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O1 INTELLECTUAL OUTPUT
Output type: Studies / analysis –
Best practice guidelines / report

REVIEW



BEST PRACTICES

In Educating Sustainability
and Heritage

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MARIA PHILOKYPROU
ANA NIKEZIĆ
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PARTNERS:

The University of Belgrade - Faculty of Architecture // Serbia
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The University of Seville // Spain

**Enhancing of Heritage Awareness and
Sustainability of Built Environment in
Architectural and Urban Design Higher Education**



CONTRIBUTORS:
HERSUS CONSORTIUM MEMBERS

UB-FA
Vladan Djokić
Ana Radivojević
Ana Nikezić
Jelena Živković
Nataša Čuković Ignjatović
Milica Milojević
Jelena Ristić Trajković
Aleksandra Milovanović
Aleksandra Đorđević
Mladen Pešić
Bojana Zeković
Tamara Popović
Nevena Lukić

IUAV
Emanuela Sorbo
Enrico Anguillari
Sofia Tonello

UCY
Maria Philokyprou
Aimilios Michael
Panayiota Pyla
Odysseas Kontovourkis
Maria Nodarakis
Theodora Hadjipetrou
Stavroula Thravalou
Andreas Savvides

AUTH
Konstantinos Sakantamis
Alkmini Paka
Kleoniki Axarli
Maria Doussi
Angeliki Chatzidimitriou
Sofoklis Kotsopoulos

USE
Mar Loren-Méndez
Marta García-Casasola
Daniel Pinzón-Ayala
Julia Rey Pérez
José Peral López
María F. Carrascal-Pérez
Enrique Larive
Roberto F. Alonso-Jiménez
María Alvarez de los Corrales

EXTERNAL COLLABORATORS:

Remorker architects
Dejan Miljković, Jovan Mitrović, mr Branko Pavić
Mihailo Timotijevic, Miroslava Petrovic-Balubdzic
Chryso Herakleus, University of Cyprus
Fabrizio Antonelli, The Iuav University of Venice
Municipality of Thessaloniki
Municipality of Pavlos Melas
State Museum of Modern Greek Culture
Miguel Hernández and Esther López, PhD architects. AF6 Arquitectura
Luis Machuca, PhD architect. Luis Machuca y Asociados
Miguel Angel Ramos Puertollano, Quality Surveyor. Antonio Jiménez Torrecillas architectural firm
Francisco Reina Fernández-Trujillo, architect
Victoria Segura Raya, Architect, Responsible of geo urban data IDE Sevilla, Department of Sustainability and Urban Innovation, Sevilla Town Council

IMPRESUM

EDITORIAL BOARD:

Vladan Djokić, Maria Philokyprou,
Ana Nikezić, Emanuela Sorbo,
Konstantinos Sakantamis, Mar Loren-
Méndez / *HERSUS Scientific Coordinators*

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IO1 lead: Maria Philokyprou, UCY

HERSUS Project leader: Vladan Djokić, UBFA

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CREHAR
UNESCO Chair

SPAIN

✕

Marta García-Casasola

Daniel Pinzón-Ayala

* Information, text, images, drawings
and plans provided by
Luis Machuca Santa-Cruz

project

03

El Caminito del Rey (King's Path)

Recovery of King's Path, Gaitanes Gorge

IDENTIFICATION

Designations

- ✗ Los balconillos (The little balconies)
- El Chorro
- Service Road of the hydroelectric dam of The Gaitanejo

Information about the location

- ✗ Rural
- ✗ Mountain

Address

- ✗ Paraje Natural Desfiladero Natural de los Gaitanes (Álora, Antequera, Ardales).

Country / Region

- ✗ Spain / Málaga

Coordinates

(GIS: ETRS89 / Google Maps: WGS84)

- ✗ 342083.01, 4087033.13
- 36°54'57.97"N, 4°46'22.08"W

City size

- ✗ N/A

Website

- ✗ <http://www.caminitodelrey.info/es>
- <http://luismachuca.com/proyectos/recuperacion-del-caminito-del-rey-desfiladero-de-los-gaitanes-3/>
- <http://luismachuca.com/proyectos/centro-de-recepcion-de-visitantes-caminito-del-rey/>
- <http://luismachuca.com/proyectos/control-de-entrada-caminito-del-rey/>



Figure 1. View of the bridge into The Gaitanes Gorge.
Author: © Duccio Malagamba, 2015.
Source: Luis Machuca y Asociados, S.L.P.

