support and fittings.
Cladding: doubled porcelain tile.

- Integration in the natural environment. In gardens, the vegetation is controlled, and live elements are transformed into objects with straight and artificial forms. Hedges are artificial, but are at the same time growing elements, trunks and branches that bear a geometrised plant mass. This was the image that inspired the line: the bench became a mass supported by a multitude of steel legs.

The collection sought a response to each user need with small modifications: in the 'bench from which to rise with ease', the seat was sloped 3 degrees towards the user, favouring the action of getting up; in the 'bench for a long rest' the seat was sloped 3 degrees counter to the user, favouring rest; the bench without a horizontal back could be used on both sides, etc. (Figure 4)

Figure 4. Representative bench of the line 'Integration in the natural environment'.

Materials: AISI 316 steel fittings and reinforced concrete core.
Cladding: doubled porcelain tile.
Possibility of ergonomic variations.

- User–furniture ambient. This line focused on the possibility of creating ambients in different spaces, trying to activate communication between the users. In regard to the shape of the elements, the organic aesthetic was the determining product factor. (Figure 5)

Figure 5. Representative bench of the line "User-furniture ambient".

Materials: reinforced concrete.
Cladding: doubled porcelain tile.

The sketching stage concluded in a single proposal as a project draught that was subsequently developed. The line of work termed 'User–furniture ambient' was chosen, with certain nuances adopted from the other lines.

4.2. PHASE 2. PROJECT. PRODUCT DESIGN. DEFINITION OF DETAILS.

The total development of the chosen proposal was made by generating all the necessary graphic and technical support for the manufacture of the product. The design process was characterised by constant changes, due the multiple participating sectors, but reports and the necessary technical plans were made for the manufacture, assembly and construction, as well as estimative studies on the factors that would affect the commercialisation phases: cost prices, assembly times, etc.

In the Humus Collection project, 3D modelling and the urban integration of the elements in natural environments and urban ambients were decisive, since one of the collection's most distinctive qualities for use was that of combining the different elements that compose the collection, forming different groups and, thus, contributing different concepts of use for each of these. (Figure 6)

We analysed the different spaces that are created in our urban environment and the scenarios most demanded by citizens. This analysis enabled determining the different factors that influence users in given actions: for example, many people feel inhibited when strangers sit on their bench, so that they choose to go away or simply stop acting normally. This situation led us to conclude that the vital spaces somehow needed to be bounded, in order to solve this problem. In conversational situations involving a group of persons seated on a bench, these persons tend to find it difficult to keep up a fluid conversation for any length of time, due to the positions that need to be adopted in order to communicate adequately. Therefore, this situation needed to be addressed, and the seats arranged so that these situations would not occur.

Figure 6. 3D modelling of the items of the Humus Collection

In view of these data, the conclusion was reached that it did not suffice just to design an element, but the relation that was established among the elements and the user's response to these new spaces also needed to be included in the conceptualisation.

4.3. PHASE 3. FORMS OF FABRICATION IN COLLABORATION WITH COMPANIES.

This stage was proper to the manufacturing and development companies, at which, under ALICER supervision, different trials and measurements were made that enabled the companies to realise the product perfectly in an appropriate and profitable fabrication process.

In the case of the Humus Collection the manufacturing process was defined according to the breakdown of the items making up the collection set out in the project. The fabrication of each piece was studied individually, and in subsequent work, several studies were carried out in relation to the assembly of the various pieces.

4.3.1. Fabrication process.

The manufacturing process begins with the production of the reinforced concrete parts, the bases of the items of furniture, using metallic forms made by stamping, specially developed for this purpose. The forms were designed so that they could be used for the manufacture of several elements, by the simple incorporation or elimination of one or several pieces of the form.

For the installation of the items of urban furniture, a system of bolts incorporated in the base of the reinforced concrete pieces was designed. In the item of urban furniture, an orifice was made in which a bolt was fitted which had been fixed and adhered previously to paving.

The ceramics pieces were machined by water-jet cutting, which assured the best result with maximum economy in time and cost.

The joining of the various materials had been planned with adhesives that assured bonding between the different pieces. The adhesive chosen is classified according to UNE-EN 12004:2001 as an R2 reactive resin, enhanced, with reduced slipping. This would be applied round the piece and inside the support in which it was to be set.

4.4. PHASE 4. END PRODUCTS

After the physical and technical characteristics, texture, materials and processes had been established, the group of participating companies was ready to initiate the whole assembly process of the line of products.

4.4.1. Collection Humus. Family of urban furniture.

The Humus Collection comprises a complete programme of urban furniture in the line of design inspired by a scale-up of the 'fungus'. We have over-sized an element that, of itself, invites taking seat.

