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## Transition histories

# Progress in the nineteenth-century: planning, building and managing the modern urban infrastructures in Coimbra

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**Abstract:** During the 19th century, cities throughout Europe faced a period of transition. The rise in technical skill, the hygienic theories, the urban sanitation and the new forms of transport created an unprecedented transformation in European cities and dictated the emergence of urbanism. Portugal, a small, peripheral country also faced this transition. Moreover, this change was not limited to the urban fabric, it was necessary to create a body of technicians capable of planning and carrying out the major infrastructure works. It was also required to create institutions capable of programming these processes and municipalities had to form technical entities, commission the first topographic surveys and demanded a large dose of politicians' boldness. Coimbra, a medium-sized city, but until the beginning of the 20th century, the settlement of the only Portuguese University, was an example of these process of modernization. However, the size of the city and the lack of entrepreneurs made it difficult and delayed the process. This paper aims to show how during the second half of the 19th century, Coimbra managed to dare to replicate the improvements in progress in Europe and, beyond the expansion of the urban fabric, introduced modern urban infrastructures into the city.

**Keywords:** sanitation, urban planning, infrastructure networks, public service

### The begging of the nineteenth century and the emergence of public health

In Europe, the nineteenth century is a period of transition. Following the industrial revolution, cities changed, not only because of the increase in population and urban area but also because of the new technology and the introduction of new urban infrastructures and new conditions for comfort (Hall, 1997; Sutcliffe, 1980 and 1980).

At the beginning of the century, Coimbra was a medium-sized Portuguese city, yet the seat of the only Portuguese University, a fact that placed the city among the most important Portuguese Cities, just after Lisbon and Porto. However, faced serious health problems, in particular, because of the Mondego River that recurrently invaded the lower part of the city and because of the lack of the modern public infrastructures.

Moreover, the development of medicine and science had led to a growing concern about the urban conditions of cities and the concept of public health. With the emphasis on the French investigations focusing on the health of buildings and spaces carried out by the *Société Royale de Médecine* and by the *Académie des Sciences*, and which underlined the importance of urban conditions in containing epidemics. The concept of *Public Health* was, then, disseminated, published in texts by some doctors who defended the need to create and impose public hygiene regimentations to improve the health of the people.

In Portugal, we must highlight the work of Ribeiro Sanchez, who published the book *Tratado de Conservação de Saúde dos Povos* (Treaty of Peoples' Health) in 1756, one year after the Great Earthquake of 1755. In this book, he defended the need to preserve human health and argued that the population is the first source of national wealth and so should be protected. This idea, at that time, reveals the rise of a new understanding of government, where what mattered was no longer the individual but the people as a whole. This text was very innovative and defined restricted sanitary police regulation, extended to architectural forms and to the organization of cities, pointing out the dimensions and form for squares and green spaces, as well as the location of temples, convents, hospitals, prisons and housing itself.<sup>1</sup>

Despite this innovative thought, only after the cholera morbus epidemic, which devastated the whole of Europe, did the need to reform the city begin to emerge in the early nineteenth century. In this sense, in 1848 London published the Public Health Act and the Law of August 31 which created the General Board of Health, inaugurating a new form of city planning which was to have repercussions throughout Europe, emphasising the importance of urban infrastructure networks, especially water supply and the sewage system for the health of the city.

In Portugal, at the beginning of the nineteenth century was created the *Junta da Saúde* (Health Board) with responsibility for defining a new Health Regulation and for monitoring the country, assessing the "state of cleanliness of the different Cities, Villas, and Places of the Kingdom, and the most effective and convenient way to set up the necessary cleanliness when it does not exist."<sup>2</sup> After the liberal Regime created the first draft of the General Regulation of Public Health in 1821, however, this was a period of great social, political and economic instability and it took fifteen years to publish the definitive regulation and create the Council of Health and the medical district delegates. In the following years, a set of legal documents was published which shows the difficulties and the resistance to the implementation of some of these measures, which implied new habits and ways of life.<sup>3</sup>

The main changes concerning urban planning and the sanitation of cities came after two new cholera epidemics in the years 1855-1866 and a decade later in 1865. As a consequence of these epidemics, most cities built public cemeteries and increased their concern with the water supply of the city.

