Ge-conservación
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Conservation and restoration works of the Four Sewers Fountain in Daganzo (Madrid, Spain)

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Abstract: The paper's field focuses on the Restoration of the Four Sewers Fountain of Daganzo and the improvement of its immediate environment, linked to the Plan of Fountains and Historical Gardens of the Regional Government of Madrid.

Historically, this element has been a reference at a territorial level, being part of troughs net and cattle trails for livestock, besides urban scale, serving public utility and point of drinking water supplying for the village.

The intervention has had a dual purpose. On the one hand, monument's enhancement, recovering the original presence of the Fountain, altered after paving works of the square in 1985, which left it half-buried. On the other hand, recuperating the memory of the laundry, demolished on the same date, making it the main character of a new public space created around the pylon, which recovers its social role as meeting place for neighbors.

This process has benefited from a deep archival previous research; documentation, conservation and display of archaeological remains discovered; and a thorough restoration work to return its values to this Cultural Heritage Property.

Key words: Restoration, Conservation, Architecture, Fountain, Limestone, Daganzo, Madrid.

Obras de conservación y restauración de la Fuente de los Cuatro Caños en Dagando (Madrid, España)

Resumen: El ámbito de la comunicación se centra en la Restauración de la Fuente de los Cuatro Caños de Daganzo y el acondicionamiento de su entorno inmediato, que se engloba dentro del Plan de Fuentes y Jardines Históricos de la Comunidad de Madrid.

Históricamente, dicho elemento ha sido un referente tanto a nivel territorial –formando parte de la Red de abrevaderos y Vías Pecuarias para Ganado–, como a escala urbana, sirviendo de lavadero público y punto de abastecimiento de agua potable para la villa.

La intervención realizada ha tenido un doble propósito. Por una parte, la puesta en valor del monumento, recuperando la presencia original de la Fuente –alterada tras las obras de pavimentación de la plaza en 1985, que la dejaron semi-enterrada–. Por la otra, rescatar la memoria del lavadero –demolido en la misma fecha–, para hacerlo protagonista del nuevo espacio público creado alrededor del pilón, que recobra su función social como lugar de encuentro para los vecinos.

Este proceso ha contado con una profunda búsqueda archivística previa; con la documentación, conservación y muestra de los restos arqueológicos descubiertos; y con un minucioso trabajo de restauración para devolver sus valores a este Patrimonio Cultural Inmueble.

Palabras clave: Restauración, Conservación, Arquitectura, Fuente, Piedra caliza, Daganzo, Madrid.

Preamble

This paper provides information about the restoration and the process of improvement, enhancement and proposals done on the Four Sewers Fountain of Daganzo. As part of the *Plan of Historic Gardens and Fountains*, belonging to the Community of Madrid, this is one of the 583 fountains and 84 gardens (Aymerich 2012) listed.

The restoration is part of a collaboration program signed between the Technical University of Madrid and the Community of Madrid through its General Directorate of Cultural Heritage. This program eases the students from the Master of Conservation and Restoration of Architectural Heritage to get proffesional jobs in the historic heritage field, so to get further training and field experience.

The plan includes a close following from the General Directorate, that collaborates by connecting different agents such as these enthusiastic novel Architects with construction companies or experienced technical architects they invite to bid.

This double approach guarantees an appropriate final result of the works as it merges experience and know how together with eagerness dedication and the wish to implement the lessons learnt along the Master. Besides, the experience acquired by the new architects is a remarkable issue from several points of view: management, budgets and several Administrative levels: local, regional, and even state level in some cases.

Other plans under the direction of the Community of Madrid are working with this management model, too, such as the *Plan of Bridges* or the *Plan of Visitable Sites.* In other cases, the orders aim to focus on different tasks, not linked with heritage restoration only, but having to do with documentation, investigation, dissemination and cultural heritage of Madrid better knowledge; for instance: exhibitions, planimetries, historical or characterization studies, publications, preparation of museological installations, and more.

Historical-geographical context

To understand the restoration process done in 2015, a deeper description of the relevant role of water in the heritage of Daganzo is required.

— Territorial connection

The Henares valley, where the Four Sewers Fountain is located, is an area rich in groundwaters, and they have historically been used to hold human populations (Aymerich 2012).

At a territorial scale, this fountain is linked with the Via Pecuaria Galiana, as it belong to the Watering Places System, used for cattle; at a urban scale, it is a basic structural element of the development of the human settlements around (Lorenzo 2009).