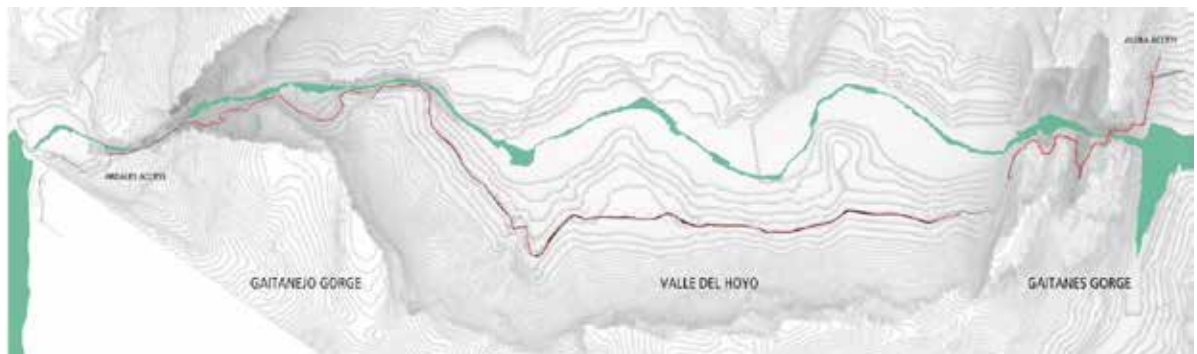


Figure 2. Location Map. Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey".
Author: Luis Machuca y Asociados, S.L.P.
Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey". In: Arquitectura Viva.

Accessibility

X Public

Public visits

X Yes

Category

X Architectural project
Reuse (Adaptive)
Other

X Landscape
Intervention
Preservation

X Infrastructure planning
X Cultural planning

Deliberative and participatory planning

X No

Current use

X Turistic Path

Year (period) of the project renovation / restoration

X 2014-2015: El Caminito del Rey

Area of the building (m²)

X The total length of the route is 7.7 km, divided into 4.8 km of dirt tracks and access roads and 1.9 km of footbridges anchored in the vertical walls of the gorges.

Current owner

X Public: Diputación de Málaga

Architects

X Luis Machuca y Asociados, S.L.P.

Other designers / engineers

X Collaborators:
María Luisa Escudier Vega, Manuel José Rodríguez Ruiz, Borja Peñalosa Bejarano (Architects).
José Luis Escola (Civil Engineer)
José Ángel Mata (Industrial Engineer)
José Luis Juanas (Quantity Surveyor)
Juan Schwarzmann Fernández (Quantity Surveyor)

Other agents

X Encarna León (Geographer)
Aurora Quesada (Biologist)
Carlos Vasserot (Economist)
Amor Oliveira (Legal Advice)

Developer

X Diputación de Málaga; Municipalities of Álora, Antequera y Ardales; Junta de Andalucía

KEY FEATURES



Remarkable attributes / Singularities / Specific Values

- > It maintains the current landscape and does not damage the environment, as it is natural heritage.
- > It preserves the memory of the old path as industrial archaeology.
- > Restores accessibility to a natural and cultural landscape. It foresees the human impact on the surrounding area with the opening of the path.
- > Solves the complexity of the project with a moderate budget and a simple design.

Scope of application / necessity of the project:

The recovery of the path is not only relevant as a tourist attraction but also involves the vindication of the history and heritage of the Gaitanes.

The aim of the project has been achieved through a mimetic construction system with the escarpment, reinterpreting previous obsolete structures, and which adapts to the vertical topography as if it were a living being that adheres to the rock, and therefore organic: the idea was to create something new but to make it look as if it had always been there.

Building contractor

- ✗ Grupo SANDO and Hermanos Campano, S.L.

Cost of the project / execution time

- ✗ 2.240.000 € / 10 months

Previous studies (Ex. Archaeological, historical, structural, materials, etc.)

- ✗ There was no documentation of vertical topography, and so some tests were carried out on the rocks. Historical, Archaeological and characterisation studies were carried out, the results of which were compiled in several publications.