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<sup>1</sup> According to miasma tic theory, epidemics were the result of poor air quality, caused by the putrefaction of organic materials or the polluting fumes of industries, so it was necessary to guarantee the cleaning of streets and dwellings, especially in the less wealthy zones of population.

<sup>2</sup> Ordinance of August 28, 1813, Article X and XII. (Portuguese Court, 1836)

<sup>3</sup> This resistance lasted through the century, for example, concerning burials in cemeteries or the generalization of vaccines.

### **The installation of modern urban infrastructures. The difficulties of a medium-sized city<sup>4</sup>**

Coimbra in this period was one of the most important of Portuguese cities; however, the city was mono-functionalized around the University and lacked other activities, namely industry. Nevertheless, the University had a huge influence on what happened in the city, if during the Ancient Regime, the presence of the University was compulsory in the City Council. Later, during the Liberal Regime, this influence prevailed, this time, conquered by vote. In fact, between 1834 and 1934, most of the elements of the City Council and the Municipal Senate were professors of the University.

This may explain some of the innovative projects that were planned in the city, like the early initiative in January 1835 to establish a public cemetery in the city – eight months before the first national legislation that established the obligation of the Municipal Council to create spaces for burials.<sup>5</sup> This was probably a consequence of the difficulties experienced during the epidemic that devastated the city in the previous year, and despite this, this measurement reveals the knowledge of the Municipal Council about what was happening in Europe and the will to transform the city in accordance with modern hygienic principles. Thus the council asked for two fences of old monastery buildings, one on each side of the river to create two cemeteries. However, it was only on May 4, 1843, that the government ceded land for the implantation of the municipal cemetery, in the former farm of the College of Tomar. Yet this land was unsuitable for establishing a cemetery and the City Council had to buy Conchada Farm. After many technical and financial problems, the city finally blessed the municipal cemetery in September 1860.

In addition to this improvement, the city required some measurements to prevent the Mondego river flooding, like the upheaval of the low neighbourhood and the construction of a new river bank. The wetness of the land and still water were the focus of unhealthiness, which worried the Municipal Councils who repeatedly asked the government to make these improvements. But while on the one hand, the Mondego had this destructive nature, on the other hand, it was the largest source of water supply for the population. Its water was sold by water sellers in the streets and it was used for washing clothes and for bathing. While the water in the public standpipe was scarce or of poor condition. The municipality tried to solve these problems by diverting the watercourse of some springs on the limits of the city, but the problem persisted.

The first attempt to resolve the situation definitively was in 1865. When António Augusto da Costa Simões, a former mayor and a professor of medicine at the University, went to Paris on a scientific visit and during his visit, offered to hire a technician to study a water supply project through the capture and elevation of the Mondego River water. This idea arose in sequence to a series of analyses carried out in the University's laboratories of the city's water sources in the year 1862, in which it was concluded that the best water for

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<sup>4</sup> This paper is based on the work developed by the author's in her PhD dissertation, in this sense the main reference is Calmeiro, M.R., 2015, *Urbanismo antes dos Planos: Coimbra 1834-1934* (Coimbra: University of Coimbra).

<sup>5</sup> On January 10, 1835, the mayor asked the government for some land from a former monastery to "establish in this city [...] convenient locations for public cemeteries". However, the first national decree to fix the need to create public cemeteries was that of September 21, 1835, in line with the European sanitary legislation created after the cholera epidemic that plagued Europe in the early nineteenth century. Representation of the Chamber of January 10, 1835. In Arquivo Histórico Municipal de Coimbra, Registration of Correspondence, Volume IV, 1829-1835, fl37. Decree of September 21, 1834, (Portuguese Courts, 1837)

