THE INTERNATIONAL
JOURNAL
of THE CONSTRUCTED
ENVIRONMENT

Volume 2, Issue 2

Road Bridges of South-eastern Spain, 1850-1936. Heritage Awaiting Recognition: Recovering a Heritage

María Paz Saéz Pérez, Antonio Burgos Núñez
and Juan-Carlos Olmo-Garcia

COMMON GROUND

www.ConstructedEnvironment.com

THE INTERNATIONAL JOURNAL OF THE CONSTRUCTED ENVIRONMENT
http://constructedenvironment.com/Journal/

First published in 2012 in Champaign, Illinois, USA
by Common Ground Publishing LLC
www.CommonGroundPublishing.com

ISSN: 2154-8587

THE INTERNATIONAL JOURNAL OF THE CONSTRUCTED ENVIRONMENT is peer-reviewed, supported by rigorous processes of criterion-referenced article ranking and qualitative commentary, ensuring that only intellectual work of the greatest substance and highest significance is published.

Typeset in Common Ground Markup Language using CGPublisher multichannel typesetting system
http://www.commongroundpublishing.com/software/

Road Bridges of South-eastern Spain, 1850-1936. Heritage Awaiting Recognition: Recovering a Heritage

María Paz Saéz Pérez, University of Granada, Spain
Antonio Burgos Núñez, University of Granada, Spain
Juan-Carlos Olmo-Garcia, University of Granada, Spain

Abstract: The development of a system of national roads in south-eastern Spain entailed the construction of a considerable number of bridges. Their design incorporated the main novelties of bridge engineering of the day, and, after more than 100 years of service constitute a harmonious ensemble of heritage in which certain salient typologies and other common features can be identified. The present research, based both on the study of the original documents preserved in different archives of the region as well on the identification of bridges that are still standing, has the aim of describing these typologies and common construction trends. At the same time, this represents an initial effort towards their systematic cataloguing as well as a step towards establishing their value and recognition as elements of heritage of the first magnitude.

Keywords: Heritage, Bridges, Roads, Spain, 19 and 20 Centuries

Formation of the State Road System of South-eastern Spain

THE FIRST STEPS to establish a modern road system in Spain were taken in the second half of the 18th century. On the encouragement primarily of the illustrious king Carlos III, six main arteries from the capital, Madrid were laid out, radiating towards the ports and cities of the Spanish periphery. This radial design was to intended be completed afterwards with other complementary roads. However, in the ensuing decades, the country plunged into deep political turmoil (the Napoleonic invasion, civil wars) that paralyzed the materialization of these plans.

From 1840 onwards, construction was resumed, beginning by setting out the basic axes of the national roads in the south-eastern part of Spain. This consisted of two alignments almost perpendicular that crossed at Granada, the most important city of region. The vertical alignment on the map connected this city to the general highway of Andalusia, which north to the town of Bailén and south to the port of Motril on the Mediterranean coast. Meanwhile, the horizontal alignment on the map went from Malaga (to the west), the other large city and the main Mediterranean port of the region, to Granada, continuing eastwards towards the Levant, passing through the towns of Guadix and Baza.

In the mid-19th century, the Spanish government made a notable effort to improve infrastructures by developing roads, specifying their legal framework for construction, and definitively designing the national road system. Thus, in 1860, the first general road plan

The International Journal of the Constructed Environment
Volume 2, Issue 2, 2012, http://constructedenvironment.com/Journal/, ISSN 2154-8587

was approved[1], which basically laid out the road system in south-eastern Spain. The main axes established previously were completed with secondary roads.

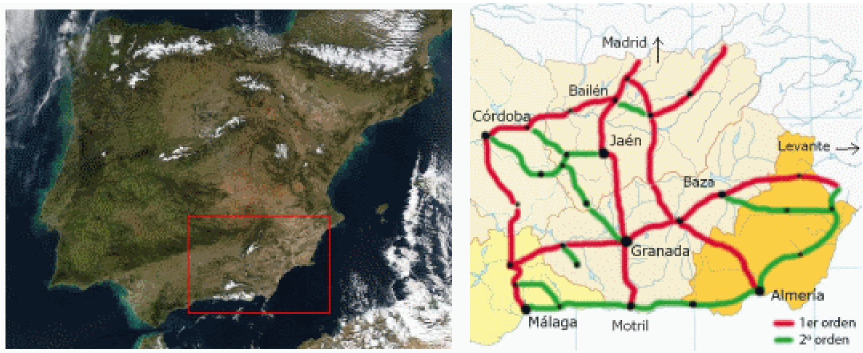

Figure 1: The Main Roads of South-eastern Spain, According to the Plan of 1860 (Drawing by the Authors)

Later, in 1877, a new plan was promulgated[2]. This did not substantially modify the main lines but rather set up a new hierarchy for roads, taking into consideration not only the importance of the cities that were connected but also connections with the incipient rail lines.

