

Earthen Industrial Buildings in the Canal of Castilla: Eighteenth and Nineteenth Centuries

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INTRODUCTION

During the Illustration period, under the reigns of Fernando VI and Carlos III, road communications within Spain were very poor. To counteract this enormous backwardness and trying to solve this serious problem, a project was planned to connect the cities of Zamora, Valladolid, Palencia and Segovia through several canals which, once they were linked, would ensure the easy transport of wheat to Madrid and the Cantabrian coast. They traced a route through the Guadarrama mountains as well as a route linking Reinosa to Alar del Rey at the head of the Canal of Castilla course, but only the latter was constructed.

THE CANAL OF CASTILLA

The building of the canal began in 1753. It is a 207 kms long watercourse which winds its way through the provinces of Palencia, Burgos and Valladolid in the heart of the Castilla - León plateau, an arid region of continental climate where construction is traditionally made of earth to mitigate temperature changes and avoid the use of wood which is in short supply. The canal was intended to improve communications and transport within the area, as the north, south and east range of mountains encompassing the cereal producing central plain prevented wheat export. They will very soon think about using the canal to irrigate the contiguous land which was very rich with water supply. Construction began in Calahorra de Ribas underneath the fifteenth century Franciscan monastery whose belfry was taken as a point of reference. Just a short time after, small *cuérnagos* (auxiliary canals whose volume of water or flow was used to move industrial mechanisms) were included in the locks to make its industrial use possible. After Francesco Sabatini's inspection in 1755, they began to build a very small type of water mill with only three millstones, a prototype repeated, with hardly any variations, along the Canal.

Jovellanos, who visited the building works for the first time in 1791, said this was the beginning of further industrialization and he could already see 11 industrial buildings between the seventh and the 21st locks. Juan de Homar, the last great project director drew 23 industrial buildings along the 24 locks of the *Ramal del Norte* (north branch) in 1806. Most of them were constructed of *tapia* (rammed earth) and *adobe* (mud bricks made with earth, straw and water, usually dried in the sun and not even baked). Both, using earth from the excavation itself and using techniques local people

were expert in, reduced cost, which was considered very convenient for the depleted coffers of the Spanish Treasury.

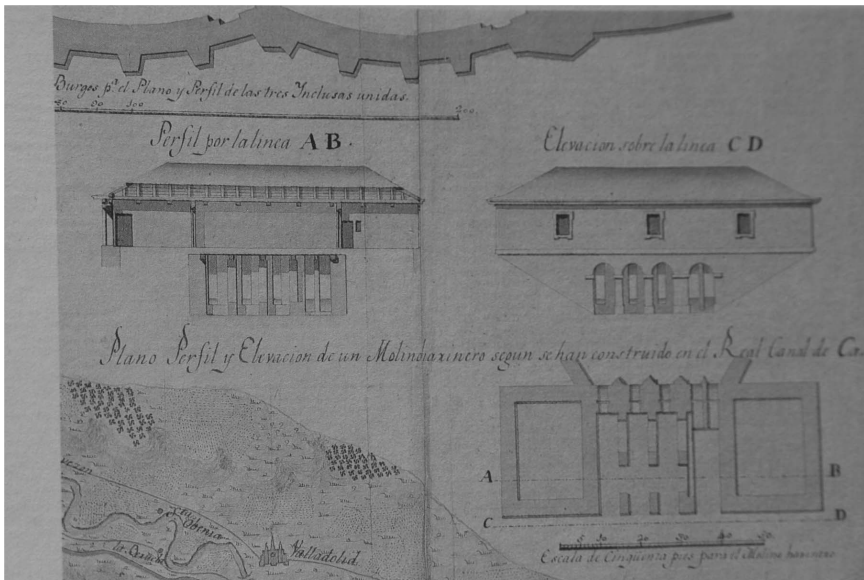


Figure 1. Mill prototype (Helguera 1992, p.35).



Figure 2. Eighteenth century typical Mill with rammed earth walls (Helguera 1992, p. 36).