consumption was river water. (Simões, 1890). The Municipal Council accepted the offer and Professor Costa Simões hired the engineer Louis- Charles Mary, a well-known engineer (responsible for the water supply project of many European cities like Lisbon or Barcelona), to start the project. Meanwhile, a new Municipal Council was elected, and the project was postponed. A few years later a new council decided to continue the project, but the French engineer's fees were too expensive. Thus, the municipality decided to create invite tenders from companies interested in planning, building and then exploring the new water supply network for the city. There were two proposals, with the winning one from Professor Costa Simões in partnership with engineer Cândido Xavier Cordeiro, a Portuguese engineer who had studied with Mary in Paris. The provisional contract was signed on January 27, 1872. However, this partnership needed to find a construction company with the financial and technical capacity to build their project. Unfortunately, they failed to interest any company and had to request the restriction of the contract in November of that year. The following year, tenders were invited again and Professor Costa Simões and the engineer Cândido Xavier Cordeiro won again, but once again they could not find investors interested in taking on the risk of undertaking the building and exploiting the water supply network of Coimbra.

However, Professor Costa Simões would not abandon the idea. A few years later, as director of the University Hospital, he gained the support of the director of the University Botanical Garden, Professor Júlio Henriques to jointly request a project to supply water to the University. They contacted the engineer Adolfo Ferreira Loureiro, Director of the Improvement Works of the Mondego River. This experienced engineer, confronted with the proposal and recognizing the need to provide this service to the whole city, designed a project that could be extended to the whole city if there was financial support from the central government. On June 20, 1876, the project was presented to the Ministry responsible for the hospitals and the University, but they received no answer.

Meanwhile Professor Costa Simões, again on a study visit in Paris, decided to consult companies to supply the necessary equipment for the execution of the project and was able to establish a partnership with a metallurgical entrepreneur, Hermann Lachappell, for the supply of all the machines and pipes. A new contract was signed with the municipality in February 1879 but the desired water supply network from the Mondego River was postponed once again. The expansion of the project to supply the whole city had tripled the initial budget, and the French businessman was unable to achieve what he had set out to do. But this time Costa Simões managed to pass the contract to an English industrial engineer James Easton, in July 1881. This entrepreneur was trying to build the water supply network in Seville, Spain and the work of the water supply of Coimbra could enhance more projects in Portugal. In December 1881, after finishing the final studies for the network he proposed to also project, construct and explore the sewer network, evoking the reduced number of inhabitants and profit. Despite the need for this improvement, the municipality had no financial capacity and as a consequence, the entrepreneur refused to sign the final agreement and in September 1887 the contract with the English industrial was rescinded, with serious damages to the city, which continued with a water supply from standpipes and faced scarcity and poor quality of water, as well as the lack of any sewage network.

In 1887, a severe outbreak of typhoid fever affected the upper neighbourhood and the university area. According to experts, this fever originated from a water distribution aqueduct, contaminated by a break in a sewer pipe. Because of this incident, the mayor, Professor Luís da Costa e Almeida, asked the government "for the means necessary to undertake the necessary improvements in the city, especially in the sewer pipes and since this was the setting of a remarkable scientific establishment where every year hundreds of students from all parts of the country come"<sup>6</sup>. He also claimed that this crucial work for the University and especially for the University

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<sup>6</sup> Representação de 16 de Junho de 1887. In AHMC, *Representações às Cortes e ao Governo, 1881-1892*.

Hospital should be carried out by the government or at least with its financial support. In response, the government delegated the engineer Adolfo Ferreira Loureiro with the elaboration of a project to create the best sewage system for the city.

### **Transition in the municipal administration, abandoning reliance on private enterprise and spearheading the installation of the new public services**

In 1886, the municipality, headed by João José Dantas Souto Rodrigues, tired of the various attempts to create a modern water supply network and embarked on a new and decisive phase, not only for the water supply but for the future of the city administration. They decided to assume responsibility for the execution of this improvement and undertake the construction of the new water supply network from the Mondego River by their own means. For this, they hired the engineer Adolfo Ferreira Loureiro to update his project approved in 1879. On January 5, 1888, a contract was signed with Eugène Béraud and the work began in March.