During the last third of the 19th century, the road construction was strongly fomented, the main system being practically finished towards 1900 (although some of the most significant ones would take another 20 years to finish in the south-east of the region[3]).

However, with respect to the secondary system (provincial and municipal roads) a plethora of difficulties delayed construction, so that it was not completed until well into the new century. In the 1920s, development surged under the Second Republic of Spain, culminating in the following decade. This plan was designed in the middle of the 19th century and therefore responded to the needs that the country faced at that time. At the end of the 20th century, most of the system was still in service, despite that Spain has undergone sweeping changes (shifting from an agricultural country with a primarily rural population to a tertiary economy with a strong index of urbanization).

The inevitable remodelling came about in the last three decades, without being completely finished even yet (precisely in the south-eastern area some major highways remain incomplete). Nevertheless, the activity has been intense. Although some of the old routes have been partially used, many new lines have been added. In any event, the design of all the roads of the new system corresponded to motorized traffic, which in the case of the old roads involved major transformations and in many cases their disappearance.

However, not all the sections of the old roads have been lost. Through the numerous modifications of the line, many short stretches that did not interfere with any plans were

[1] Real Decreto de 7 de septiembre de 1860, approving the general road plan of the state. *Gaceta de Madrid*, 11 de septiembre de 1860.
[2] Real Decreto de 11 de julio de 1877, approving the general road plan of the state”. *Gaceta de Madrid*, 23 de julio de 1877.
[3] CUÉLLAR VILLAR, D. 2003. Los transportes en el Sureste Andaluz, Madrid, Fundación de los FFCC Españoles, p. 150.

either converted to auxiliary lines of the modern ones or else had simply been left without traffic.

In any case, modernization has not reached the local or provincial system, which remains today practically as it was originally constructed. Also, this has become fused with certain stretches of the main system mentioned above.

These old roads as a whole constitute valuable heritage, especially noteworthy from the standpoint of Civil Engineering. Furthermore, their components alone are valuable and representative testimonials to the construction methods of their time. In the present study, we examine the most outstanding examples of bridges, which are extraordinary for their abundance and diversity.

19th-century Road Bridges of South-eastern Spain, a Broad and Diverse Group

Bridges are often the most significant elements of the entire road infrastructure. Never simple and almost always costly, bridges determine the design of roads, often forcing a new line to pass through the most suitable site for the bridge. In south-eastern Spain, this importance is magnified by the difficulties inherent in the complex orography of the country. All the roads had to include a great number of bridges, though these are not usually large. Except in certain cases, the rivers are not very wide, and therefore road bridges of short or medium spans predominate.

This became one of the main challenges for technicians of the 19th century in laying out the new road system. With sound criteria, they often took advantage of existing bridges, many of which dated even to the Roman period. This was the case for example with the general highway of Andalusia, which crossed the Guadalquivir river in Andújar (Jaén) over the old Roman bridge. Another magnificent bridge that was added to the system was the Renaissance bridge of Benamejí over the Genil river, which was used as the main highway from Cordoba to Malaga until a couple of decades ago.

Figure 2: Bridge of Benamejí over the Genil River (16th Century). Currently in Service as Part of the Secondary Road

In addition, the system included roads constructed in the 18th century. Between 1790 and 1800, the construction of roads and byways surged somewhat in south-eastern Spain, with new or refurbished lines such as that of Malaga to Antequera and Vélez or the one from Guadix to Almería. These roads incorporated a good number of bridges, though their design still followed traditional models.

Figure 3: Jaral Bridge on the Road from Malaga to Vélez, with a Brick Arch of 11 Meters of Span, and with Tympana an Abutments of Rough Stonework, 1789. Domingo Belesta and Diego de Córdova y Pacheco were the Military Engineers

From 1850 on, when construction of the new system began, the art of bridge construction had markedly evolved. At first, those in charge of designing and constructing bridges were specialized technicians, organized in Spain in the prestigious body of "ingenieros de caminos, canales y puertos" (civil engineers) of the state, a select group of professionals of the highest training.

In the design of the new masonry bridges, these technicians put into practice the wide-ranging innovations by the French engineer Jean Rodolphe Perronet in the previous century. Thus, as opposed to the typical structural configuration of round arches supported by powerful piers and abutments, the generalized solution became that of equal segmental arches constructed simultaneously with piers of minimum width.

