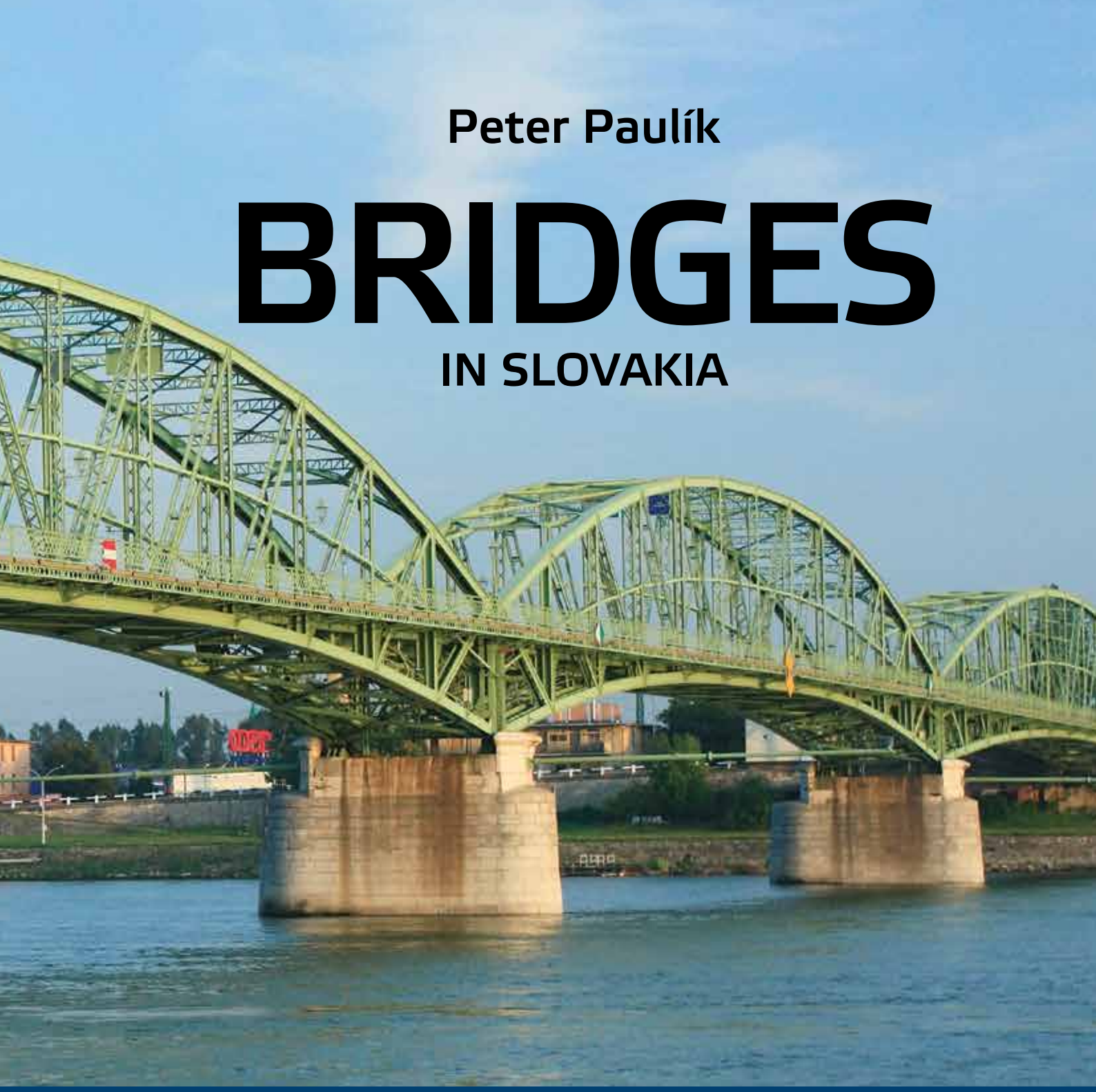
Peter Paulík

BRIDGES

IN SLOVAKIA



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Peter Paulík

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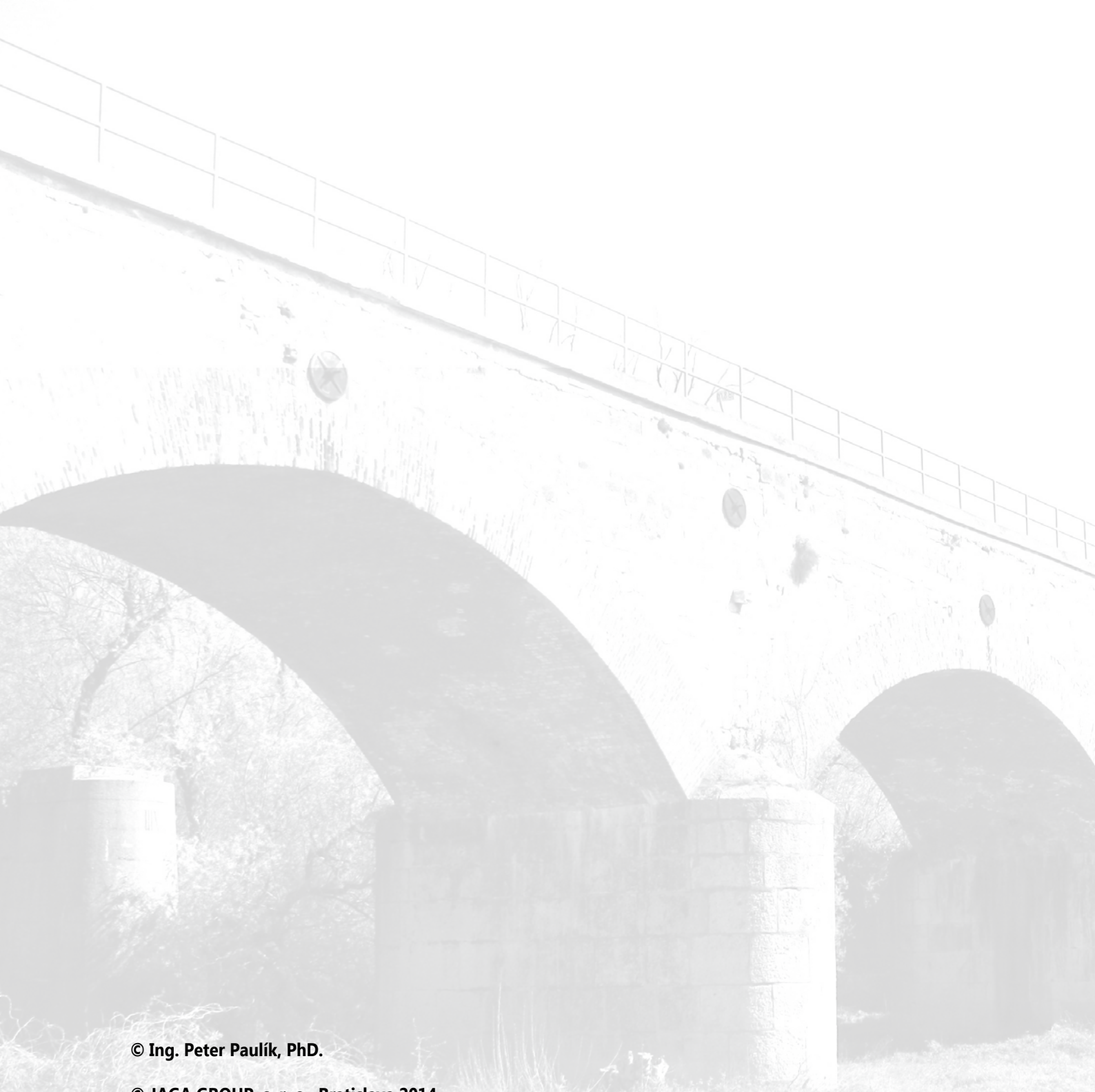

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I would like to dedicate this book to my grandparents, Jozef and Mária Kisléghy, Elena and Ján Paulík.

Acknowledgements

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PREFACE

MSc. Peter Paulík, PhD
The author of the book

To begin with, a basic question has to be asked: What actually is a bridge? In professional books, we can find many definitions which are correct from the technical point of view; however, they often lack their actual purpose. Although bridges are mainly engineering structures, we cannot forget their social and architectural function, since they significantly contribute to social, cultural and environmental development and this makes their definition anything else but simple.

Bridges are symbols of their age

Bridges have forever served not only as functional structures, but also as the symbols of their age, mirroring a particular nation's advanced level of culture and technology. The surroundings in which bridges were created influenced their shapes, structural materials or the details which form their overall appearance. As a result, in many cases we can see at a glance the origins of a bridge. For example, a great difference is to be seen between the bridges built in a relatively steady period at the end of the 19th century, when culture was at its peak, and the bridges built in the constructive era of socialism. With the changing times, the bridges also changed. A good example is the presence of the statue of the Saint John of Nepomuk (the patron saint and the protector of bridges). It is present on nearly all the larger bridges built before World War I, but it is very rare on the newer ones. Human thinking has changed in the course of time and so has changed its feeling towards bridge structures. Another example could be the complete disappearance of some minor aesthetical details on the handrails of bridges, or the disappearance of decorative columns and other decorative accessories after the Second World War. Although as a result bridges have lost something of their value, by their appearance they still perfectly represent the era in which they were built. However, in my opinion, a bridge without the perfection of details does not have a soul.

Bridges mirror the level of knowledge

In building a bridge, there is much more than just its aesthetics. For this reason, by observing the development of bridge structures, the development of human knowledge in the construction field may also be observed. A bridge is mostly a functional structure, so there has always been an effort to build it as cheaply as possible, but at the same time to achieve adequate safety and reliability. This requirement may be fulfilled only by the extension and appliance of knowledge in the theory of structures and by implementing the results of research into the field of construction technologies and materials. This role belongs mainly to universities, which should apply these results into practical use. Without universities, progress would simply stop at some point. The book describes several bridges representing milestones in bridge construction, from which universities have never been absent. Science and bridge construction have always been moving forward side by side.