At the beginning of 1889, the water pumping station at Porto dos Bentos was ready to operate and in May of that year, the network started to operate. Just nine years after Lisbon and three years after Porto, Coimbra had a modern network of water distribution by mechanical means, with the particularity of it being the exclusive responsibility of the municipality.<sup>7</sup>

Shortly after the construction of the water supply network, the engineer Adolpho Loureiro submitted to the government and the Advisory Board of Public Works and Mines the project and budget for the sewage network for the city. It proposed the use of an innovative solution, applied in Paris, called the *Berlier Metallic Pneumatic System*, composed of a network of iron pipes and collectors connected by pneumatic devices that ensured that the pipes were always empty. It also had the advantage of being easy to apply and completely impermeable and on the other hand, the sewage flow would be reduced, facilitating its use for fertilization of farms along the Mondego valley. Unlike most of the systems applied at that time, this system was designed only for sewage; there was another network for rainwater and this duplication increased the costs but safeguarded the drainage network during river floods. The minister approved the project, but the innovation of the system generated great discussion in the city and as a consequence, when the government invited tenders for the works, the possibility was opened to propose a different solution.

The winners were the engineers José Cecílio da Costa and João da Costa Couraça, who proposed a *System of Continuous Circulation of sewage*, a unitary system for the network of rainwater and sewage. To reduce costs and facilitate implementation, they proposed a set of small section pipes, three main collectors and a reservoir, set up in the Padrão area, which would raise and discharge sewers directly into the irrigation fields of the Mondego valley. (Costa, Couraça, Bessa, 1893)

The construction works began in November 1897 with the main collectors, after which the remaining works would be conducted according to the financial availability of the municipality and with the progressive growth of the city. In fact, at the end of the 19th century, when the city began to build several neighbourhoods and expand its limits, the sanitation network started operating but without the Padrão reservoir, and sewage was

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<sup>7</sup> In Paris, this method of water pumping was used since 1782 and in London at least since 1829. In Lisbon, the method was used early in 1869 but the system had a large deficit of flow and only becomes effective after the water pumping station at Alviela in 1880. (Custódio, 1994 and Pinto, 1972). In Lisbon, the water supply system was leased to Companhia das Águas de Lisboa since 1867. On the issue of municipalization of the Companhia das Águas de Lisboa see Álvaro Ferreira da Silva.(1998 e 2004).

launched directly through the drains of Coselhas into the river Mondego, without treatment and without having been used for fertilizing the fields. The fragmented construction of the network compromised the performance, and only at the beginning of the 20th century was the situation solved.

### **From the municipal water supply network to the municipalization of all urban services**

At the end of the 19th century, in addition to the modern water supply network and the sewage network, Coimbra had a gas network for individuals and public lighting. Thanks to the English entrepreneur Hard Hislop, who was also responsible for the installation of the Porto gas network, the streets and streets of Coimbra had been illuminated by gas since October 1, 1854, one year after Porto and only six years after Lisbon. (Custódio, 1994 and Caetano, 1998)

Regarding the creation of a public transport network, the process was not so fast or simple. The first attempt occurred in 1874 when American Car started to connect the railway station to the city centre (as seen in Figure 1) but lasted only eleven years. In 1885, the new train station near the river in the downtown led the Conimbricense Railroad Company to close. Before that, they had proposed a new line to connect to the Alta, but the new Santa Cruz neighbourhood was not yet built, and the proposal was considered impracticable.