The items of furniture each have an individual aesthetic value, heightened by the possibilities of different groupings, according to the particular needs of the urban space at issue.

The shape of the individual bench refers directly to the formal appearance of fungi. It consists of a cylindrical foot and a disk-shaped seat with rounded sides. The top of the seat is finished with a circular porcelain tile, produced by machining with water-jet cutting.

In contrast, the longitudinal bench has been produced by extrusion of a section of the individual bench made via the centre. The section has a T-shape with rounded side wings. The top of the seat is clad with porcelain tile, whereas the rest of the bench is facing concrete. The longitudinal bench is available in two versions: with back and without back, and in several lengths.

The ischiatic support, a support for the hip at a height of 70 cm from the ground, is an adaptation of the individual bench; the foot is extended until it reaches the height required to respond to the functions that are demanded of it, and the seat slopes to receive the user.

In the case of the wastebasket, the response again started out from the individual bench; the foot is extended to provide room for the boxes that collect the refuse.

4.4.2. Outdoor bench with radiant heating

By combining the new technologies applied to heating systems for radiant flooring, and the advantages of ceramics as a heat-accumulating material, a functional improvement has been made to public benches. Heat-generating devices have thus been incorporated, aimed at drying and making the seats located in cold climates more comfortable. (Figure 7)

Figure 7. Outdoor bench with radiant heating.

The project itself has required the participation of at least three companies from different sectors: companies from the heating and the air conditioning sector, ceramic companies and, of course, urban furniture companies. This has allowed bringing the ceramic sector into contact with companies from different sectors, thus opening up the field of activity of the ceramic companies.

It meets the objectives of using the latest technologies, since heating systems by radiant wiring are a recent implementation. These systems are made with bipolar parallel heating cables engineered with sealed ends. They are characterised by a heating conductor that is coiled in a spiral around the two insulated conductors of the cable, with which it makes contact alternately at certain given points. The cable forms an intern system with many resistances in parallel fed by both conductors through the contact points. Note that it is made with liquid-proof silicone and that the ends are sealed with silicone plugs, which make it moisture-proof.

In regard to the impact that it could have in the urban furniture sector, we have observed that the possible product competition in the market is inexistent at the moment, since there is no other type of outdoor bench that works like this. We have also observed that it is not subject to any type of restriction either because of conflicts with existing regulations or because of unfeasibility at production level.

5. CONCLUSIONS

The Humus Collection combines all the features that it was attempted to give the project: an own, appealing identity that would allow it to have a multidisciplinary character by joining different industrial sectors.

The fusing of materials like ceramics and concrete provides new perspectives for a type of urban furniture that, in addition to the aesthetic characteristics, offers resistance to vandalism and wholly satisfactory durability.

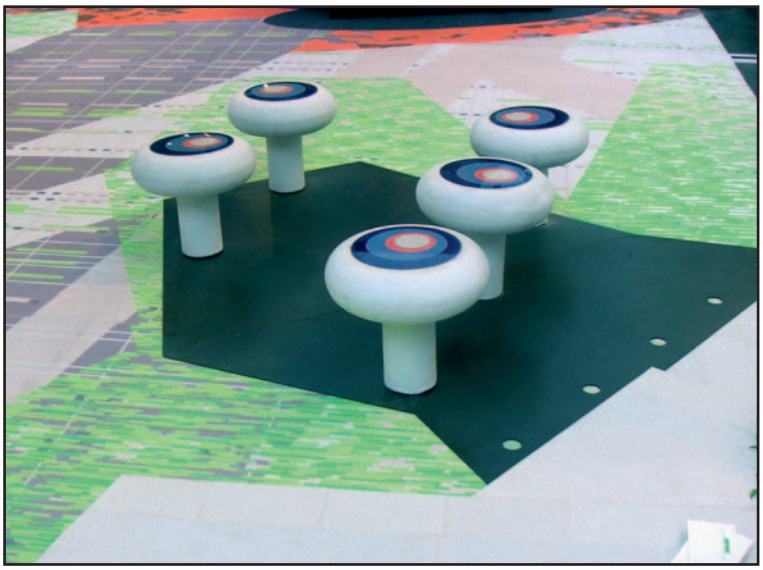

Figure 8. Individual benches of the Humus Collection exhibited in the TRANS/HITOS exhibition

The fabrication and commercialisation of the Humus Collection has been achieved through a consortium formed by the companies that participated in the project. The product was presented at CEVISAMA 2004, in the temporary TRANS/ HITOS exhibition. (Figure 8)

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