Bridges are constructions that influenced history

It was bridge construction that helped the expansion of regions and territories by allowing the exchange of goods. Developed countries were characteristic of their advanced infrastructure and their further expansion was possible only through its improvement. In some places,

bridge building often meant the region's rapid growth and thus bridges became one of the most important structures of mankind. However, history is written also by wars, in which bridges played a big part. They were built, protected and destroyed for the purpose of military campaigns. During the wars, they had a key role, since they served as the frontier between the fighting armies and so many of them made their mark in history. Wars also created space and pressure on the development of new technologies, which would have enabled reconstruction of the destroyed routes. During and after a war, new technologies emerged, which have been used ever since. Therefore, it is clear that bridges do not only have their present form and shape, but also their history. Exactly for this reason it would be short-sighted to describe only their present state without history and historical factors which affected them directly or indirectly. In almost all descriptions of the bridges I have tried to give more details about the historical background of their construction and the most important events which happened to them or in their near surroundings; because bridges played a big part in the history of nations.
The bridges in this book are arranged in an alphabetical order according to the nearest town or village. The website www.mostynaslovensku.sk is a fundamental companion to the book, where you can find all the bridges on a clearly arranged map of Slovakia. More explicit information and their co-ordinates are at your disposal in the book. Here you can find different kinds of bridges built by different technologies in different times, so it should serve as an inspiration for bridge constructors. They must realize, that if we do not construct bridges to the liking of the majority (maybe also thanks to some details), our work will never be appreciated enough. Not even if we create structurally ideal masterpieces. This fact was also acknowledged by one of the most famous bridge constructors of the 20th century Othmar H. Ammann by a statement "It's a crime to build an ugly bridge."

The insignia of the Slovak University of Technology from the year 1941 (The Department of Civil Engineering was one of the first departments of the Slovak University of Technology in Bratislava)

PREFACE

Prof. MSc. Dr. Vladimír Benko, PhD.
Head of the Slovak Chamber of Civil Engineers

The design and the building of bridges are difficult tasks, during which mainly the issues of structural design and the demands of those involved must be taken into consideration and to which the whole concept of a bridge must be adapted. A technically well-designed bridge should at the same time fulfil also some aesthetic criteria. For some civil engineering structures, the major role may be played by a graduate with architectural education. This is, however, more an exception than a rule. One of the most famous contemporary architects in Europe – Santiago Calatrava, also realized this. After having finished his studies of art in France and architecture in Valencia, he completed his education by a doctorate in structural engineering at one of the best technical universities in Europe – ETH Zurich. It is questionable to what extent Santiago is an architect or an engineer. Regarding his studies, he achieved the highest degree in structural engineering. Santiago Calatrava is a good example for those alumni of architecture studies who intend to also design civil engineering structures such as bridges.

Bridges and their constructors – civil engineers

Technical competence of a nation is defined by the level of its civil engineering structures. The insight to the remote past also shows us how great importance was attached to bridge building. After all, Pontifex Maximus, the chief bridge constructor in the days of the Roman Empire, is a part of the Pope's titles, although in this case it is rather the case of some symbolic bridges between the God and humans. Engineers spend little time promoting their work. The amount of information about their activity which appears in public is small and thus investment in their own promotion and self-publicizing should be one of the main tasks of their professional organizations. Engineers should promote themselves more, mainly because the fact that the authorship of their structures is often attributed to architects. Such information is, however, often quite misinterpreted (by the public). It involves bridges, tunnels, dams and other civil engineering structures. The author who designs the structure and who bears the responsibility in the event of structural collapse is the engineer. In Slovakia as well as in other countries, it is the author of the architectural layout who is mentioned as the author of the structure and in cases when the architectural layout is made by a civil engineer, he or she is often described as the architect of the structure, even though his education and the scope of his work is structural engineering. In this event, the reader mistakenly connects the architect with the studies of architecture. The authors of the world's most famous bridges are often also referred to as architects, even though they were structural designers educated in technical universities. A good example is that of Millau Viaduct, the world's highest bridge extending over the valley in the French region of Millau at an altitude of 270 metres. It was completed in December 2004. Although, the British architect Sir Norman Foster is often considered to be its author, the main creator of the idea is Michel Virlogeux, structural designer and bridge specialist, who is also often mentioned as an architect. Foster, in an interview regarding who had the major role in the bridge design, said: **"Bridges are mostly engineering projects. That is the dominating aspect. We (the architects) don't force the engineers to meet our visions, but we are cooperating with them and drafting the possible solutions."** (Interview for the NCE magazine; December 2004.)

A similar example from Slovakia is the SNP Bridge in Bratislava. Few people know that it was to be the world's longest cable-stayed bridge. Unfortunately, before it was finished in 1972, three bridges from other countries had overtaken it and so in its days it was only the fourth biggest bridge in this category with a span of 303 metres. However it was maintaining its leadership in the subcategory of cable-stayed bridges with only one

plane of stays. It is undoubtedly unique also for its restaurant placed on the top of an 85 metre high pylon which is still admired by foreign visitors. The author of the bridge's structural design, who had a leading role during the planning, is Professor Arpád Tesár from the Department of Steel and Timber Structures of the Faculty of Civil Engineering of the Slovak University of Technology in Bratislava. Even though Professor Tesár was cooperating with some architects during the design of the bridge, it would be a mistake to accredit this bridge to someone else without mentioning his name.