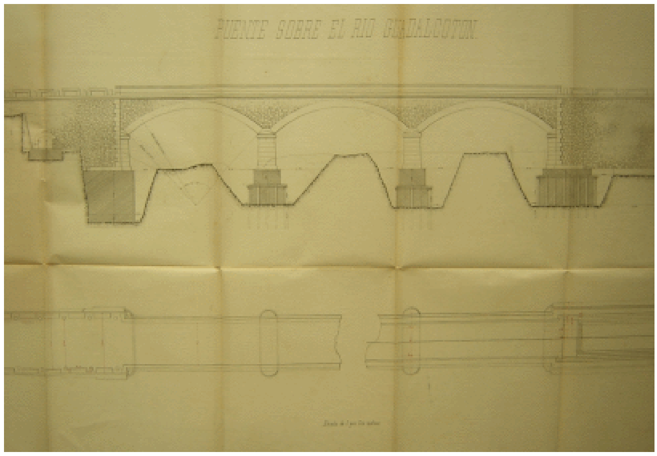

Figure 4: Bridge over the Guadalcotón River, with Three 15-m-span Arches Built of Massive Brick and Concrete, on the Primary Road from Alcaudete (Jaén) to Granada. Fermín Bollo, Civil Engineer. Replaced by a bridge of Reinforced Concrete in 1940

On the other hand, during this period, other major advances in civil engineering were rapidly incorporated in the bridge design and construction. In Spain, metal bridges arrived somewhat late but achieved quick acceptance. Specifically in roads of south-eastern part of the country, a great number were constructed, with different typologies that evolved over the second half of the 19th century. The first bridges were made of straight compound metal girders, which were later replaced first by closed-lattice girders and afterwards by triangulated beams and the Linville truss system. Finally, at the beginning of the 20th century, bowstring-arch bridges became generalized.

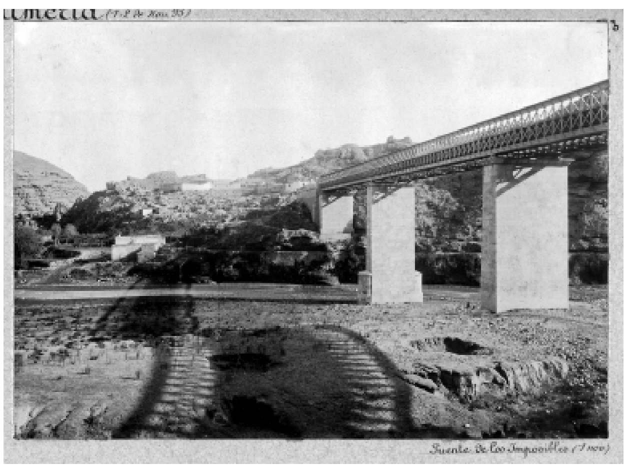

Figure 5: Puente de los Imposibles over the River Andarax, on the Primary Road from Estación de Vilches (Jaén) to Almería. Straight Girder of the Linville-type Lattice, 1893. Valero Rivera, Civil Engineer. Replaced by a Reinforced-concrete Bridge in 1945. Photograph by Paul Sejourné, Courtesy of Marc Giraud

Early in the installation of the road system (1840-1860), all the bridges were of masonry, including those of great dimensions. With the steel bridges, which were more economical and functionally advantageous for large gaps, the masonry bridges were relegated to minor works, though such methods were not entirely abandoned. Quite the contrary, hundreds of such bridges were constructed in this period only on roads of south-eastern Spain.

The situation changed with the appearance of steel-reinforced concrete. When this new construction method began to be used in Spain (at the beginning of the 20th century) the main arteries of the system were already finished, where most of the largest bridges were situated. On the other hand, practically the entire network of provincial and local roads remained to be built, but these did not need large bridges, though they did require a large number of bridges with small spans, pontoons, and culverts.

Steel-reinforced concrete proved the most suitable option for these types of works, becoming rapidly generalized in the roads of south-eastern Spain. This was aided also by government announcements of official collections of standardized bridge plans. The majority structural typology of the reinforced-concrete bridges involved the straight beam over simple supports, although some ingenious engineers, particularly at the end of the period studied, implemented other more refined solutions.

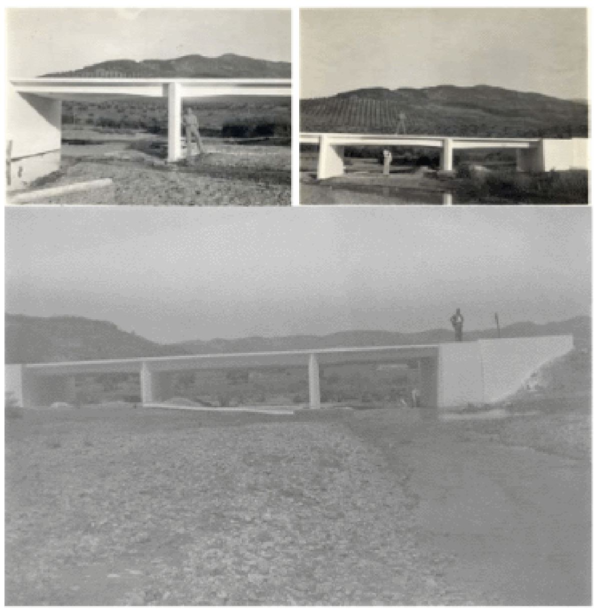

Figure 6: Bridge over the Onsares River, on the Provincial Road from La Puerta de Segura to Siles (Jaén), with a Portal Frame of Three 20-m Spans, 1933. Carlos Fernández Casado, Civil Engineer. Recently Replaced by a Prestressed-concrete bridge. Archive of Carlos Fernández Casado, CEHOPU-CEDEX

