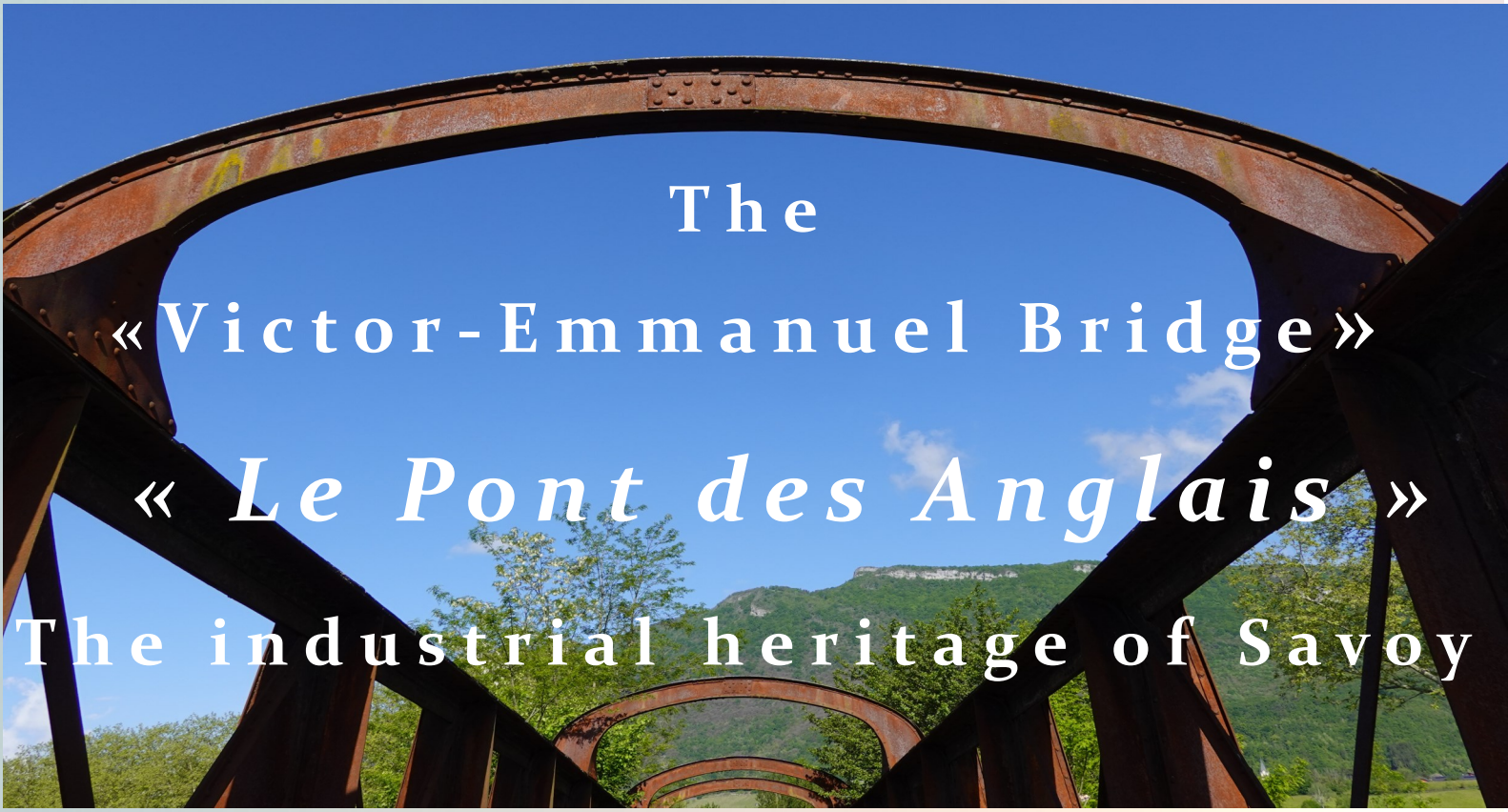


The «Victor-Emmanuel Bridge»

« *Le Pont des Anglais* »

The industrial heritage of Savoy

History and Architecture

Three Highlighted projects for the Savoyard Associations

Association des Amis de Montmélian et de ses Environs

Académie des Sciences Belles-Lettres et Arts de Savoie — Flores Fructusque Perennes