Uniqueness of the bridges in Slovakia
We cannot say that Slovak bridge constructors avoided innovation in projects. The elevated highway in Považská Bystrica serves as evidence. It is the first highway bridge in Slovakia made of concrete, whose superstructure follows the entire highway profile. This unusual concept resulted from the requirement to affect the city area as little as possible. With its length of 969 metres it is also the longest continuous section in Slovakia. It is quite a bold concept even for European conditions. Another similar case is that of the Apollo Bridge in Bratislava. It became famous for its construction method as its main span (weighting 5 200 tons) was swung across the river Danube into its final position. Thanks to this technology of construction it was nominated in the Opal Awards 2006 in the USA, in which it stood its ground among great competition of much bigger structures and it was placed among the first 5 structures which received awards. Although we tried to push boundaries, both examples had good conclusions. So it is not true that Slovak structural designers lack courage. After all, the SNP Bridge in Bratislava is still being used as a teaching example to demonstrate engineering skills.

Few people know that the Lafranconi Bridge built by the free cantilever cast-in-situ method, also belongs among the world's rarities. Its concrete cantilever is among the longest in the world. Had another such cantilever been done, as it was originally intended, it would still be among the top ten bridges of its kind.

Engineers and their technical intelligence must make themselves visible in society. Peter Paulík, the author of the book Bridges in Slovakia, not only delights civil engineers, but he would also delight the constructor of the century (in Slovakia) professor Peter Danišovič, who at the age of 104 years in one interview for the media said: "It makes me sad that our technical and most of all our engineering intelligence shows itself so little, that it is hardly heard, although it is a thousand times more numerous as we were in our beginnings before the war. There were few of us, after all, who founded the first Slovak University of Technology." After the Velvet Revolution, many of us expected greater acknowledgement and appreciation from society for the mental work in technical fields. Few things have changed after the first generation and we see that the validity of professor Danišovič's opinion persists. It is us, the engineers, who have to let the world hear from us also when we succeed in our work and it serves society without any problems. It is a pity that the media get interested in us only in the event of some emergencies and accidents. The publication of the Bridges in Slovakia did not happen easily; there is the author's hard work behind it. We discussed the first ideas leading to its birth with the author back in 2010 and I am already looking forward to the next books about bridges by Peter Paulík, which will definitely be among the publications contributing to the visualization of several generations of technical intelligence in Slovakia.

There are so many engineering structures in Slovakia such as dams, water structures, tunnels, roads, highways, railways, cableways, reservoirs, chimneys, cooling towers, power stations and so on, that it would be possible to publish many similar publications. Other young enthusiastic engineers have to be found, who will surely receive our similar support.

THE BOOK'S FORMATION

I have always been fascinated by bridges and I have always admired their magnificence and the mastery of their creators. To me, they are more than just simple structures. They are symbols, representatives of the history, art and progress of civilizations. This led me to carry on with my studies at the Slovak University of Technology in Bratislava where I chose the faculty of Civil Engineering and I began to study "bridge building". Thanks to the construction of the Apollo Bridge, on which I had the opportunity to work and spend several months, my affinity with bridge structures became even more profound. After I had finished my studies, I started to work in the company Doprastav and for over a year I was working on the construction of the bridge built by incremental launching technology in Štrba. There I met my wife. Therefore, bridges became more than just work for me, they became my hobby and to a degree also my destiny. Although I have always been fascinated by them and I have been collecting postcards with historic bridges for several years, I had never imagined that one day I would publish a book about bridges.