ROOTS

These large water power mills did not allow inland navigation in Spain, despite people kept up the old Islamic and Roman tradition of building canals and *acequias* (irrigation ditches) using them for turning big waterwheels or for irrigation. However, there was a conflict of interest between the canal being used for transport and the powerful lords (Nicolle, 2005). Ferdinand II the Catholic promulgated Pragmatics, such as the one regulating navigation and irrigation along the Pisuerga river in 1509. Carlos V and later on Felipe II did not resolve these problems. However, between 1548 and 1550, during the regency of Prince Maximilian whose court was in Valladolid, it was agreed that the German engineer Hefelder would visit the Court. The Regent, very interested in interior navigation, promoted the three leagues-long canal between Husillos and Villamuriel, both villages in the province of Palencia, was completed a short time after, in 1551. Francisco Lobato's drawings and notes give details of the interest this matter caused (Carricajo and G.Tapia,1990). Large mills owners objected to the plan, although despite this opposition, the engineer Antonelli presented a project plan to make the river Duero a good link to Portugal, which had been recently annexed to the Crown, in 1581. Labanha and the Royal Cosmographer Soto studied the navigation possibilities on the Pisuerga and Esgueva rivers in 1607. Antonio de Ulloa, a naval officer who had visited several European countries as a spy for the minister Ensenada in 1751, invited the French engineer Charles Lemour to visit the area as King Fernando VI's wish was to improve interior communications. As a result, Castilian wheat exports would be possible. Lemour's designs initiated the canal building works in 1753 and it was completed nearly a century later, in 1849.

FRENCH MODEL

Despite having models from the United Kingdom where canals had been built since Roman times and where part of the Exeter Canal had been already built in 1566 and also the Kennet and Avon ones in 1702, (Crowe 1994) they copied from the Canal of Midi initiated by Riquet in 1665. In Spain, famous architects or respected engineers such as Cermeño, Lucuce, Sabatini or Betancourt expressed their opinion. In France, Vauban also took part in building the aqueduct of Pechlaurier in 1689. He considered the Canal of Midi: "le plus beau et le plus noble ouvrage de cette espèce jamais entrepris" (the most beautiful and noble work of this kind ever built). Riquet had argued: "un cheval, marchant au pas 10 heures sur 24, peut porter 100 kilos; attelé à une charette, il peut transporter 1 000 kilos; attelé à un bateau, il traînera 60 000 kilos" a horse going at its gait 10 hours out of 24 can carry 100 kilos, harnessed to a cart it can carry 1 000 kilos; harnessed to a boat it will be able to carry 60 000 kilos (Destrem, 1996). His reflections also generated interest in Spain where economy prevailed. This French model can be clearly seen in the canal locks but the liking at that period is shown on the bridges which are very similar to those drawn by Rennie for the Canal of Lancaster and on the aqueducts which are just like the Mildford one, drawn by Brindley (Alonso 1987). Even the shape and size of the British warehouses, looking like big houses, was repeated in the enormous factories along the Canal of Castilla (Ware 1995).

INDUSTRIALIZATION

During the eighteenth century, dispersed systems of production such as the *Verlag* System were abandoned and construction concentrating the whole process within a single space began to show up (Otero, 1998). Because of this factor, construction developed into a big rectangular building, looking like an enormous house, very different from subsequent factories with saw-tooth roofs. An abundance of wheat and changes in flour processes changed canal constructions into the enormous nineteenth century industrial buildings when they accumulated production processes on different levels. Javier Moreno writes “Flour mills are part[.....] of those historical civil buildings of the greatest interest[.....]They survived the passing of decades of neglect due to having been built with sturdy solidity (Moreno Lázaro,1991). We can also find large fulling mills for suede leather, buckskin or for well-finished textile production along the Canal. There were more than 1 000 cloth mills during the second half of the eighteenth century in the province of Palencia, with villages such as Amusco which employed 86% of its neighbours in textile work. (García Colmenares, 1991). Also there were paper mills with floors and sections drawn in detail by Juan de Homar. The very old Iberian tradition for making paper had been already mentioned by Idrisi in the twelfth century (González Tascón, 1998). Small arms as well as metal industries located on the first sections of the canal, with their drop hammers, also used water power. Juan de Herrera, architect of El Escorial had been interested in this water power energy when he built the Royal Mint in Segovia or the Foundry of Durango during the sixteenth century.