Masonry, iron, and steel-reinforced concrete and their structural typologies comprise the majority of the road bridges built in south-eastern Spain, although these were not the only ones. Also, several singular bridges were built, among these some suspension types and many temporary wooden bridges.

Figure 7: Suspension Bridge of 105 m Span over the Guadalquivir in Mengibar (Jaén), on the road from Bailén to Motril, 1845. Eugenio Barrón, Civil Engineer. Disappeared in 1932. Graphics Archive CEHOPU-CEDEX

Thus, between 1840 and 1936, a broad variety of bridges were built in south-eastern Spain with the aim of creating a modern road system. In general lines, these bridges had the same characteristics, both morphologically and structurally, as those constructed in the rest of Spain during the same period. Nevertheless, in the south-east, certain distinctive features were repeated, the examination of which has enabled a preliminary definition and cataloguing of the dominant typologies.

Masonry Bridges. Main Typologies

Among masonry bridges, the most common type is the single-span segmental arch with a narrow span (c. 12 m), embedded in abutments with thick supporting walls.

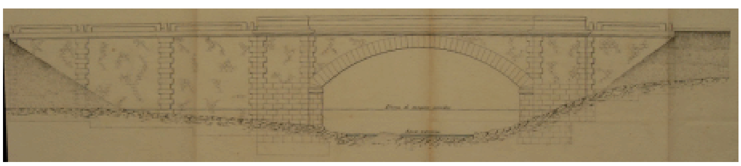

Figure 8: Bridge Project over the Arroyo Herreros Stream (Jaén). Secondary Road from Jaén to Albacete by way of Úbeda and Baeza, 1877. José Iturralde, Civil Engineer. Historical Archives of the Province of Jaén

Figure 9: Bridge over the Arroyo Velillos Stream in Pinos Puente (Granada), on the Secondary road from Alcaudete to Granada by way of Alcalá la Real. Last Quarter of the 19^{th} Century

Figure 10: Bridge over the Alhama River (Granada), on the Secondary Road from Armilla to Alhama de Granada. Last Quarter of the 19^{th} Century

For wider and shallow valleys, combinations of these arches and the traditional round arch were used indifferently.

Figure 11: Bridge over Arroyo Salado Stream in Porcuna (Jaén), on the Secondary Road from Torredonjimeno to El Carpio by way of Bujalance. Last Quarter of the 19th Century

Figure 12: Bridge over Chíllar River in Nerja (Málaga), with three Arches of 16 m in Spans, on the Secondary Road from Málaga to Almería. Last Quarter of the 19th Century

In the deep valleys, the round arch was more commonly used, in combination with different spans and slender piers.

Figure 13: Izbor Bridge (Granada), with a 23-m-span main Arch and Three 7-m-span Access Arches, on the Primary Road from Granada to Motril. Third Quarter of the 19th Century

Figure 14: Gérgal Bridge (Almería), with a 20-m-span main Arch and Two 6-m-span Access Arches, on the Primary Road from Las Correderas to Almería. Last Quarter of the 19th Century

Another common type was the viaduct composed of many arches of narrow spans and small piers of great height.

Figure 15: Rambla de Huéchar Viaduct (Almería), with five 14-m-span Arches over Sloped Piers 30 m High, on the Primary Road from Las Correderas to Almería. Third Quarter of the 19th Century

All these masonry bridges are characteristic of the first stage of development of the road system. From the last third of the 19th century, for viaducts of middle-sized spans, metal bridges were imposed, resolving the problem in a much more economical way. Consequently, the costly large masonry arches were no longer constructed on Spanish roads[4]. On the other hand, the smallest bridges continued to be built of masonry for a few decades more and did not disappear until the generalization of steel-reinforced concrete in the 1920s.

The chapter of the masonry bridge ended with a specific typology in south-eastern Spain, which did not appear in any other place: bridges over *ramblas* (seasonal water courses). That is, in the most easterly part of the area, where the climate was almost sub-desertic, permanent water courses hardly existed, the majority being ramblas which were dry most of the year. In autumn, however, sporadic flow could be extraordinarily intense, carrying the only rain that fell during the year and thus giving rise to sudden, short-duration torrential flows of great volume.

All the linear infrastructures found here encountered the problem of crossing the wide, shallow valleys that were usually dry but with the risk of powerful flash flooding. The engineers responsible for the roads of the 19th century resolved the problem in a practical way with alignments of small arches.