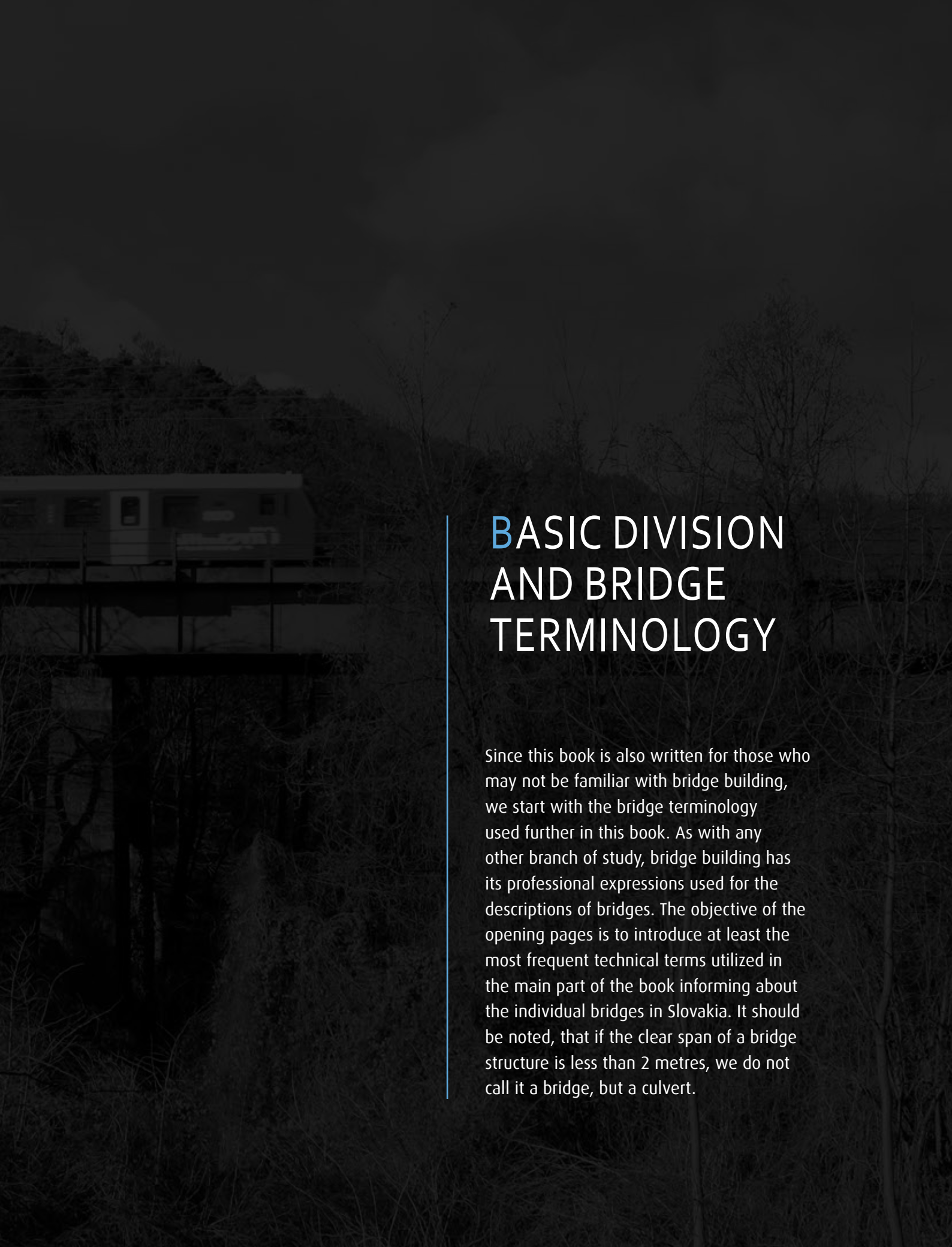
The breaking point was the journey to the Hradec Kralové's conference in November 2010, during which I was talking with Professor Benko about how Slovak bridges are somewhat in the background and that they are not socially appreciated enough. We agreed that one of the major reasons could be that common people do not have even the slightest idea how many unique bridges exist in Slovakia because there is no such a source. That is how I originated the idea to write a book for the general public with the selection of some representative bridge structures. Although I already had quite a good overview of the most interesting bridges in Slovakia at those times, a difficult period of collecting data and clues followed. Older books from the 80s, some newer brochures published in the Czech Republic by assoc. prof. D. Jozef and a vast amount of archive material helped me as a start. The Internet was also of considerable help by means of which I went through all the main railways, roads and water routes. This arduous, but on the other hand exciting work lasted several weeks. I outlined an electronic map and I planned the journeys of photography expeditions. This map is currently available on www.mostynaslovensku.sk. The photographing of the bridges followed, during which I literally criss-crossed the whole of Slovakia and with a laser device I measured almost every single stone bridge I saw and it has to be said that in some cases there were great differences between the data in previous books and the reality. Taking pictures and measuring took me several tens of weekends. Naturally, there were times when I was not satisfied with the photograph or I discovered another bridge near to where I had been before, so there are some places which I visited more than 3 times. I visited Bratislava airport's lighting bridge the most often of any; I returned 7 times until I was finally content with the photo.

Many bridges were located in an inaccessible terrain so I often had to climb steep slopes, wade through swamps, and walk through 2 metre high nettles and so on. There were also several times when dogs from a chalet or from a nearby village chased me (for example when I was passing by the settlement of Letanovce). I even had to creep through fences or trick a guard to reach some bridges. This happened with a bridge in the area of Halič manor house, which was strictly guarded during the reconstruction. However, before the guard pulled himself together I had already made some snaps. The longest expedition was that to the heart of the Slovak Paradise, into the part Oblazy, into which I was walking for 7 hours only to make a single photo. Moreover, I became lost and since I had not brought any water, I had to drink directly from the stream in the forest. I will also never forget the truck drivers who, in the night, were looking after my motorbike near the Ukrainian borders, or my trek through the Hornád Canyon for which I only had limited time. I discovered how to get chilled to the bone when I was passing through Dobšiná and Telgárt at 6 o'clock a.m. when the temperature was around 5°C and I was wearing motorbike clothes adjusted to the temperature around 25°C. After that I was glad to welcome the sun beating down on the mountain side and the blood began to circulate in my chilled hands again. The motorbike was very useful; it could be parked almost everywhere and there were also some routes impossible to pass by car. A disadvantage was the dependence on weather. Because of this I spent several hours in a local pub or in an abandoned bus shelter waiting until the rain stopped. I was often photographing on the way to my