— Historical evolution

It is a functional element that evolved in phases: two pylons were built at a first stage, one for population and one for animals. The later addition of a two-sink laundry downstream the original one server dor optimization of the water. Lastly, laundry labour conditions were improved by the addition of a shelter.

More than a pure utilitary construction, the Four Sewers fountain used to be a meeting point around the water supply: a symbolic and valuable resource that was an essential part in the daily living, so, this area was a hub for the community feelings and exchanges, a milestone with strong social interaction (Ruiz-Bedia 2011).

Early stage description

This part describes the stage of the fountain and its inmediate surroundings prior to the restoration labours [figure 1].

Figure 1.- Constructive analysis of the initial stage of the fountain (2013).

— Geometric analysis

The construction is made of limestone blocks, and it is composed by a central body with a square pedestal of 40 centimeters that holds a pyramidal shaped finishing piece on top. A long sewer emerges from every of its four sides, and they pour the water into a two sinks pylon. The perimeter of the parapet is 2.75 by 8.40 meters, made of limestone, too. The blocks used to build it are 26 cm width by 75 cm height and variable length, with chamfered corner edges.

The body used for laundry was placed towards it, inside a 9 x 6 m shelter made of masonry walls with a wooden structure gable roof. Both do not longer exist nowadays.

— Constructive analysis

- There are two limestone types: class A, wich is darker, with hollows and more abundant; and class B (pieces 09, 13, 17, 18 and 19), less frequent, of a lighter colour and a special texture got by small hammer blows, that are the ones suffering a more severe level of damages such as alterations, disgregations and efflorescences. Even though the reasons of the use of these two types are not clear, it seems the second type was used during a later restoration works, that consisted of a replacement of the original –but damaged– class A pieces by newer class B blocks.

- Pyramidal finishing element on top of the pedestal is a movable cover, for inspection of the inner water conduits, that may belong to the fountain from its very begginning or be part of a later addition. So, its top component, maybe a ball, is lost and left a hole only.

- The lead of seventeen staples remain in place, linking the top part of the parapet blocks.

- There are hystorical traces worth preserving, such as abrasing marks due to animals action while drinking, or due to ceramic jugs continuously placed towards the sewers during the refilling (Velasco 2007).

- Original water drainage went through a corner spillway, that is no longer used. Two newer spillways were added laterly: one is at a lower height so to connect to another close fountain prior to pour the water onto the stream; and another one connects to the local sewer system.

— Pathological analysis

Four main conlussions were obtained from the pathological studio:

- First of all, there was an incompatibility between the cement-based materials and the limestone ones, since cement is chemically attacked by the so abundant sulfates of limestones, which transform the cement soluble compounds into bigger crystals that break the inner structures and result into an brittle, whitish appearance and progressive cracking that decomposes it.

- The limestone carbonation process results in its dissolution. This stones are rocks composed of calcium carbonate ($CaCO_3$) and are impermeable and insoluble in water under normal conditions. However, if the water contains CO_2, this carbonic acid (H_2CO_3) attacks the limestone, forms calcium bicarbonate $Ca(CO_3)_2$ and decomposes the rock.

- The different types of limestone suffer different pathological processes: class A has hollows or cavities on its surface; class B pieces are affected by processes of desquamation; and the pyramidal stone of the top finishing is being attacked by orange lichens.

- The elevation that is more affected by filtration humidities is the North one, due to a constant leak and no direct sunlight. As a result, efflorescences and biological colonization appear. However, smaller leaks and abundant direct sunlight in the southern wall produce little and punctual efflorescences, so as widespread dirt.

Preliminary investigation

As part of the intervention methodology, a thorough preliminary investigation was carried out in order to establish the guidelines to use during the project. The main conclusions of these analysis are summarized below:

— Historical documentation study

Its origin is uncertain, although it could have been built between the late sixteenth century and the first decades of the eighteenth century. There are references on a water supply source dated 1579 (Ortega 1918) and in 1847 (Madoz 1845). In 1985, a refurbishment of the square around the fountain was done, and it consisted of a complete dismantling of it all and the demolition of the laundry area. A concrete slab was built below the fountain and the pavement around changed: a new level, 50 cm higher, left the fountain half-buried and it lost its proportions, so the parapet looked smaller. The result: an isolated area, almost non-accesible due to the continuous traffic around and the lack of use.

— Petrological analysis

Analysis and previous tests were conducted to find the leakages causes and to determine the actions to be taken. They consisted of: visual inspections, water absorption tests, infrared thermographies, petrographic analysis, ultrasonic surveys and surface hardness determination by rebound permeability measurements (Fort 2013). The results lead to agree on the good conservation of the limestone blocks, not as much of the mortar joints, that had to be replaced.