CRUET Nature et Patrimoines — l'envie de découvrir — http://cruet.np.free.fr

Association Maurienne Patrimoine — 73300 St Jean-de-Maurienne

The Thomas Brassey Society

Société Savoisienne d'Histoire et d'Archéologie

Guides du Patrimoine Savoie Mont Blanc

Fédération Alpyfort

IESF — Société des Ingénieurs et Scientifiques de France — Sillon Alpin

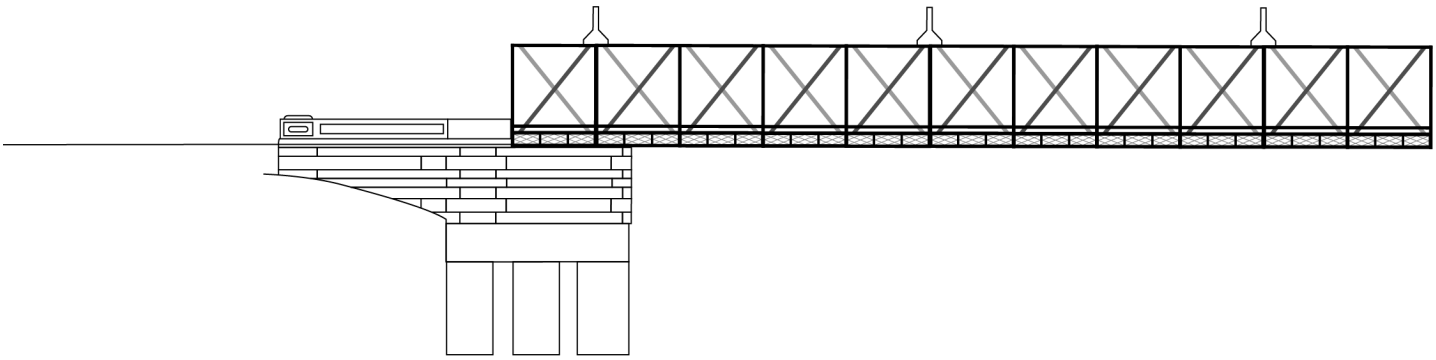
Société des Amis du Vieux Chambéry

CDTE Savoie — Comité Départemental de Tourisme Equestre de la Savoie

Association pour la Sauvegarde du Patrimoine de Tresserve — Mairie 40 chemin de Belledonne 73100-Tresserve

Savoie Equi France — Sabaudia — La Savoie a Cheval

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"Les Amis de Montmélian", "Cruet, Nature et Patrimoines" and "The Thomas Brassey Society".

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The « Victor Emmanuel Bridge » known as « Le Pont des Anglais » the remarkable industrial heritage of Savoy

In 2021, the department of Savoy in France commissioned heritage architects to establish a restoration programme for the « Victor-Emmanuel Bridge » commonly known as « Le Pont des Anglais » (« The English Bridge »).

The bridge obtained its **classification in the additional inventory of Historic Monuments in 1994.**

The bridge is located in the **Geopark in Bauges**, which is now noted as a **World Geopark UNESCO site**.

The Savoyard Associations have had significant interest in the Bridge for many years, as it is one of the major elements of the industrial heritage of Savoy.

The «Victor-Emmanuel Bridge and Railway **»** are the subject of many publications and even a thesis in 2013 of 700 pages by Emilie Cottet Dumoulin, under the supervision of Professor Denis Varaschin of the University of Savoy.

The Italians from the University of Aquileia were also interested in « Le Pont des Anglais » (« The English Bridge ») and a recent publication, published in 2021 during the **« 7th International Congress of History of construction cultures » in Lisbon, shows the use of the « Triger pneumatic caisson process »** for the construction of pillars for many bridges in Italy before it was used for « The Eiffel Tower » in France.

"Le Pont des Anglais" was one of the first to have the foundations for the pillars built using this innovative caisson technique.

The British are also passionate about this monument through its association with Thomas Brassey, the great British railway builder. « **The Thomas Brassey Society** »**,** based in the United Kingdom in Chester, aim to educate the public about the work of Thomas Brassey, their compatriot, who was able to build an industrial empire working with some of the best railway engineers in the world during the 19th century.

Summary

I - Situation and chronological progress of the construction of « Le Pont des Anglais » (« The English Bridge »)

II - Architecture and technologies that make it a major Savoyard industrial heritage site

III - Three highlighted projects:

1 - Development of a museum on the Bridge to present its construction and the history of « The Victor-Emmanuel Railway »

2 - Creation of a global tourist circuit going from Aix les Bains (Choudy) to Saint-Jean-de-Maurienne and Modane «The Railroads in Savoy from the Sardinian period to the Empire"