parents-in-law who live in Štrba and so a 3.5 hours journey was prolonged to 6 or 7 hours. My wife tolerated it only by strong self-control. I had better skip the story about our romantic trip to the region of Orava on which I spent most of the time measuring and taking pictures. On my journeys I mostly followed the satellite navigator which, however, often brought me to unused roads. Until I realized the road was getting worse and worse, it was too late to return. In this way I crossed a closed, completely destroyed road near Ulíč, where I was lucky to get away with it safe and sound. The most dangerous stretch of road where the navigator took me was a passage through an abandoned tunnel near Margecany. At the beginning it seemed to be fine, but after more or less 200 metres it became pitched dark with approximately 20 centimetres of mud. Although my motorbike's light guided me through the dark, had there been any log or a rock hidden in the mud, I would have crashed. There used to be light at the end of the tunnel and fortunately so it was, with the only difference that I ended up in a forest instead of a road. Returning to the tunnel was out of the question so I rode approximately 20 kilometres through the forest, in which I met some surprised mountain bikers. After such expeditions I was really fed up with my motorbike, but as another weekend came, I sat on it again.

Towards the end of the autumn 2011 I had most of my material ready and I began writing the book. Long evenings followed during which I was sometimes writing till late at night. Searching for missing information and writing e-mails to the municipal offices and institutions was a necessary part of this phase. Unfortunately, it was often the self-governments in many cities and most of all in villages that were very reluctant to provide information. However, there were also some which were very helpful in providing me all the requested information (for example in Stará Ľubovňa, Ružomberok or Liptovský Hrádok). A visit to the exhibition of a photographer Peter Gyukics, who applied himself to photographing the Danube's bridges, was a significant encouragement in my work. I met there MSc Samuel Jelínek from the Slovak Road Administration to whom I happened to mention that I was preparing such a book. He gladly provided me the information I lacked and his great enthusiasm in this sphere inspired me to even greater activity.

In May 2012 the book was at about 90% completion. When I would have thought that the most difficult part was over, a question of financing came up. To obtain enough financial resources for its publication was more difficult than I had expected. The crisis dominating the construction industry caused many companies simply not to be able to afford additional expenses. In this phase a great deal of help came from Professor Jaroslav Halvoník with whom we visited the major engineering companies operating in Slovakia in the field of bridge design. Even in spite of the crisis we experienced a very helpful approach and big willingness to help to publish this book. On the other hand, it was more difficult with the companies from the field of bridge construction, even though they are involved with much higher sums of money than the designing offices. Their willingness, except for a few cases, was scarce. At the end enough finances were collected and the first work on book editing began. At this point I would like to express my gratitude to the JAGA publishing house for their professional approach. You are reading these lines also thanks to them. I hope you like this book and I strongly believe that it will provide you with much interesting information and that bridges will win your heart not only by their present appearance, but also by their history, because bridges do not only have their structure, but also their destiny and soul. They mirror the destinies and the culture of nations. Many of them retain memories of our forefathers, who ceased to exist long time ago, and many bridges are their last memoirs. And if life is a way, then let us not forget that a way is usually only a connecting line between two bridges.



BASIC DIVISION AND BRIDGE TERMINOLOGY

Since this book is also written for those who may not be familiar with bridge building, we start with the bridge terminology used further in this book. As with any other branch of study, bridge building has its professional expressions used for the descriptions of bridges. The objective of the opening pages is to introduce at least the most frequent technical terms utilized in the main part of the book informing about the individual bridges in Slovakia. It should be noted, that if the clear span of a bridge structure is less than 2 metres, we do not call it a bridge, but a culvert.

BRIDGES CAN BE GENERALLY DIVIDED INTO THESE BASIC CATEGORIES:

1

ACCORDING TO THEIR PURPOSE:

- Railway bridges
- Road and highway bridges
- Pedestrian bridges
- Industrial bridges (pipe and conveyor)
- Aqueducts
- "Ecoduct" bridges (serve for example as passage above highways for wild animals)

2

ACCORDING TO THE MATERIAL USED

- Stone bridges
- Timber bridges
- Brick bridges
- Cast iron bridges
- Steel bridges
- Bridges made of aluminium alloys
- Concrete and reinforced concrete bridges
- Composite bridges (for example if the girder of the bridge is made by a combination of steel and concrete structural elements,)