HISTORY OF THE BUILDING/SITE



Original use

- ✗ Industrial
- ✗ Commercial
- ✗ Other

HISTORIC USES

Service road: The path was built at the beginning of the last century in 1901-1905 with the intention of having control and maintenance of the canal and also to give access to the workers from the Conde de Guadalhorce dam to the hydroelectric power station of El Chorro. Thus, the workers and their families living in the settlement El Chorro avoid the long way through the sierra. Communication path: The Caminito del Rey was of great help to the local inhabitants. Children could go to the nearby school, women could buy essential products and it allowed them to keep in touch with other nearby villages in the surrounding mountains (cave houses).

CONSTRUCTION PERIOD

- 1904: Aqueduct bridge
- 1901 / 1905: El Caminito del Rey



Figure 3. Previous state of the footbridge. Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey".

Author: Luis Machuca y Asociados, S.L.P.

Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey". In: Arquitectura Viva.

SUMMARY OF MAJOR FUNCTIONAL AND STRUCTURAL CHANGES / YEAR OF INTERVENTION

Once it lost its industrial relevance at the end of the 20th century, it has remained in ruins due to the action of nature itself, the passing of time, and vandalism.

ARCHITECTS / AGENTS

Aqueduct bridge: Eugenio Ribera (Engineer)

PHYSICAL CONDITION BEFORE RESTORATION / RENOVATION

The old trail died when it became unusable, obsolete for the local people. The trail was described as one of the most terrifying hikes in the world, closed for 20 years.

STATUS OF PROTECTION

The Caminito del Rey is located in the Desfiladero de los Gaitanes Natural Park, declared by the Junta de Andalucía. Furthermore, this site belongs to Natura 2000: European ecological network of biodiversity conservation areas, as evidenced

by its declaration as a Special Area of Conservation (SAC) and Special Protection Area for Birds (SPA).

Since 2019, the Caminito del Rey is preparing its candidacy to become a UNESCO World Heritage Site.

GENERAL DESCRIPTION OF THE BUILDING BEFORE ITS RENOVATION / RESTORATION

The hanging walkways were originally built with metal squares embedded in the rocks supporting wooden planks. Basically the structure consisted of corbels embedded in the rock, the joint with beams are tied together with plenty of wire, the beams support vaults and solid wooden planks joined together with lime mortar. The metal beams were actually railway rails.

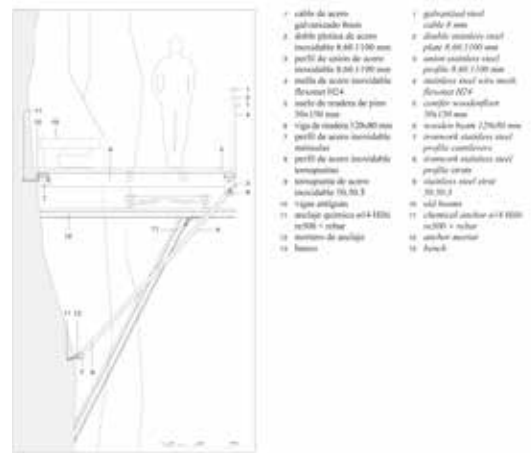


Figure 4. Construcción detail of the new footbridge over the older one

Author: Luis Machuca y Asociados, S.L.P.

Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey". In: *Arquitectura Viva*.

PROJECT DESCRIPTION

DESIGN PROJECT IDEA FOR THE RENOVATION / RESTORATION

The design solution of each piece is useful, and everything has a purpose, no useless ornaments. Nothing is superfluous. The design is an organic body, really a centipede-like mecano that has adapted to the escarpment walls.

There are seven parts of the route:

- Visitor Reception Area Shuttle bus stop and a car park El Kiosko Restaurant
- Two access areas: the path and Gaitanejo way (2.7 km or 1.5 km long route, depending on your choice).
- Visitor Reception Centre and Gaitanejo Reservoir.
- First Canyon: Gaitanejo Gorge (2.9 km from the entrance to the exit)
- Second Canyon: Las Palomas Cliff
- Hoyo Valley
- Third Canyon: Gaitanes Gorge (Desfiladero de los Gaitanes)
- Last Stretch Boardwalk to the exit
- Downwards path to the El Chorro Train Station, called Avenue Caminito del Rey (2.1 km).