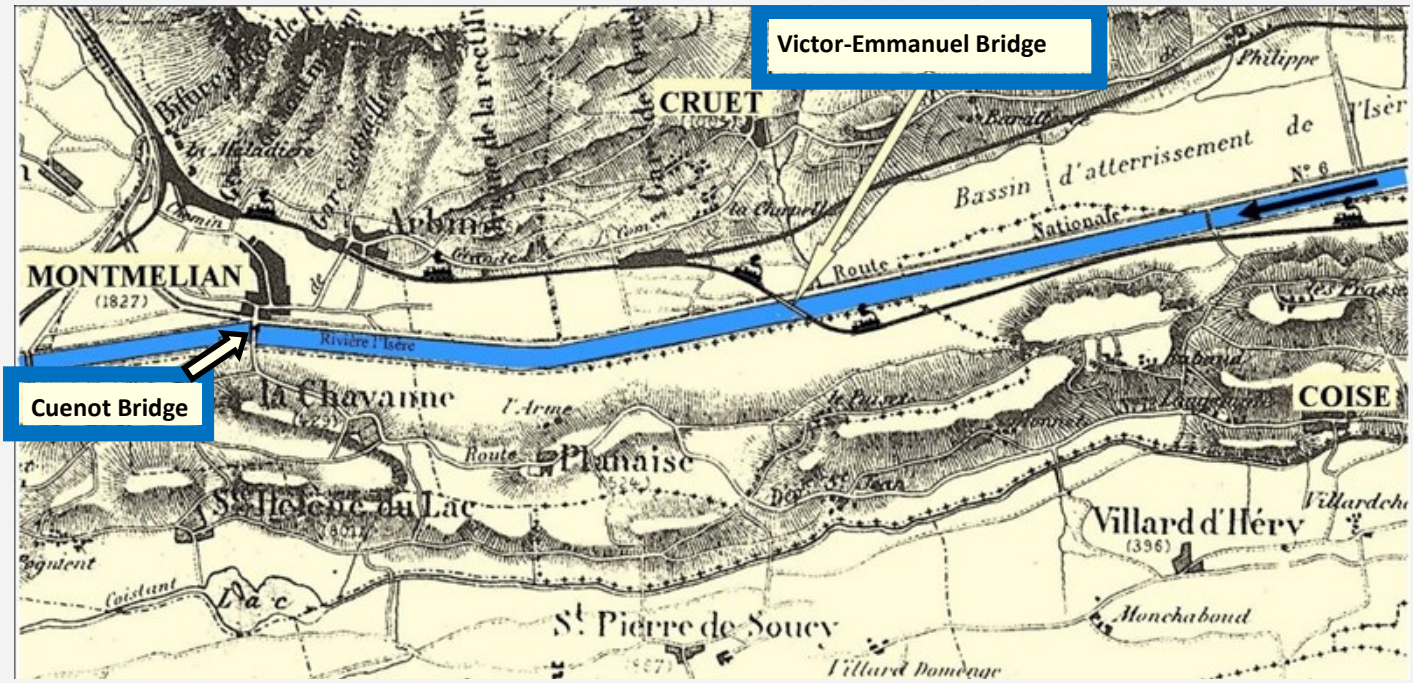
3 - Creation of a soft route on the dyke, the left bank of the River Isère, from Cruet to Montmélian to reach « The Cuenot Bridge », barely 4 km away. The building site and the techniques for the containment of the River Isère and the prowess of its engineers and entrepreneurs would be presented.

I - Situation and chronology progress of the construction of «Le Pont des Anglais» («The English Bridge»)



Among the notable elements of the industrial heritage of the department of Savoy there is « The Pont Victor-Emmanuel » known as « Le Pont des Anglais ». It crosses the River Isère near Cruet. Its construction took place from 1853 to 1856. It was entrusted to the London engineer George Newman of the British consortium « Jackson, Brassey and Henfrey » who were chosen to build «The Victor-Emmanuel Railway Line ».

Situation



«The Victor-Emmanuel Bridge » known as « Le Pont des Anglais » crosses the River Isère at Cruet.
It is 4 km away from « The Cuenot Bridge » in Montmélian.

Chronology

New Construction Techniques were used

Two discoveries launched the large metal structures in puddled iron.

1839 : Fat puddling process to create Wrought Iron using much less fuel was developed. It launched the massive production of iron, which was of a more consistent quality.

1847 : The publications of the engineer, Whipple, in the United States explained for the first time how the forces act in the chords of a lattice bridge. In this structure, the metal bars are either pulled or compressed but do not undergo the bending for which they are too brittle. The structure is much lighter than a "solid" beam. This allows far greater spans than bridges built before then. This knowledge and the mastery of the manufacture of puddled iron (also known as wrought iron) revolutionised the construction of metal structures and led to the product being used for railway bridges, in particular that of « Le Pont des Anglais ».

May 29th. 1853 : King Victor-Emmanuel II authorizes the opening of a railway line between Culoz and Modane.
1853 - 1856 : Construction of «Le Pont des Anglais».

1856 : On October 20th., official opening of the line linking Choudy (Aix-les-Bains) to Saint-Jean-de-Maurienne.

1857 : Inauguration in the presence of King Victor-Emmanuel II, Camillo Benzo de Cavour and Jérôme Napoléon, nephew of Napoleon III.

1857-1860 : Strategic and diplomatic role in the creation of the Italian State and the attachment of Savoy to France.

1857-1876 : Contribution to the economic and industrial development of Savoy.

1864 : The railway line concession is taken over by the company « PLM» (« **P**aris-**L**yon-**M**éditerranée »).