[4] Gaztelu, L. "Los grandes arcos de fábrica en los puentes de España". *Revista de Obras Públicas*, número extraordinario de 12 de junio de 1899.

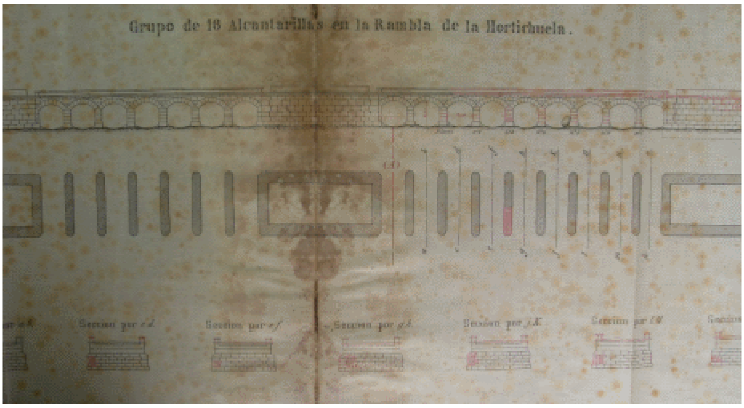

Figure 16: Grouping of 16 Culverts in the la Rambla de la Hortichuela (Almería). Road-Repair Project of the Primary Road from Malaga to Almería, 1883. Juan Ezcurdia, Civil Engineer. Historical Archives of the Province of Almería

Afterwards, these alignments were made more complete, combining arches with wide spans and retain walls. This gave rise to the typology known as "rambla bridges", one of the best examples being the bridge of Rambla de Valcabra, composed of 29 arches of different spans and two buttresses, for a total length of 240 m.

Figure 17: Bridge of Rambla de Valcabra in Caniles (Granada), on the Secondary Road from Baza to Huércal Overa by way of Purchena. Last Quarter of the 19th Century

Metal Bridges. Main Typologies

Metal bridges were introduced in Spain towards the middle of the 19th century. Their acceptance was swift, with a great number being built between 1860 and 1910. However, today very few remain, as opposed to masonry bridges, because of the periodic need for maintenance, which the government neglected. Most were replaced in the 1940s and 50s by reinforced-concrete bridges. Those that survived are located on minor secondary roads and for the light traffic did not justify the construction of a new bridge. In this way, we can cite those that are still in service today.

When they were introduced into Spain, more advanced countries such as Great Britain and France had already accumulated great experience in their design and construction, and therefore their technology as well as their designs were imported for the construction of Spanish bridges.

The first metal bridge in the south-east of Spain was built over the Víboras river (1863). Although it had been projected by Spanish technicians (an official commission formed by three prestigious civil engineers), its design was based on a British model, being formed by straight compound metal girders with a 60-m span, supported on an intermediate masonry pier. This laminated iron girder was manufactured in England and shipped to Andalusia.

Figure 18: Bridge over the Víboras River in Martos (Jaén), with a Straight Beam with Two 30-m Spans, on the Secondary Road from Alcaudete to Granada by way of Alcalá la Real, 1863. Lucio del Valle, Víctor Martí, and Ángel Mayo, Civil Engineers

Without changes to the structural model in the following bridges the compound metal girders would give way quickly to closed lattice, which were less expensive and simpler to handle. One of the few examples of this type that has survived in south-eastern Spain is the bridge over the Vélez river in Torredelmar (Malaga).

Figure 19: Bridge over the Vélez River in Torredelmar (Malaga) with a Straight Beam having Five 20-m spans, on the Road from Malaga to Almería, Towards 1865

However, despite that in these first experiences British influence was determinant, French models eventually became predominant. In the final third of the 19th century, French construction companies practically monopolized the construction of Spanish rail lines. In this way, their influence in this field of engineering was great.

The great viaducts designed by Wilhelm Nordling for the train lines of the French Massif Central (Bouble, Bellon, Rouzat, and Neuvial)[5] made a profound impression on Spain, where they were rapidly imitated. The Linville-type open-lattice beams became generalized both for train trestles as well as road bridges. Unfortunately, none of the ones constructed in the Spanish south-east has survived. However, several bridges with bracing X truss (inspired by the designs of Eiffel) have survived. These were reserved for single-span bridges on the order of 20 to 30 m.

[5] AGUILÓ ALONSO, M. 2008. Forma y tipo en el arte de construir puentes, Madrid, Abada Editores.

Figure 20: Bridge over the Campanillas River, with Triangulated Metal Beams on a Single Stretch with a 30-m Span, on the Road from Málaga to Almogía (Province de Málaga). At the End of the 19th Century

Another type that was also widely accepted among Spanish bridge designers was the bow-string arch. The last great metal bridges constructed in this way dated to the early 20th century. Of the many that were built in south-eastern Spain, only that of Luis Armiñan over the Genil river (Córdoba) and that of Cantoria over the Almanzora river (Almería) survive.