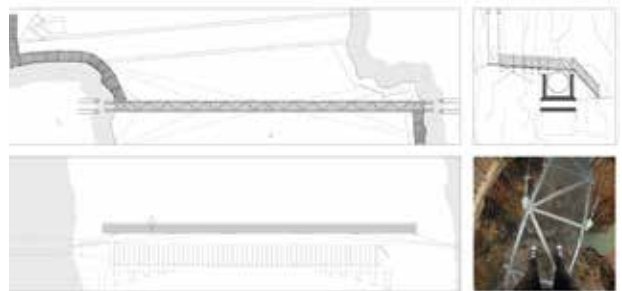


Figure 5. New bridge next to aqueduct bridge: floor plan, elevation, section and image of the footbridge. Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey".

Author: Luis Machuca y Asociados, S.L.P.

Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey". In: *Arquitectura Viva*.

DESCRIPTION OF THE CHANGES AND ADDITIONS

> Footbridges: The decision to keep the old footbridges allowed us to appreciate how it was built, the human resources materials and the management of the workforce a hundred years ago. Today it is impossible to reform it completely, because it does not comply with current regulations.

> Hoyo Valley: The walkway has been preserved in its natural state, only cleaned on both sides for fire prevention and reinforced with quicklime mixed with the natural earth.

> Tunnel: An alternative path was found that can avoid the most dangerous place depending on the weather, when it rains and strong wind rocks fall on the path, so visitors can run into the old tunnel channel, which is 285 m long.

BUILDING MATERIALS

As for the footbridges, they had to have the least impact on the surroundings and the system should be very affordable and cost-effective to maintain. Materials such as stainless steel (anchors, brackets and braces) and wood (beams and walkway) are used.

PROJECT IN RELATION TO THE SUSTAINABILITY

Social aspect:

The Caminito del Rey and the bridge are in the memory of those who lived there, as they were of great help. It was necessary to recover this element as part of the collective memory of the area's inhabitants.

Economic aspect:

El Caminito del Rey's opening has brought significant improvement and economic growth to the area with the attendance of an increasing but controlled number of tourists.

Environmental aspect:

The site is an important archaeological industrial settlement, a wildlife area of botanical, geological and anthropological interest. At the midpoint of the route, a small pond has been created to protect the habitat of the common horned toad.

Tourist access is limited to a maximum number per year.

SPECIAL METHODS OR TECHNIQUES USED IN THE PROJECT WHICH REFLECT THE SUSTAINABLE DESIGN

- The intervention is reversible. If the footbridges were removed, the environment would remain unchanged.
- The wooden floor and beams are cut according to the state of the rock at each



Figure 6. View of the old and the new Caminito del Rey.
Author: © Duccio Malagamba, 2015.
Source: Luis Machuca y Asociados, S.L.P.



Figure 7. Aerial view of the two footbridges.
Author: Juan María.
Source: Luis Machuca y Asociados, S.L.P.



Figure 8. View of the tunnel.
Author: Jesús Ponce.
Source: Luis Machuca y Asociados, S.L.P.

point, as are the supports and ball joints, resulting in excellent adaptability and making the panels easy to replace.

- The wooden structure blends in with its surroundings. As the material comes from nature, it turns grey and thus blends in with the environment. All materials are recyclable.

DIGITAL DATA EMPLOYED FOR THE DOCUMENTATION (3D SCANNING, PHOTOGRAMMETRY, ETC.)

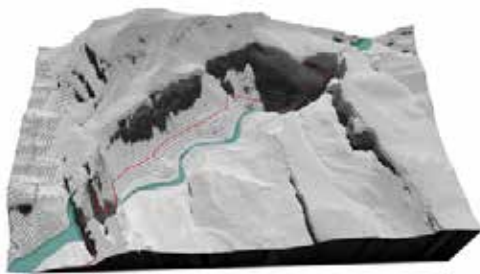


Figure 9. Digital Topography: Los Gaitanes Gorge.

Author: Luis Machuca y Asociados, S.L.P.

Source: Luis Machuca y Asociados, S.L.P.



Figure 10. 3D Software: Design of the footbridge, balcony and enclosed footbridge.

Author: Luis Machuca y Asociados, S.L.P.

Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey". In: *Arquitectura Viva*.