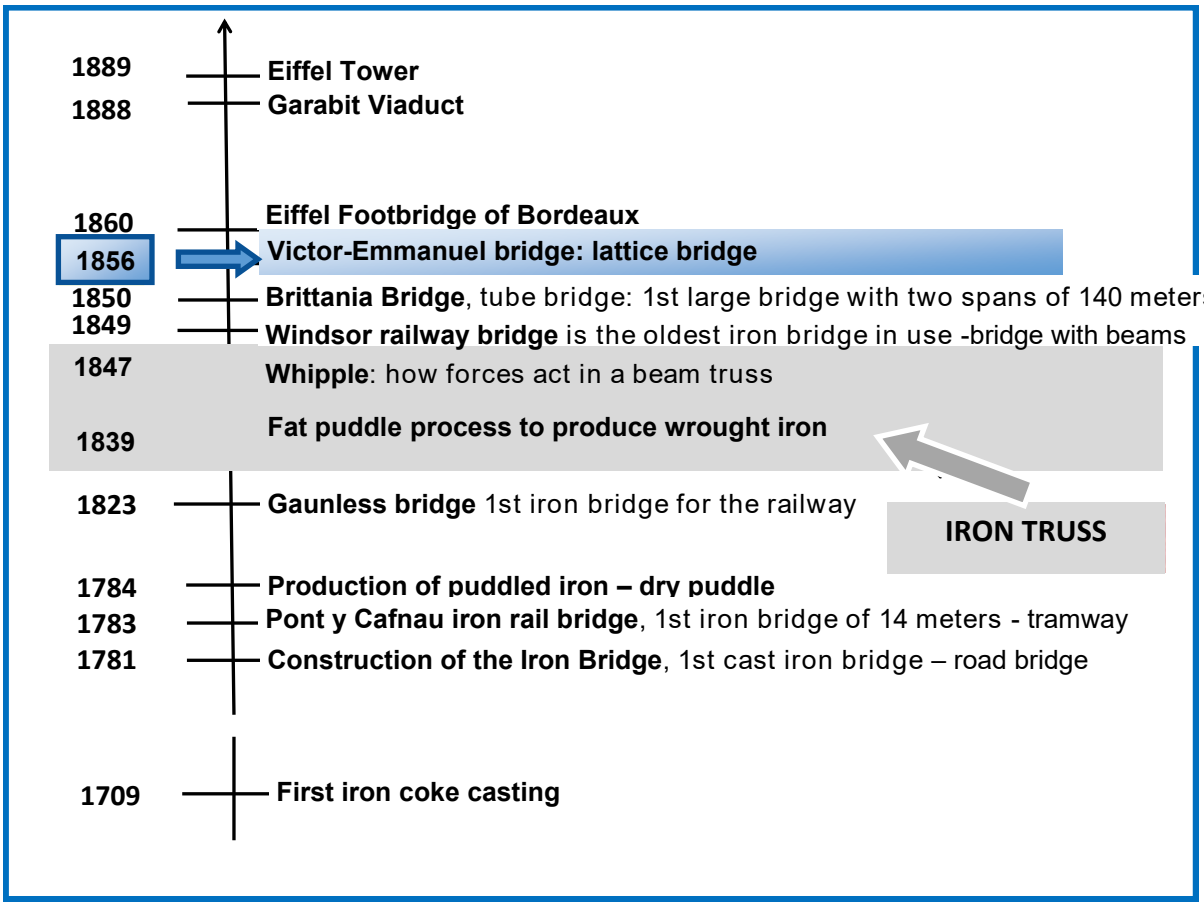
1872-1876 : « La Malle des Indes » (liaison between London and Bombay) crosses « Le Pont des Anglais »

1887 : The bridge, which had cost « The Victor-Emmanuel Company » 350,000 Francs, is sold to the Savoy Department for 20,000 Francs. The rails and wooden sleepers are replaced by a concrete slab, the bridge becomes a road and takes the name of « CD33 ». Used mainly by the local inhabitants, it does not undergo any modifications which makes it **a unique historical example in the development of metal railway bridges.**

Until the dawn of the 1850s, railway bridges were built of stone, brick or wood because metal bridges could not withstand the stresses generated by the dynamic forces of railway convoys.