Figure 21: Bridge over the Almanzora River in Cantoria (Almería), with a Bowstring Arch having a 60-m Span, 1925. Ángel Ochotorena, Civil Engineer

Reinforced-concrete Bridges. Main Typologies

In Spain, the method of steel-reinforced concrete was introduced very soon, coming into general use in the country during the 1920s. It was perhaps in bridges that this method was most rapidly accepted, quickly replacing masonry bridges and shortly afterwards metal ones.

When the new materials came onto the scene, the development of the road system entered a new phase. The main system had already been practically finished and what was urgent was to undertake the construction of secondary roads. This was greatly delayed, so that the government pushed for measures to facilitate its design. One of the most successful initiatives was the writing of official collections of standardized plans of steel-reinforced bridges for roads. These included designs for the most common situations.

The first of these collections, prepared by the civil engineer Juan Manuel de Zafra, was dedicated to straight beam bridges. It included two basic types of bridges, those of beams with transversal cross-sections in p and those composed of triangulated beams. Two years later, the collection of arched bridges would come to light, conceived by the civil engineer José Eugenio Ribera[6].

The immense majority of the Spanish road bridges constructed after 1920 correspond to some of the basic formulas included in these collections. On the other hand, time has confirmed the suitability of their design, as a large number of these bridges have remained intact with hardly any maintenance.

The most common type were without a doubt the simple straight beams of transversal section in p. Almost all the bridges with narrow spans (on the order of 10 m) followed this design, hundreds of them appearing along the roads of south-eastern Spain.

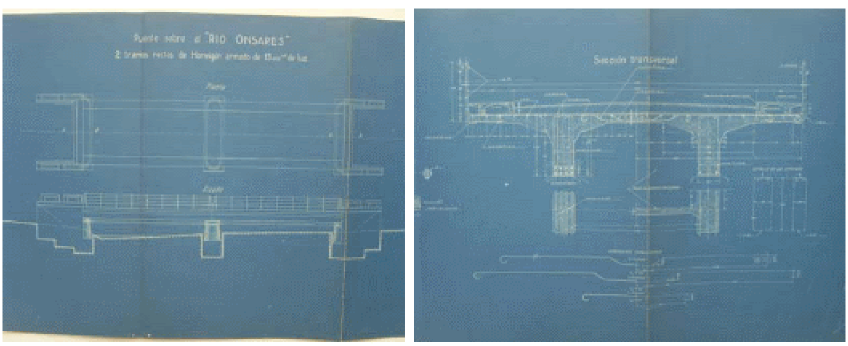

Figure 22: Bridge Project over the Onsares River on the Tertiary Road from Puerta de Segura to Siles (Jaén), 1929. J. Acuña, Civil Engineer. Historical Archives, Province of Jaén

[6] R. Del Cuvillo. Colecciones oficiales de obras de paso de carreteras (siglos XIX y XX). p.p. 15-60, Colegio de ingenieros de Caminos, Canales y Puertos. Madrid, 2007.

Figure 23: Bridge over Granadillas Stream in Benagalbón (Malaga), with a Straight Beam of Steel-Reinforced Concrete of Transversal Section p of a 15-m Span, 1920-30

The model of triangulated beams was put into practice on some occasions, to construct viaducts of substantial lengths.

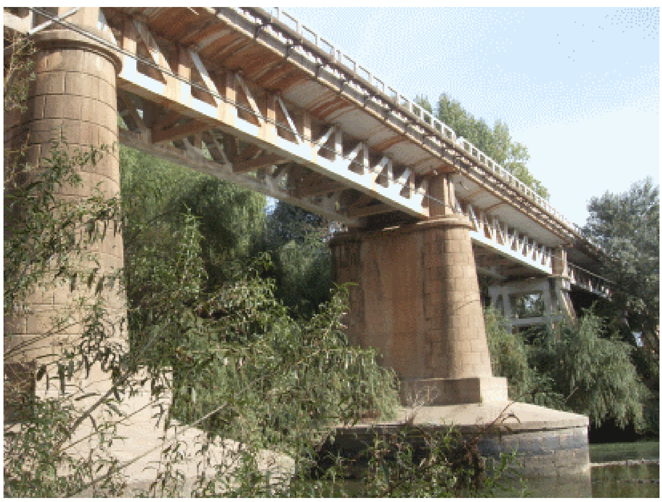

Figure 24: Bridge over the Guadalquivir River in Villanueva de la Reina (Jaén), with 12 Straight Sections of Triangulated Beams of Steel-reinforced Concrete of 20-m Spans Each, over Piers of Masonry and Paling Fences of Reinforced Concrete, 1929

However, most of the bridges with medium to large spans of south-eastern Spain are built with steel-reinforced concrete. According to the models of the collection, all are deck bridges, generally supported by piers supporting two twin arches with transverse bracing.