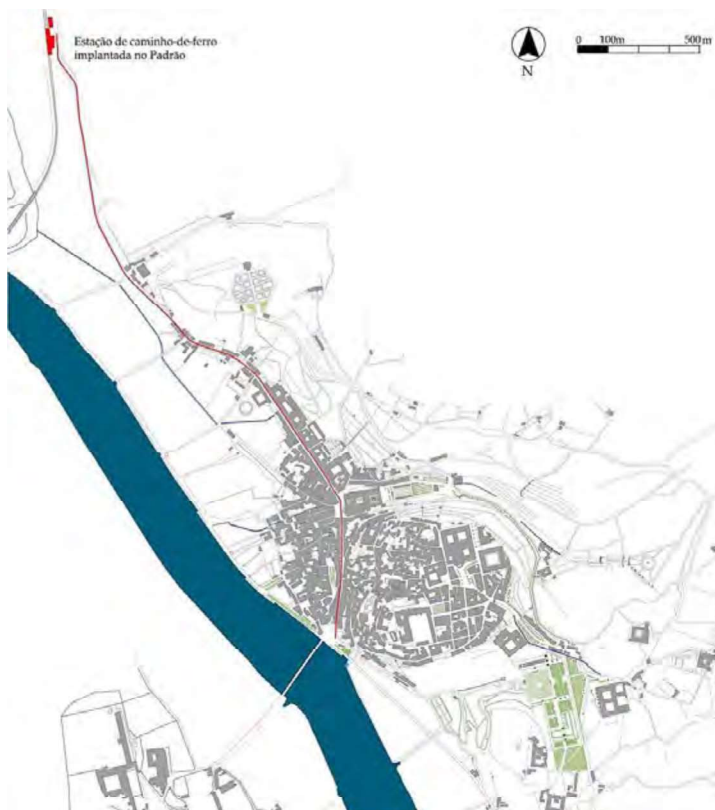


Figure 1 American car route in 1874 (Calmeiro, 2015: 285)

Seventeen years later, the entrepreneur Augusto Eduardo Freire de Andrade, owner of the *Coimbra Carris de Ferro Company*, presented a proposal for the creation not only of a line but of a network articulated with the growth of the city. Although the proposal had the support of the local press, the mayor Manuel Dias da Silva was unwilling to implement it because he wanted an electric system instead, for both public transport and lighting. For this, he invited tenders to introduce electricity in Coimbra. However, the small size of the city did not arouse the interest of external investors and there were no proposals. With this setback, the concession to the Coimbra Carris de Ferro Company was approved and at the beginning of 1904 two lines began to operate, one between the train station and *Largo Príncipe D. Carlos* and another between *Estação Nova* and the Castle.



However, this system of traction using animals soon proved to be inefficient for the slope of the city streets and two years later the concessionaire proposed installing electric traction with the financial support of the municipality. Despite the subsidy, the company started to face financial difficulties, worsened by the death of Augusto Eduardo Freire de Andrade, and the work was postponed.

Meanwhile, the municipality continued trying to install electric light in the city and in 1903 signed a new contract with a Portuguese company, *Almeida e Santos, Lino & Companhia*, but a series of delays led to the termination of the contract. This, in turn, led to a new way for the municipality to work and a new understanding of how urban public services should be managed. The mayor Professor Manuel Dias da Silva tired of the dependence on foreign investors for the municipality decided to repeat the process carried out to install the water supply network and install electricity with municipality resources. Thus, it municipalized the gas factory to create an electricity factory and a new network of electric lighting for all the city.

A few months later a new mayor, Professor Marnoco e Sousa, was elected, a law professor with a new vision of the role of the local administration in the planning and development of cities. As a defender of public service, he was highly critical about the participation of private companies in the city services, affirming even that "the regime of concessions has had its time since only serves to favour the interests of the private companies to the detriment of the community"<sup>8</sup>. Thus, one of his first measures was the municipalization of public urban transport to install electric traction. He claimed that with this municipalization, Coimbra had "the three industrial services of city municipalized – water, lighting, and transport. These services help each other [...] Water is needed for the electricity factory, just like the coke produced by the gas factory. On the other hand, the transport facilitates the transportation of the by-products of the gas factory and helps with this transportation of the coke to the water supply station, solving, in addition, the problem of lighting the great avenues and wide streets of the city with voltaic arcs [...]"<sup>9</sup>

The following July, the Chamber of Deputies approved a loan for the municipalization and installation works for electric traction. On February 11, 1909, the project of the engineer Guilherme de Lima Henriques was approved and work started in September.

On the first day of the year 1911, the electric urban transport network was inaugurated in Coimbra, which became the fourth Portuguese city to have this service, but the first municipality responsible for the service. Shortly after, the electric power of the trams started to be used to light the main streets.