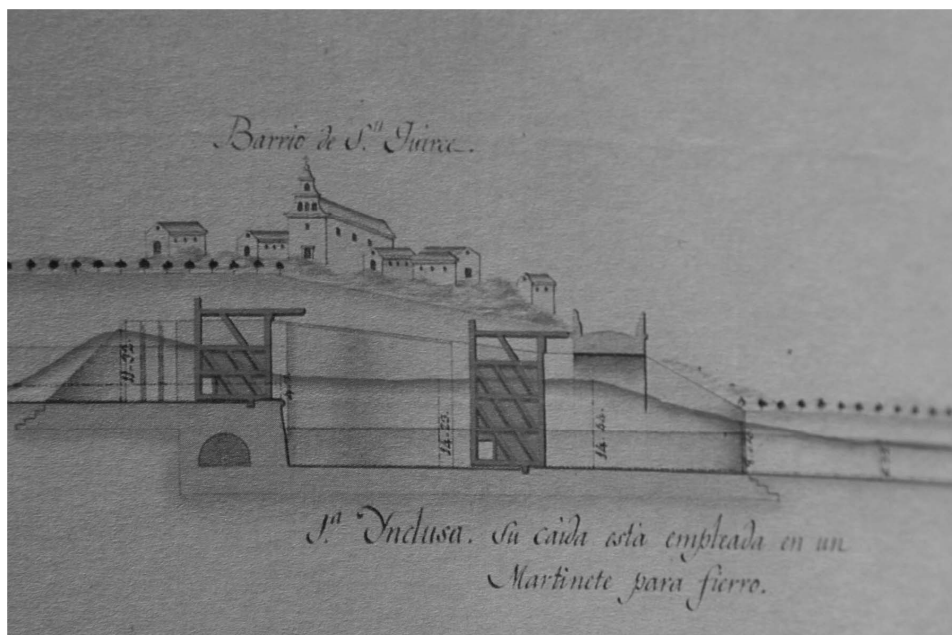


Figure 3. Metal industries located on the first lock (Helguera 1992. p.60).

There were also factories located in warehouses or docks to supply the necessary building materials for the canal construction.

BUILDING TECHNIQUES

People in Castilla have been building with earth since prehistoric times. There are adobes in Soto de Medinilla from the tenth century B.C. and also in Vacceos settlements such as Pintia. We know about the frequent use of adobe in Hispania by Vitrubio or Columella's works. We can read in Varrón, Plunio or Isidoro de Sevilla's writings about the frequent use of rammed earth on the Iberian Peninsula.

PRESENCE OF EARTH IN THE CANAL

It is usual to find adobe making up interior partition walls and also covering the inside of exterior walls if they were made of brick or masonry. We can find single adobes and those in a shape peculiar to the nineteenth century industrial architecture: adobes arranged between buttresses and ceramic *verdugadas* (a course of brick in a wall of stone, brick and mud).



Figure 4. Current wooden and adobe structure in the Canal's buildings

Rammed earth has been used to build exterior as well as interior supporting walls. It was frequently used in the earliest buildings and also in ones of less height.

Adobe buildings

Batán del Rey (Royal Fulling Mill) at lock 7, *Ramal del Norte* (north branch) also “Real Fábrica” (Royal Factory) assigned to the system which allowed the Nation to be self-sufficient imitated the one used by Colbert during Louis XVI time in France may be considered. It was a textile fulling mill intended for making buckskin and tanned skin. It would tan the American deerskins arriving in Santander only 20 leagues away from there, this way avoiding import through the tax-exempt provinces and the Kingdom of Navarra. The Nation lost 1.5 million *reales* (old silver Spanish coin) a year. Its ruins show adobe walls covered in bricks and adobe partition walls.



Figure 5. Adobes in the inside of the brick walls in a view of *Batan del Rey*.