Figure 25: Bridge over the Guardal River in Huéscar (Granada), with an Arch and a Straight Stretch of 36-m and 17-m Span, Respectively, 1927. José Mendez and Rodríguez Acosta, Civil Engineers

Also, the barrel vaulting under a deck supported by transverse walls became a general solution.

Figure 26: Bridge over the Almanzora River in Purchena (Almería), on the Road from Baza to Huercal–Overa, 1929. Ángel Elul, Civil Engineer (Photograph Prior to its Restoration)

The years preceding the Spanish Civil War in south-eastern Spain saw the first examples of the *Bridge Collection of Strict Height*, conceived by the great civil engineer Carlos Fernández Casado. These correspond to the most advanced stage in the evolution of reinforced-concrete bridge design, immediately prior to the appearance of prestressed concrete.

Figure 27: Bridge over the Vega River in Santo Tomé (Jaén), with a Gantry of 3 Spans (6 m +8 m+6 m) and a Reinforced-Concrete Continous Slab Deck, 1933. Carlos Fernández Casado, Civil Engineer

Bridge Survival. Current Situation and the Problem of Conservation

The road system that was developed in the second half of the 19th century did not undergo major variations until only a few decades ago. In the last quarter of the past century, it has been the object of profound and accelerated modernization, materialized in the laying out of new routes and in the adaption of a good part of the existing ones to the needs of current-day traffic. Nevertheless, a good part of the traditional roads have been maintained, although reorganized to form new trajectories and with the routes profoundly modified.

However, for functional reasons, it has not been possible to incorporate old bridges in these new infrastructures, despite that many, especially the masonry type, have reached the present in good condition. In any case, at least in south-eastern Spain, most of the bridges continue in service, whether reused for accessory branches or in old stretches adapted as local roads and even marginal byways. In this manner, their conservation is relatively ensured.

Figure 28: Bridge over the Nacimiento River in Abla (Almería) with Five Arches of 18-m Spans, on the Primary Road from Estación de Vilches to Almería, 1868. Juan Ezcurdia, Civil Engineer. Currently Reused as a Branch of the Exit for Freeway A-92

Others, on the other hand, stand on abandoned roads, so that their original use is irretrievable. They survive, despite the adversity, because in general they occupy areas free from urban pressure and their presence is not a disturbance. However, time is taking its toll and they are beginning to show symptoms of deterioration.

Figure 29: Bridge of Masonry Arches Near Nerja (Málaga), on an Abandoned Road from Malaga to Almería along the Coast. The Modern Bridge that Appears in the Background is on Another Old Stretch of the Highway, Today Replaced but Still in use as a Secondary Road

Conclusions

The development of the national road system in the second half of the 19th century gave rise to the construction of numerous bridges of different materials and typologies. A good part of these were made of stone, incorporating construction innovations and design representative of the last stage in the evolution of these types of bridges.

The bridges constructed in this period in south-eastern Spain, though their design in general terms corresponds to models that could be considered standardized, nevertheless show specific qualities that make certain dominant types recognizable.

In service or not, the old bridges of the 19th and 20th centuries that are conserved constitute an ensemble of heritage of the first order, underscoring the urgent need to undertake studies and formulate plans for conservation.

References

ALMENDRAL LUCAS, J.M. 1986. *Jaén desde sus obras públicas*, Madrid, Colegio de ingenieros de Caminos, Canales y Puertos.
ALZOLA Y MINONDO, P. 1899. *Historia de las Obras Públicas en España*; reedición: Colegio de ingenieros de Caminos, Canales y Puertos, Madrid, 1979.
CUÉLLAR VILLAR, D. 2003. *Los transportes en el Sureste Andaluz*, Madrid, Fundación de los FFCC Españoles.
DE LAS CASAS GÓMEZ, A (dir). 2000. *Catálogo de la exposición Obras Públicas en Andalucía*, Madrid, Ministerio de Fomento-Cehopu.
FERNÁNDEZ TROYANO, F. 1999. *Tierra sobre el agua. Visión histórica universal de los puentes*, Madrid, Colegio de ingenieros de Caminos, Canales y Puertos.
LÓPEZ GALAN, J.S. y MUÑOZ MUÑOZ, J.A. (coord). 2008. *Guías de Almería. Arquitectura tradicional*, Almería, Instituto de Estudios Almerienses
MINISTERIO DE FOMENTO, 1878. *Obras Públicas de España, año 1878*; reedición: Ministerio de Fomento-Cehopu, Madrid, 2007.
RIBERA, J. E. 1925. *Puentes de fábrica y de hormigón armado,* Madrid, Talleres Gráficos Herrera.
URIOL SALCEDO, J. I. 1992. *Historia de los caminos de España,* Madrid, Colegio de ingenieros de Caminos, Canales y Puertos.