3

ACCORDING TO THEIR ESTIMATED LIFE

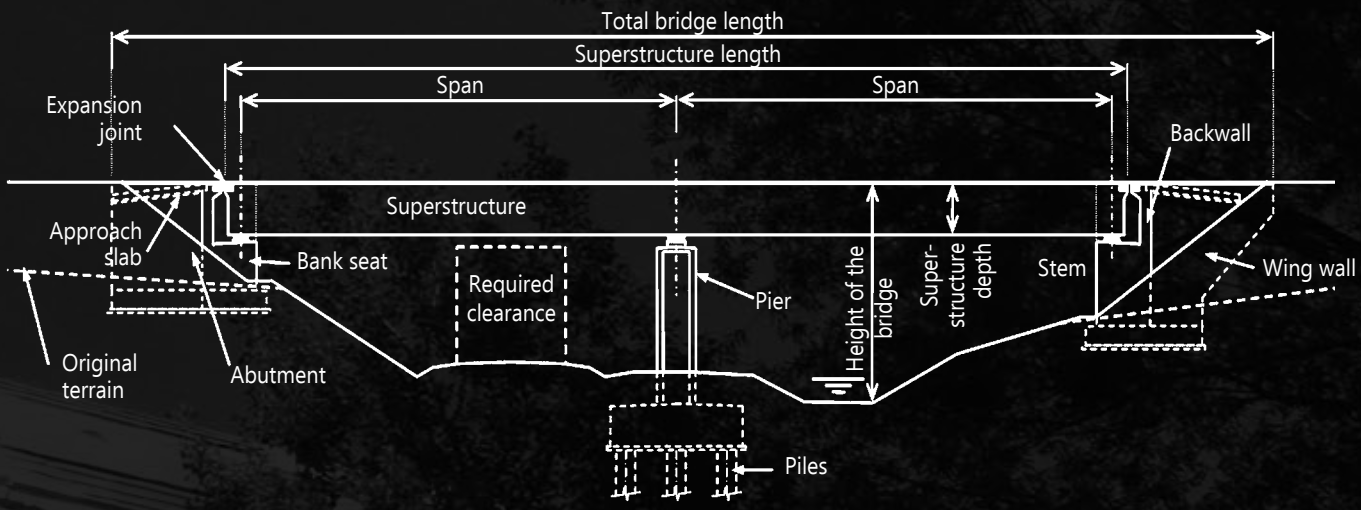
- Temporary bridges, which are further divided into:
  - Short-lasting (built for a maximum of 5 years)
  - Long-lasting (built for more than 5 years)
- Permanent bridges (planned durability is at least 100 years)

4

ACCORDING TO THE SHAPE OF THE CROSS-SECTION

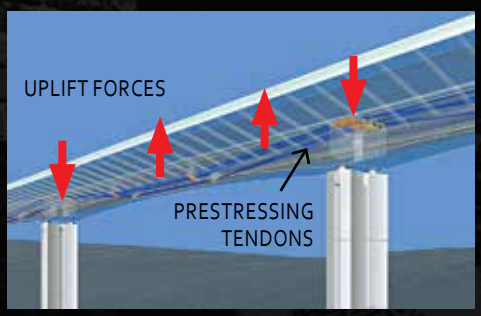
- Slab bridge
- Girder bridge
- Box-girder bridge

TERMINOLOGY OF THE BASIC PARTS OF THE BRIDGE IN LONGITUDINAL SECTION

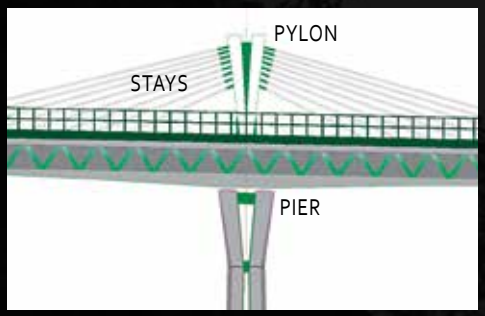


5 CONCRETE BRIDGES ARE FURTHER DIVIDED ACCORDING TO THE DEGREE OF REINFORCEMENT

- Bridges of plain concrete (without steel reinforcement, or when the degree of reinforcement is smaller than the so called minimum amount of reinforcement)
- Reinforced concrete bridges (the degree of reinforcement exceeds the minimum amount of reinforcement – the reinforcement contributes to the load-bearing capacity of the bridge)
- Prestressed concrete bridges (in these bridges so called pre-stressing tendons are used, which are anchored after having been stretched and so they apply compression force, by which the load bearing capacity of the concrete structure is significantly improved. These tendons are mostly placed inside the bridge so they are not visible from the outside)