— Archaeological excavation

The archaeological excavation resulted into the discovering of important remnants of the old laundry brick construction, together with the original cobblestone boulder set around the pylon and the original slab foundation, made of stone (Mendoza 2014). So, team proceeded to study, document and integrate it in the restoration project [figure 2].

Figure 2.- Comparison between the archaeological excavation and the final restoration.

Purpose and objectives

There are three main purposes that guide the intervention: The first one is to recover the image and scale of the fountain, reverting the paving intervention in 1985 that left it half buried [figure 3]. Secondly, rescuing the memory of the demolished laundry by marking its footprint on the new pavement above the remains of the foundation found during archaelogical excavation. Finally, pylon and surroundings conditioning, so to get an accesible, agreable meeting point for the village citizens that comes back to its original function.

Therefore, intervention strategies were: reducing the ground level to its initial, lower level, that got the parapet and the pedestal of the sewers to go back to their original height; and generating a public square around the fountain and the laundy area.

The general criteria applied were:

- Compatibility between the old and the new through the remains reinterpretation.

- Integration: global unity as a whole, but interventions are differentiated in the detail scale.

- New elements are clearly separated from the remains by their modern design. Thus, the contributions can be easyly read.

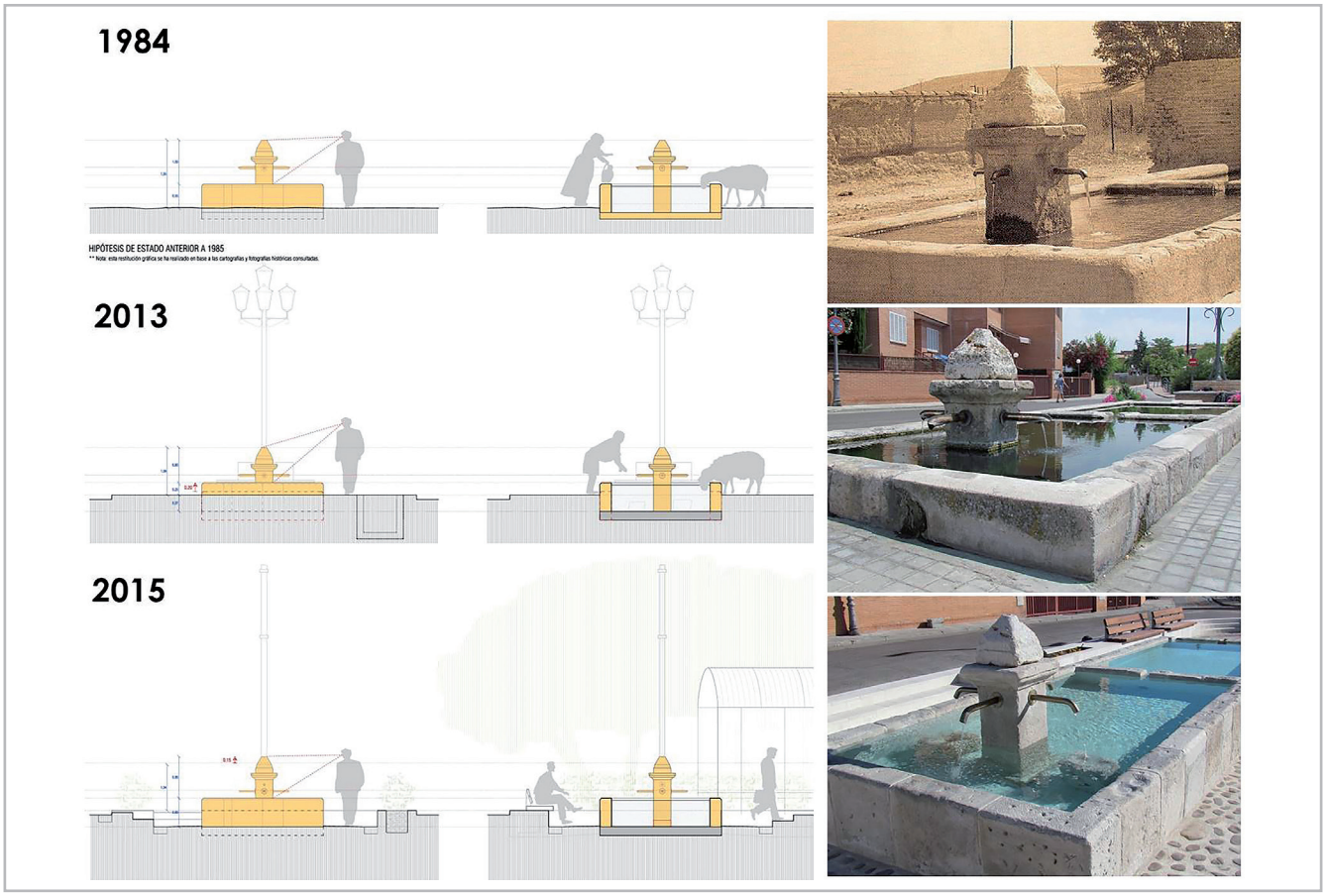

Figure 3.- Analysis of conditions into three periods: before 1985, from 1985 to 2015 and now.

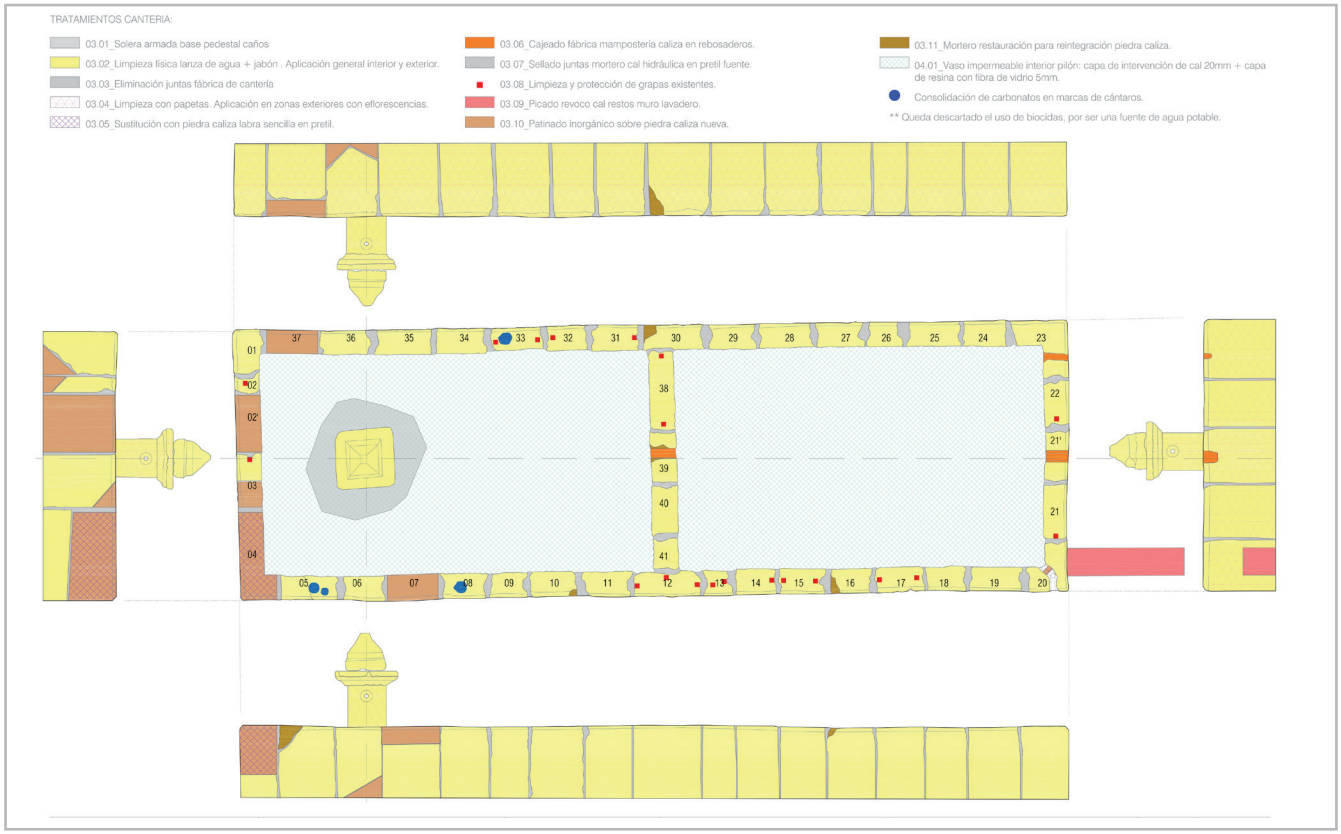

Figure 4.- Planning diagram of the conservation-restoration treatments.