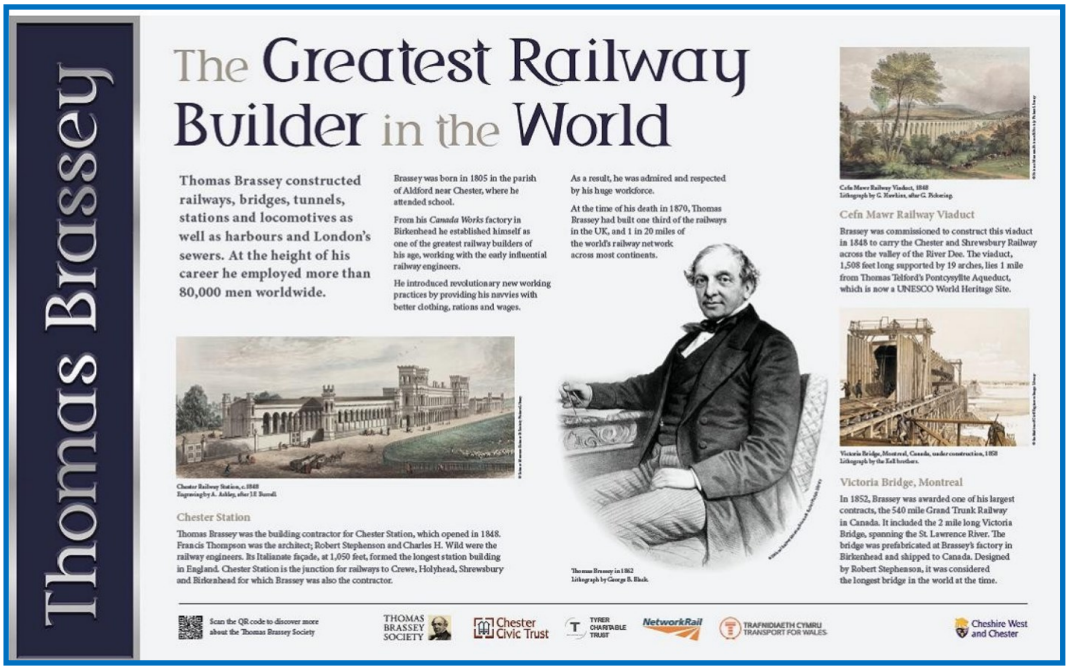


« Le pont des Anglais » (« The English Bridge ») in the history of metal bridges



« Le Pont des Anglais » is a very rare, fully preserved vestige of our industrial heritage. Interest in its conservation goes far beyond our borders. In Italy, researchers Matteo Abita and Roberto Morganti from the University of Aquileia looked at the construction of the foundations of « Le Pont des Anglais » using the « Triger process ».

Based in Chester in the UK, **« The Thomas Brassey Society »** was so concerned about the future of the Bridge that they wrote about the matter to the Department of Savoy and established close contacts with our Associations.



The Jackson, Brassey & Henfrey Company constructed more than 30% of the railway lines in Europe.

Thomas Brassey (1805-1870) was a great industrial genius.

He began his career as an apprentice surveyor and then built an industrial empire by working with the best engineers of the time such as Joseph Locke and Robert Stephenson.

Information Panel produced by « The Thomas Brassey Society » presenting the work of Thomas Brassey.

George Newman was chosen as a Chief Engineer to build the railway lines in France and Savoy.

II - Its architecture and the innovative technologies of its construction

The design of metal lattice beams using triangular frames developed by Squire Whipple *American engineer (1804 - 1888)*

The triangle construction system allows the redistribution of the loads to the joints of the triangles of the lattice bridge. The lower beams are thus stretched in tension, the upper ones compressed, and those on the diagonal creating a balanced triangle of forces. The whole structure is almost undeformable. This technique allows long light spans for heavy loads.

It is a fine example of a technical application which should be of interest to student technicians and engineers during their visits to the bridge.

The side part of the lattice beam with its Saint-André crosses, its overhead arches in basket-handle show an undeniable concern for aesthetics.



The structure of the bridge was made hyperstatic (the four spans behave like a single span).

To allow metal expansion, it is mounted on roller bearings. They allow for the elongation of the structure due to temperature variations.

This avoids additional stresses and constraints.



System of rollers on which the metal lattice beams are laid.



The hot riveting of the joints allows the assembly of metal parts with excellent clamping and longer lasting reliability

Puddled iron (Wrought Iron) :

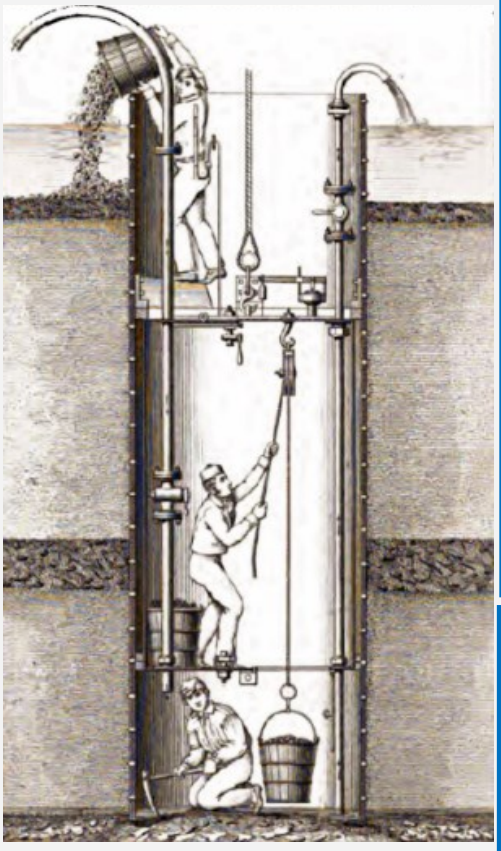
Puddled iron in England was developed for the use of iron in metal structures from 1784, but required a lot of fuel.

It was not commonly used until 1839. Eiffel also chose puddled iron rather than steel because he considered that it is more resistant to ageing, fatigue and corrosion and therefore more economical in maintenance.

The Eiffel Tower, heir to « Le Pont des Anglais » : The same techniques were used 35 years later for the Eiffel Tower (metallic lattice in puddled iron assembled by using hot rivets).

« The Triger caisson process » for the foundation construction of « Le Pont des Anglais »

An innovation for the foundations of the bridge which will be reproduced on many bridges in Italy thereafter



The Triger process around 1846 (Wikipedia).

The visible part in carved stone has an impeccable aesthetic quality, but it is the submerged part that is very innovative, as the architect engineer Matteo Abita and Professor Renato Morganti of the University of Aquileia recently discovered in Italy.

It was the « Fox & Henderson Company » which would have been one of the first to apply the « Pneumatic Triger caisson process» for bridges originally used in mines.