TOOLS/TECHNOLOGIES USED FOR THE IMPLEMENTATION OF THE NEW USE



Figure 11. Vertical working systems with technical specialists

Author: Luis Machuca y Asociados, S.L.P.

Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey". In: *Arquitectura Viva*.



Figure 12. Helicopter delivery of materials and waste management for greater precision and efficiency.

Author: Luis Machuca y Asociados, S.L.P.

Source: Machuca Santa-Cruz, Luis (2016). "Recuperación del Caminito del Rey". In: *Arquitectura Viva*.

DISSEMINATION / PROMOTION ACTIVITIES (WORKSHOPS, CONGRESS, PUBLICATIONS, PRIZES)

Prizes:

> ASTER Marketing iAwards, Escuela de Negocios ESIC.

> III National Awards: 'Ciudad y Territorio Albert Serratosá'. Colegio de Ingenieros de Caminos, Canales y Puertos y la Fundación Caminos.

> XIII Bienal Española de Arquitectura y Urbanismo: Prize Category: "Urbanismo: paisaje y ciudad" (2015). Ministerio de Fomento, CSCAE, Fundación Caja de Arquitectos y Unión de Agrupaciones de Arquitectos Urbanistas.

> "Andalucía del Turismo" Awards (2016).

Category: "Buenas prácticas". Secretaría General para el Turismo, Junta de Andalucía.

> Placa al Mérito Turístico. Category: "Destinos Emergentes" (2015). Consejo de Ministros del Gobierno de España.

> "El Caminante" Awards: Producto Turístico del Año. Periódico El Mundo.

> Architectural Awards of Archmarathon, Milán. Category: "Landscape Design & Open Space" (2016).

> X Bienal Iberoamericana de Arquitectura y Urbanismo, São Paulo (Brazil).

> The Europa Nostra Awards. Project "Grand Prix" and "Premio del Público" (2016).

> Certificate "Biosphere". Instituto de Turismo Responsable.

Publications:

> Machuca Santa-Cruz, Luis (2016).

"Recuperación del Caminito del Rey". AV, 2016.

Link: <https://arquitecturaviva.com/obras/recuperacion-del-caminito-del-rey>.

- > Machuca Santa-Cruz, Luis (2017). "La recuperación del Caminito del Rey. La singularidad de un proyecto". Málaga: SANDO, S.A.
- > Machuca Casares, Luis Javier; Alonso Núñez, Ángeles (2018). "El Caminito del Rey y la arquitectura del paisaje". Aportación a Congreso.
- > Machuca Santa-Cruz, Luis (2019). "Recuperación del Caminito del Rey". Málaga: RU books.

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Heredia Campos, María del Carmen (2006) "El Camino del Rey: un paseo por la Cuenca del Guadalhorce y una mirada retrospectiva al regeneracionismo español". *Péndulo: revista de ingeniería y humanidades*, 17, pp. 44-55.

Loren-Méndez, Mar (2007). "Conjunto Hidroeléctrico El Chorro". Registro Andaluz de Arquitectura Contemporánea. Provincia de Málaga. Sevilla: Archivo del Instituto Andaluz del Patrimonio Histórico.

Loren-Méndez, Mar (2008). "La Modernidad Española como relato de las periferias. Laboratorio arquitectónico y visiones urbanas en el alejado Sur Ibero". *Apuntes*, 21 (2), pp. 234-251.

Martín Gaité, C. (1983). "El Conde de Guadalhorce, su época y su valor". Madrid: Colegio de Ingenieros de Caminos, Canales y Puertos.

Olmedo Checa, M. (1992). "El primer camino de hierro". *Revista Péndulo*, n. 3-4.

ACADEMIC WORKS / STUDENTS RELATED PROJECTS / PUBLICATIONS

To complete the restoration of the infrastructure, it has been necessary to combine an environmental project, an urban and territorial planning project (Special Plan for the Caminito del Rey and its surroundings), and a technical execution project for the construction of the walkways and footbridges, control cabins and visitor reception centres.

OTHER SIMILAR PROJECTS AS A REFERENCE

N/A

REFERENCE TO WORLDWIDE EXAMPLES

Path in the Pinar de la Algaida, Natural Park of Cadiz Bay, El Puerto de Santa María (Cádiz) by Ramón Pico and Javier López (2002).