- Integration of facilities on the ground and onto the perimeter wall, so to get a clean view of the historical object.

- Conservation and protection of the original remains.

- Proposal for future urban intervention, based on a partial pedestrianisation of the square to make it larger and reduce its exposed sides to traffic.

Conservation-restoration treatments

Aware of the importance of the fountain, the methodology considered its documentary, architectural and significan nature values. The role of the multidisciplinary team was crucial, as all actors intervented, decided and valued the different options and treatments to get to an agreement. All these treatments were tested in small parts of the fountain and valued together before its complete application. The most relevant restoration works were [figure 4]:

- Cleaning process main objective is the preservation of the good, in order to get a real view of current situation and prepare stone for the subsequent treatments.

Intervention process started with cleaning probes to support method election based on the premises exposed in the Project, as follows: that cleaning effect shall be slow enough to allow restoration staff to control its effects, that the method shall not generate dangerous by-product that could affect the stone; and that severe abrasions, microfractures or surface modifications shall not be produced.

Mechanic cleaning process consisting of white aluminium oxide micro-projection was finally chosen as the most appropriate method. The equipment used for this purpose was a mini-abrasion machine, model CTS Art 100, able to work at low or very low pressures so as to use a wide range of outlet nozzles, that were used according to the characteristics and thickness of the layer to be removed.

- Substituting cement for limestone and/or mortar [figure 5]. Once cleaning process was over, it was possible to check the state of old Portland mortar additions, in order to evaluate removal steps and techniques to use. This procedure consisted of mechanic manual elimination prior to its substitution, done using limestone pieces and lime mortar.

The material used for the purpose of the volumetric restoration was based on size and stresses to resist analysis. Hence, bigger volumes were substituted by limestone mortar prostheses and smaller ones were replaced by lime mortar reconstruction.

- Replacement of cement mortar joints. Traditional mortars are based on lime, but it has been continuously replaced by Portland mortars in recent interventions.

This is the case of the Four Sewers Fountain in Daganzo. The use of this new products has led to unfortunate consequences in the fountain preservation: first of all, Portland mortar is less porous, less elastic, harder, has a different thermal and mechanic behaviors; besides the high content of soluble salts that may crystallize in the stone material. Therefore, it was necessaty to remove it all and subtitute by lime mortars.

Figure 5.- Restoration details: substituting cement for limestone and pylon waterproofing; discovery of the primitive spillway corner; conservation and protection of the original remains; new sewers made of brass as per the primal design.

Figure 6.- image of the intervention in the Fountain Square (2015).

The new mortar to replace the cement-based one was made of lime as binder and river sand of different granulometry.

Plaster lime was chosen instead of hydrated lime in power due to a better cohesion of the mix and its adhesive capacity to the stony surfaces. Powder hydrated limes have a worse performance in terms of bonding capacity, due to preparation process: calcium hydroxide crystals are not correctly formed and carbonation process has already started in the storage bags (Fratini 2014).

- Pylon waterproofing. This is a major problem, frequently found in historical fountains. Some procedures prevail waterproofing against stone material preservation, and resisns are massive and indiscrimate applied on the stone, regardless impairments. In our case, a long term view led to plan a future reversibility of the treatment: final solution consisted of including a layer of intervention between the stone and the waterproofing, thus it can be easyly removed if required, without affections on the original stone.

The layer composition consists of aerial lime and marble powder plaster, left for weeks to make sure carbonation process was correct. Then, an acrylic primer (Acril 33) was applied for a double purpose: union layer and a reversibility guarantee thanks to its thermoplastic behavior. Lastly, waterproofing of the pylon was done by means of polyurethane resin (five layers) and two superficial layers of marble powder and limestone to get a similar surface appearance to the original fountain lime blocks.

Results of the intervention

Firstly, this intervention in the Four Sewers Fountain brings the original proportions back to its initial stage. The collective memory and social role of historical elements like the old laundry have been recovered, too.

What is more, thanks to the actions fostered by the General Directorate of Cultural Heritage of the Community of Madrid, this urban space has been regenerated: intervention treated the close environment, included new social uses and integrated new requirements such as urban facilities in a discrete way. To sum up, it got a full equiped and interesting social area around the fountain as prime character [figure 6].

Lastly, in order to bring the intervention close to citizens, an exhibition entitled "Fuentes de Daganzo, aguas con historia" was prepared by the architect V. García, the Daganzo City Council and the Daganzo Municipal Archive for dissemination purposes and in collaboration with the Community of Madrid, in the Culture House of Daganzo from the 4th to the 28th of February 2015.

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