It consists of driving metal pipes into the river with pressurized water-proof boxes that prevent water from entering while the worker locked inside, digs. When the boxes reach stable, hard ground, they are filled with cyclopean concrete creating a solid base for the pillars and abutments (part located on the shore). For each pillar, three tubes with a diameter of 2 meters each are surmounted by cast iron beams on which the masonry pillars are built.

The junction of these elements is maintained by an iron strapping.

The « Triger process » will be used by Gustave Eiffel then a young engineer in 1858 in Bordeaux for the footbridge that bears his name.

Later he will use the same method for two of the four pillars of the Eiffel Tower built in an old arm of the River Seine.

This is why the name of Triger (1801-1867) is engraved with that of 72 other scholars on the pillars of the Eiffel Tower. The pillars were then protected by riprap held in place by larch piles still visible today.



Stone pillar resting on the three tubes of 2 meters diameter each filled with cyclopean concrete.

Extract from the Gazette of Savoy which relates the arrival in Chambéry in July 1855 of the Triger tanks:
« The pillars, which are three, are covered with iron, since the masonry is enclosed in large iron tanks, samples of which were visible on the « Place de la Boisse » a few months ago. Each pillar is made up of three systems of tanks nested, one inside the other, when one of these systems is firmly fastened in the bed of the river, we operate the pumps, we dig more and more and finally, we fill the cavity with large stones firmly united with cement. »

Aesthetic industrial construction

With their rounded, parabolic shapes, the Crosses of Saint André with different sections, the basket handles overhanging the work, give a pleasing and very aesthetic look.

Was it Victor-Emmanuel's desire to impress his people in Savoy or that of the English to show their know-how?



Basket handles



Cross of St. André of different shapes and sections



Outer buttresses



Rounded, parabolic shapes



Outer buttresses

Diagonal crossing of the River Isère :

The design of trains and tracks imposes fairly large radii of curvature. It was decided not to cross the River Isère perpendicular to the bed, but with an angle of 50°, which brings its length to 168m for a width between the dykes of 130m. However, the pillars were oriented in the same direction of the river current to maintain efficient river flow.

It was a unique example for this era. This clever construction maximised the economy of the bridge but also required perfect control of the weight distribution on the pillars.

The bridge was raised 80 centimetres above the dyke:

At the request of the Prefect at the time, this was done to protect it from very high floods. This arrangement explains the reason why the « D1006 Departmental Road » makes a speed bump to the right of the bridge.

III - The three main projects

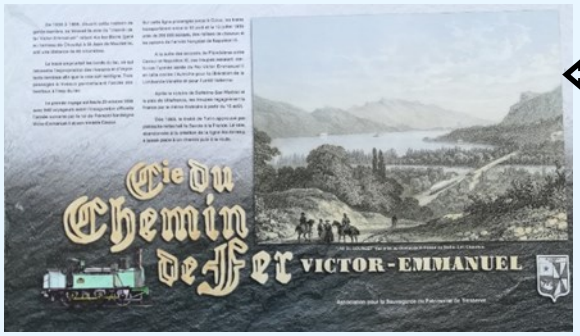
Since 1994, the year of its classification in the complementary inventory of historical monuments, several associations have looked into the tourist, ecological and cultural potential of this bridge located in an area with a high archaeological density, as the discoveries have shown and continue to show.

Project N°1 : « The railroads in Savoy from the Sardinian era to the Empire »

The history of rail in Savoy based around key locations, would be supported by the 700 pages thesis produced in 2013 by Professor Emilie Cottet Dumoulin directed by Professor Denis Varaschin and by the many publications of other authors who are passionate about this subject.

The route that reflects the success of the « Paths of the Baroque in Savoy » (« Chemins du Baroque en Savoie ») could be called **« The railroads in Savoy from the Sardinian period to the Empire ».**

Starting from the location of the Choudy station in Aix-les-Bains, it could invite the visitor to follow the route drawn in 1853 based on panels such as the one already installed near the Lido beach in the town of Tresserve by the « Association for the Protection of the Heritage of Tresserve » (« Association pour la Protection du Patrimoine de Tresserve »).



Information panel placed on the site of the former railway gatekeeper's house.

Location of the « Victor-Emmanuel Railway line » at the edge of the lake at Lido.

(Realization « Association for the Protection of the Heritage of Tresserve »)



The detailed inventory of the places to be developed is yet to be decided. The circuit could pass by the « Rotonde de Chambéry », although 50 years after the creation of the Victor-Emmanuel Railway, before continuing to the other sites of this rail epic.

« Le Pont des Anglais » would be a major stage as the most important preserved work of the time.
The route would continue to Saint-Jean-de-Maurienne where, at the level of the new station, a sculpture by the artist « **INIS** » and several panels would make the link.
Then, in Saint-Jean-de-Maurienne and Saint-Michel-de-Maurienne the railway accident of 1917 would be described as well as the drilling of the tunnel, the genius of Germain Sommeiller, without forgetting the « Fell Railway», where in 1864, Thomas Brassey joined forces with the English engineer John Barraclough Fell for the construction of the continuation of the line through « Le Col du Mont-Cenis » (« The Mont-Cenis Pass »).