Paper mill: at locks 11-12, *Ramal del Norte* (north branch) which was a Royal factory as well. Demolished at the present time, its exterior masonry and masonry cut stone covered its walls and *tabiques* or partition walls, made up of adobe. We can appreciate the magnitude of the Paper Mills by looking at Juan de Homar's designs included in his work "*Perfil General de los Reales Canales de Castilla*" now at the *Archivo* of Madrid Royal Palace. He show us also the other great paper factory, in Viñalta, near Palencia, with its three hydraulic wheels (taken from Juan Holguera Quijada's work "*El Canal de Castilla. Cartografía de un proyecto ilustrado*" (pp. 37-8). At lock 9 we can find an illustrative good example of the mills built during the eighteenth century.



Figure 6. Traditional adobe mill of the eighteenth century.

San Antonio's Flour Mill, on Medina de Rioseco dock was built between 1842 and 1849. Above the irregular cut stone masonry on the ground floor there are four more floors with buttresses and *verdugadas* (a course of brick in a wall of stone or mud). This is a Spanish system since the Almohade period. Empty spaces are covered in adobe, something peculiar to industrial buildings.

Rammed earth buildings

Villaumbrales shipyard or *Casa del Rey* (Royal House) as it is called, with Carlos III rococo coat of arms above the main building door, the only one which remains standing. The dry dock, the warehouse at the lower back and the other buildings have been demolished. It was built in 1799. It supplied barges and mitre-shaped lockgates for the locks. Rammed earth was put up between brick

buttresses above the stone footing. The ground floor, without partition walls, joins its beams in a *Rayo de Júpiter* (zigzag) design.

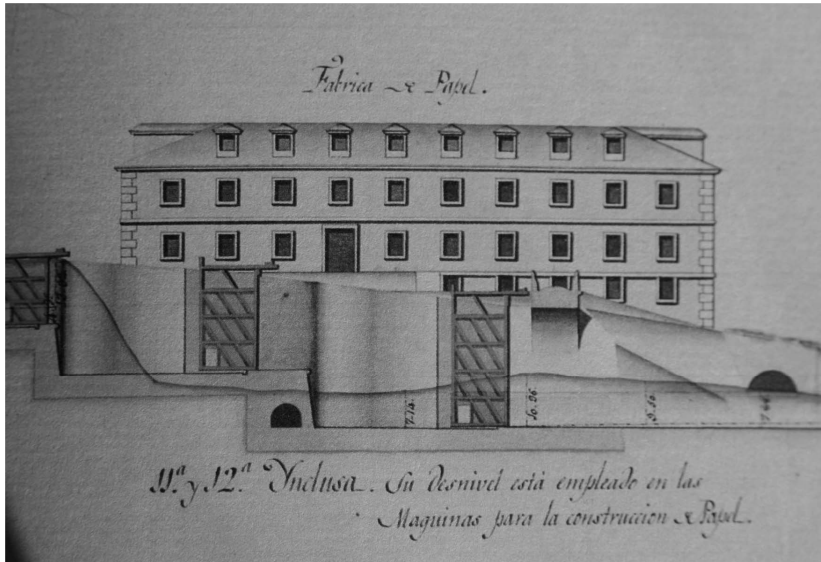


Figure 7. Paper mill on the locks 11-12.

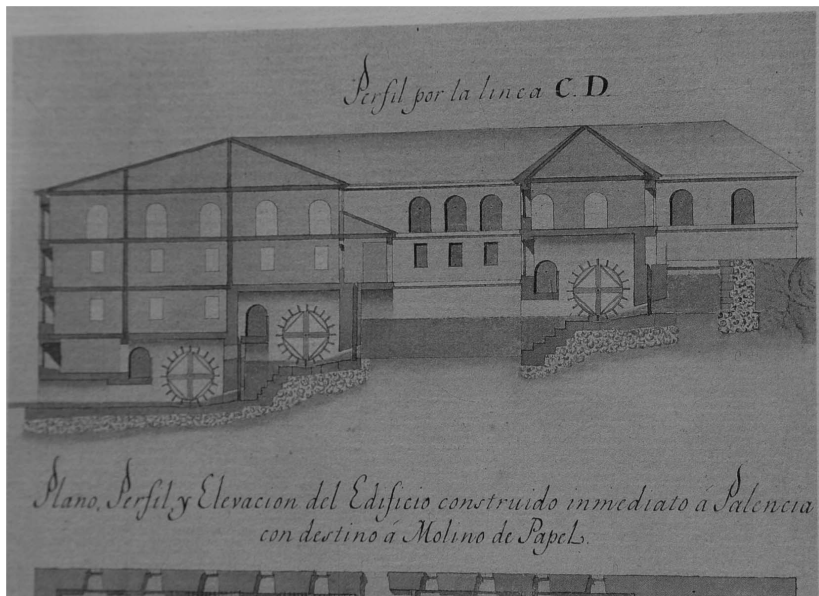


Figure 8. Cross section of the Viñalta's Paper Mill showing its three hydraulic wheels.