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<sup>8</sup> Marnoco e Sousa's speech in the Chamber Session of April 28, 1905. AHMC. *Vereações*. 1904-1905.

<sup>9</sup> Marnoco e Sousa's speech in the Chamber Session of May 15, 1908. AHMC. *Vereações*. 1907-1909.

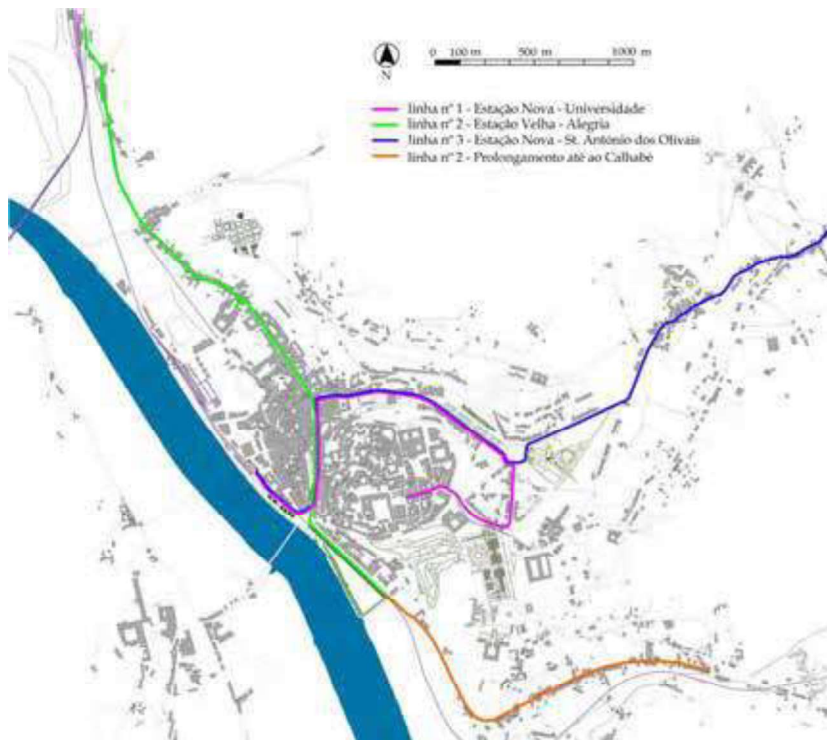


Figure 2 - Electric trams routes in 1913 (Calmeiro, 2015: 290)

### **Integrated city planning - planning and management of infrastructures and the city by the municipality**

Throughout the 19th century, a new way of planning the city was developed. (Tarr and Dupuy, 1988; Tarr 2008) This was as a consequence of the growth of cities and their hygiene and sanitation needs, but also of the new infrastructure networks. These networks introduced new ways of living, a new idea of comfort and can be considered as one of the marks of progress in the urban form. The introduction of these networks required a new city form but also large investments and technical expertise that municipal administrations did not have. Thus, this infrastructure became a private enterprise supplying goods and services. The new public services were dependent on private capital to build and manage them and public administration was limited to the regulation of the concession contracts.

In Coimbra, a Portuguese medium-sized city, this model was not applied. After years trying to build a water supply network by concession, the municipality decided to undertake the installation of the water supply network from the Mondego river, as well as the sewage network, two crucial improvements for the health of the city. A few years later, at the beginning of the 20th century, the innovative procedure continued, with the municipalization of the energy and the public transport networks to install new electric energy for transport and lightning. This new way of acting implied some constraints and delays caused by the financial weakness of the municipality and the lack of technicians working in the municipality. However, this would allow the municipality to plan the city in an integrated way, planning the new neighbourhoods and public services together. Thus, the new public transport lines or the new water, sewage and electricity network were drawn up and planned according to the municipal plan for the city's expansion. The new neighbourhoods were planned together with the new urban infrastructures.

This innovative and integrated means of action gave the municipality a new role in urban planning that had consequences in the evolution of Portuguese urban planning. However, this was only possible due to a group of daring and knowledgeable mayors together with a group of skilled and well-trained technicians.

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