About the Authors

Dr. María Paz Saéz Pérez
University of Granada, Spain

Dr. Antonio Burgos Núñez
University of Granada, Spain

Dr. Juan-Carlos Olmo-Garcia
University of Granada, Spain

THE INTERNATIONAL JOURNAL of THE CONSTRUCTED ENVIRONMENT

COMMON GROUND

The Constructed Environment Community

This knowledge community is brought together around a common shared interest in the role of the Constructed Environment. The community interacts through an innovative, annual face-to-face conference, as well as year-round virtual relationships in a weblog, peer reviewed journal and book series—exploring the affordances of the new digital media.

Conference

Members of the Constructed Environment Community meet at The International Conference on the Constructed Environment, held annually in different locations around the world. The Conference was held in Venice, Italy in 2010 and the University Center in Chicago, USA in 2011. In 2012, the Conference will be held at the University of British Columbia, Vancouver, Canada.

Our community members and first time attendees come from all corners of the globe. The Conference is a site of critical reflection, both by leaders in the field and emerging scholars and teachers. Those unable to attend the Conference may opt for virtual participation in which community members can submit a video and/or slide presentation with voice-over, or simply submit a paper for peer review and possible publication in the Journal.

Online presentations can be viewed on YouTube.

Publishing

The Constructed Environment Community enables members to publish through three mediums. First by participating in the Constructed Environment Conference, community members can enter a world of journal publication unlike the traditional academic publishing forums—a result of the responsive, non-hierarchical and constructive nature of the peer review process. *The International Journal of the Constructed Environment* provides a framework for double-blind peer review, enabling authors to publish into an academic journal of the highest standard.

The second publication medium is through the book series The Constructed Environment, publishing cutting edge books in print and electronic formats. Publication proposal and manuscript submissions are welcome.

The third major publishing medium is our news blog, constantly publishing short news updates from the Constructed Environment Community, as well as major developments in the various disciplines of the constructed environment. You can also join this conversation at Facebook and Twitter or subscribe to our email Newsletter.

Common Ground Publishing Journals

AGING Aging and Society: An Interdisciplinary Journal Website: http://AgingAndSociety.com/journal/	**ARTS** The International Journal of the Arts in Society. Website: www.Arts-Journal.com
BOOK The International Journal of the Book Website: www.Book-Journal.com	**CLIMATE CHANGE** The International Journal of Climate Change: Impacts and Responses Website: www.Climate-Journal.com
CONSTRUCTED ENVIRONMENT The International Journal of the Constructed Environment Website: www.ConstructedEnvironment.com/journal	**DESIGN** Design Principles and Practices: An International Journal Website: www.Design-Journal.com
DIVERSITY The International Journal of Diversity in Organizations, Communities and Nations Website: www.Diversity-Journal.com	**FOOD** Food Studies: An Interdisciplinary Journal Website: http://Food-Studies.com/journal/
GLOBAL STUDIES The Global Studies Journal Website: www.GlobalStudiesJournal.com	**HEALTH** The International Journal of Health, Wellness and Society Website: www.HealthandSociety.com/journal
HUMANITIES The International Journal of the Humanities Website: www.Humanities-Journal.com	**IMAGE** The International Journal of the Image Website: www.OntheImage.com/journal
LEARNING The International Journal of Learning. Website: www.Learning-Journal.com	**MANAGEMENT** The International Journal of Knowledge, Culture and Change Management. Website: www.Management-Journal.com
MUSEUM The International Journal of the Inclusive Museum Website: www.Museum-Journal.com	**RELIGION AND SPIRITUALITY** The International Journal of Religion and Spirituality in Society Website: www.Religion-Journal.com
SCIENCE IN SOCIETY The International Journal of Science in Society Website: www.ScienceinSocietyJournal.com	**SOCIAL SCIENCES** The International Journal of Interdisciplinary Social Sciences Website: www.SocialSciences-Journal.com
SPACES AND FLOWS Spaces and Flows: An International Journal of Urban and ExtraUrban Studies Website: www.SpacesJournal.com	**SPORT AND SOCIETY** The International Journal of Sport and Society Website: www.sportandsociety.com/journal
SUSTAINABILITY The International Journal of Environmental, Cultural, Economic and Social Sustainability Website: www.Sustainability-Journal.com	**TECHNOLOGY** The International Journal of Technology, Knowledge and Society Website: www.Technology-Journal.com
UBIQUITOUS LEARNING Ubiquitous Learning: An International Journal Website: www.ubi-learn.com/journal/	**UNIVERSITIES** Journal of the World Universities Forum Website: www.Universities-Journal.com

For subscription information please contact
subscriptions@commongroundpublishing.com