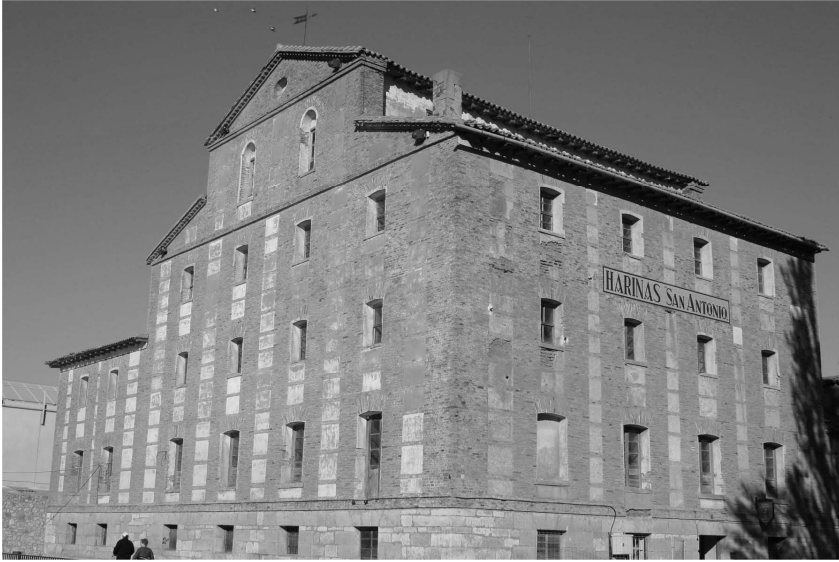


Figure 9. Medina de Rioseco's great Flour Mill.



Figure 10. Construction detail of the same building showing the adobe filling the gaps between the bricks.



Figure 11. The rammed earth walls of a Mill at Frómista.

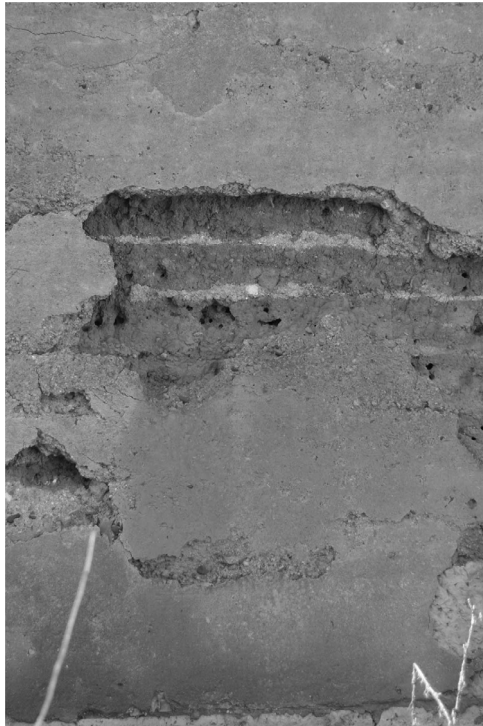


Figure 12. Succession of earth and lime layers in a detail of the previous image.



Figure 13. *Casa del Rey*, built with bricks and rammed earth.

Warehouses

A 96.20 m long warehouse was built in San Fernando, today referred to as Sahagún el Viejo, between 1753 and 1757. There are brick buttresses and rammed earth panels above a limestone footing, such as those we can see in Medina de Rioseco, at both sides of the canal.



Figure 14. Very long warehouses, Medina de Rioseco at the end of the Canal.

CONCLUSION

The Canal of Castilla, an inverted Y shape, flows among earthen industrial buildings which would be sensible to preserve because they help us understand the way of building in the area since prehistoric times.

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