Project of sculpted panels for the new station of Saint-Jean-de-Maurienne presented by the artist « INIS » on the occasion of « The Heritage Days 2021 ».

(« Maurienne and Patrimoine Association »)

Project N°2 : Development of a Visitor Centre on « Le Pont des Anglais »

Panels on the bridge would present themes related to the history of the bridge :

- **The personalities** who wanted and financed it (Victor-Emmanuel, Cavour, Napoleon III, the banker Charles Lafitte.
- **The life and industrial work of the builder Thomas Brassey.**
- **The companies involved in its construction** (« Five Lille », « Parent and Schacken » in Oullins, etc.)
- **Innovative technologies used** as mentioned above**: The Triger process** for pillars**, puddled iron, assembly technics by rivets, etc.**
- **The technique of triangulated beams.**
- **The chronological position of « Le Pont des Anglais » in the technical and industrial evolutions of the century by showing its role as a precursor since the same technologies will be used for other later prestigious buildings :** The **«** Eiffel Tower**»**, the **«** Eiffel Footbridge **»** in Bordeaux, the **«** Garabit Viaduct **»**, the stations of **«** Saint-Lazare **»**, **«** Orsay **»**, the **«** Grand Palais **»**, **«** Tower Bridge **»** in London, etc.).
- **« Le Pont des Anglais » and its 20 years of railway life.**
- **Increasingly efficient locomotives adapted to the needs of the mountains.**
- **« La Malle des Indes »** (between London and Bombay).
- **Its strategic role** with the transport of French troops with their equipment engaged with the Piedmontese in the **battle of Solferino on June 24th, 1859, and its indirect involvement in the creation of the Italian State.**

The history of the resistance would also find its place there : on June 8th, 1944 the Germans executed resistance fighters near the structure. A war memorial honours them.

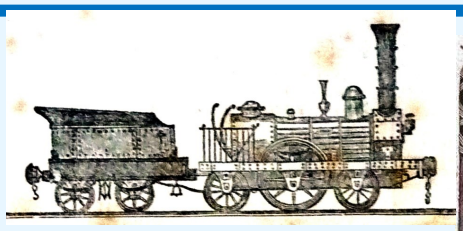
The possibility of linking the two banks of the structure by reserving it for pedestrians, cyclists and horse riders would provide an answer to the current links that are frequently used by cars. The bridge would make it possible to link Val-Coisin and the « Belledonne Massif » to « Les Bauges **»** by a soft route. This link would make it possible to make loops with the vineyard path from Montmélian on the one hand and from Saint-Pierre-d'Albigny on the other. Also note the proximity of the discovery circuits of the alluvial forest and that of the butterflies on the dry lawns of Cruet.

For « Le Parc des Bauges » with the UNESCO Global Geopark label, could « Le Pont des Anglais » not become a showcase for one of its gateways?

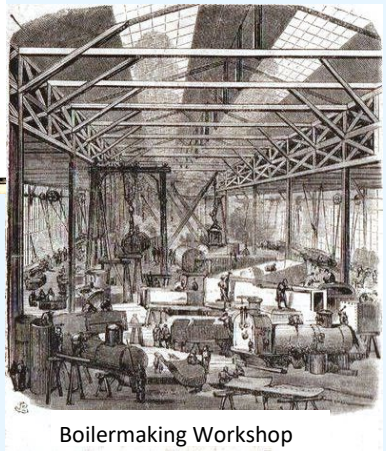


« Le Pont des Anglais »

(« The English bridge ») today



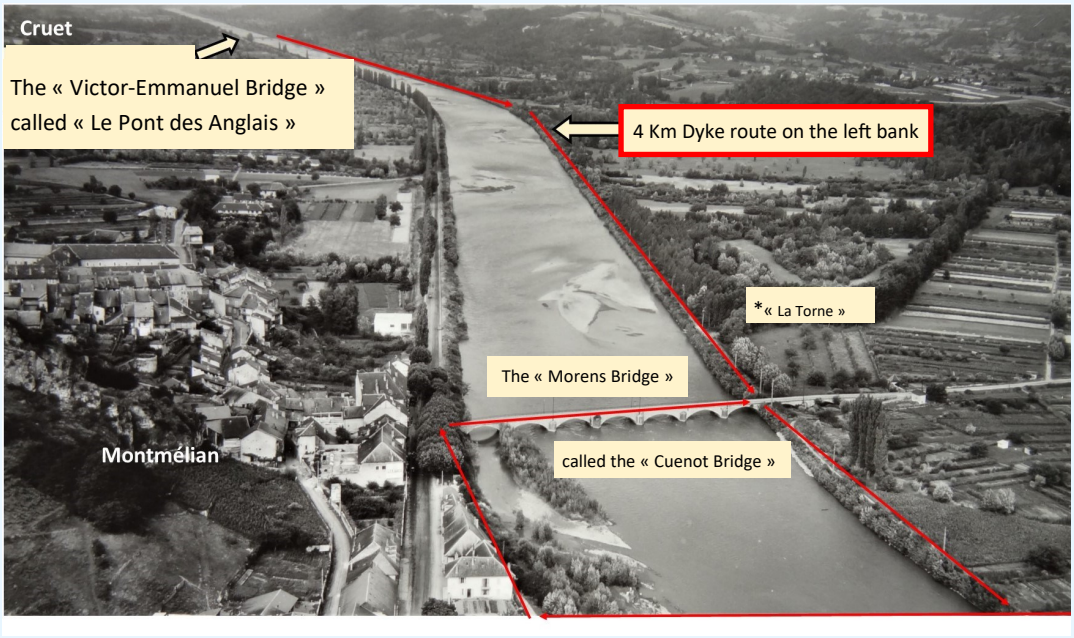
The locomotive construction workshop
of « Parent and Schacken »
visited in 1867 by Napoleon III.
(Excerpt from the "Illustration" magazine)



Boilermaking Workshop

Project N°3 : Development of the left bank dyke and « The Cuenot Bridge »

A 4 km tourist route in the direction of Montmélian, between « Le Pont des Anglais » and « Le Pont Cuenot » could be created on the dyke linking the two historical monuments. On this dyke route, accessible on foot, by bike or on horseback, and even by horse-drawn carriage, would be presented the history of the pharaonic project of the Sardinian Administration for **the containment of the River Isère**, the construction of which is contemporary with that of « Le Pont des Anglais ».



Dyke route (in red) linking the two historical monuments, « Le Pont des Anglais » and « Le Pont Cuenot »

* *« Torne earth » (earthen dyke)*

The route on the dyke would be embellished by a whole series of panels presenting the visible and nearby tourist sites and monuments, such as :

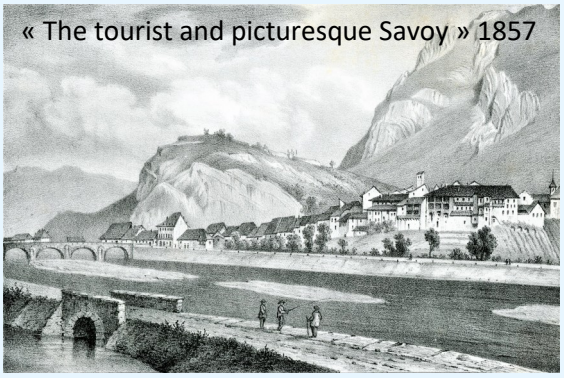
- **The archaeological site of « Châteauneuf Les Boissons », its two temples, its theatre and its thermal baths in the Gallo-Roman village at the level of the old ford.**
- **« Le Château de la Rive » and its medieval frescoes, now the jewel of the « Savoy Museum ».**
- **The Oppidum of Cruet and its « La Tène » tomb.**
- **The Archaeological Site of « Arbin Mérande » with the only polychrome mosaics in Savoy.**
- **« Le Couvent des Capucins de Montmélian » (« The Capuchin Convent of Montmélian » -1599-) and « l'Église du Couvent des Dominicains » (« The Church of the Dominican Convent » -1318-).**
- **The vineyard and walks along the hillside paths criss-crossed by the « Roman Road ».**
- **The dyke route that follows the « Natura 2000 » areas with their fauna and flora.**
- Halfway there is a gravel mining area which will have to be rehabilitated once the deposit has been exhausted. The operator is obliged to restore the site which could be transformed into a **leisure and bathing centre** like that of Saint-Pierre-d'Albigny which is very popular in the summer.

These descriptions on the dyke promenade could be supplemented by signalling panels placed directly on the various places visible from this one.

On the dyke route located between the village of La Chavanne and Montmélian, near « the Cuenot Bridge », several information panels would be installed; they would present :

- **The rich history of the sieges** of the citadel with the role of the toll bridge.
- **The construction techniques, the necessary machines, the plans for this stone bridge.**
- **The history of this « Royal Route » with intense traffic with Italy which crosses the River Isère at Montmélian to reach Saint-Jean-de-Maurienne used by the carts, mules of the merchants and the cars of the « Royal Post Office » whose « Le Relay of Montmélian » was a must.**
- **In situ presentation of copies of major works** by artists who, over the centuries, were inspired by the banks of the River Isère and this bridge. On the specific locations and viewpoints where the works were made, reproductions from many engravings and prints of the 18th century would be installed up to the sketches of William Turner, but also the photographs on glass plates due to the talents of the photographers, Grimmal and Louis Blanc, from the beginning of the 20th century…

The development of this sector will undoubtedly require rethinking the paths of the left bank area within a radius of 500 meters from the listed bridge in a landscape manner by removing the crushed waste stored there.


« The tourist and picturesque Savoy » 1857

Montmélian and La Chavanne from the left bank dyke


« The Cuenot Bridge » today


Extract from « Nice and Savoy »1860

« The Cuenot Bridge » and the dyke seen by the photographers around






Photo J.P. Sehier

The run-of-river hydroelectric power station near Chavort

The route taken could end with a quick look at the know-how of the 21st century : looking at the innovative hydroelectric power station (the second in France) of 2 Megawatt installed at the level of « The Chavort Bridge ».

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