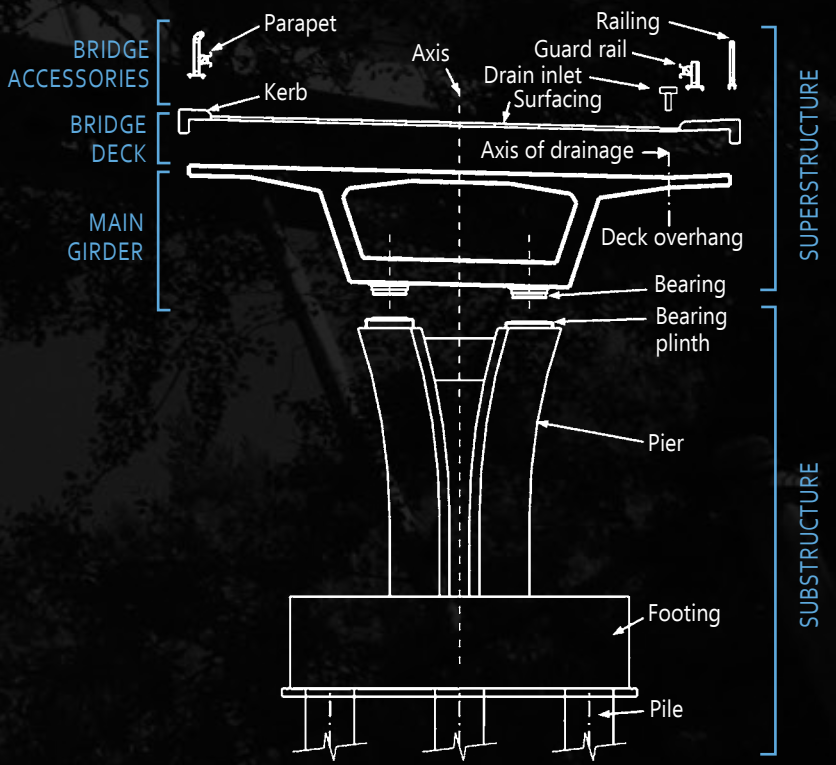


Prestressed concrete bridge

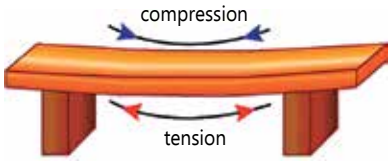


Basic parts of the cable-stayed bridge

TERMINOLOGY OF THE BASIC PARTS OF THE BRIDGE IN CROSS SECTION



TYPES AND BASIC STRUCTURAL BEHAVIOUR OF BRIDGES



Compression and tension zone in the girder bridge.

I -shaped girder

Box girder

BEAM BRIDGES

The oldest and at the same time the most widespread type of bridges is the so called beam bridge (most of the elevated highways and flyovers).

From a wider perspective, a fallen tree along which we cross to the other side of a stream can also be considered a beam bridge. Although its structural behaviour and the more precise calculations of its bearing capacity were described only around the 18th century, the skill and the experience of craftsmen had enabled them to reliably build this kind of bridge over some obstacles many centuries earlier. Naturally, the theory of these bridges is nowadays so sophisticated that we can bridge over such distances of which our ancestors had not even dreamed. And this is done without the worry whether it would carry the given load. Every bridge has to sustain its self weight and also the so called "live loads"; while mostly the self weight of the structure starts to be a problem with bigger spans and every type of bridge "balances" it specifically. From this point of view, the beam bridge is the least suitable. The basic principle of its structural behaviour lies in the creation of compression and tension zones caused by the bending near the upper and the bottom surface, as it is demonstrated in the picture.
It can be logically concluded, that the larger and deeper are the beams of a bridge, the bigger load they may carry. However, as I already mentioned, the problem is the self weight increasing by the bigger cross section of the beams. Later, as structures evolved, it has been discovered, that if rectangular cross sections are not used, but the mass instead is concentrated to the upper and the bottom surface, for example a hollow cross-section or an I shape, the load carrying capacity will remain the same (in fact it will slightly decrease in comparison with the rectangular cross section), but on the other hand its own weight will significantly decrease and with the same depth the girder will be able to carry a bigger load or the bridge could have a longer span. Moreover, for a particular span a girder with rectangular cross-section, would not be even able to carry its self weight, but made as a hollow cross-section it can also carry some additional load.
This is the reason why nearly all girder bridges are designed as hollow cross-sections (they are also called box-girder sections), eventually as I and T shape profiles. The reinforced concrete beam bridge with the longest span in the Slovak Republic is the Lafranconi Bridge (173 metres, with a cantilever 120 metres long). The beam bridge with the longest span in the world is the Shibanpo Bridge built in 2006 in China. Its span is 330 metres and its concrete cantilever is 111 metres long, which is 9 metres less than that of the Lafranconi Bridge (a span of 330 metres was achieved by inserting a steel span 108 metres long which was set on two neighbouring cantilevers 111 metres long).

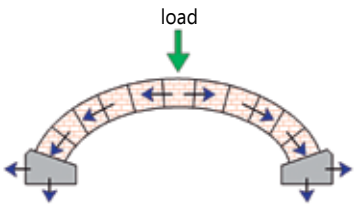
If the mass in the cross section of the beam is concentrated at the flanges its bending capacity increases

TRUSS BRIDGES

Another milestone in bridge building was the discovery of the truss.

There are many types of trusses, the principle is, however, still similar to that of the beam bridges. In bridges with a single span, the top chord is stressed by compression and the bottom by tensile force (the intermediate members are stressed either by compression or by tensile force). Since the walls are also significantly lightened, a further reduction of the self weight is achieved. The most famous Slovak truss bridges are the Old Bridge (Starý most) and the Port Bridge (Prístavný most) in Bratislava with a main span length of 205 metres. The truss bridge with the longest span in the world is the Quebec Bridge in Canada with a main span length of 549 metres.

ARCH BRIDGES

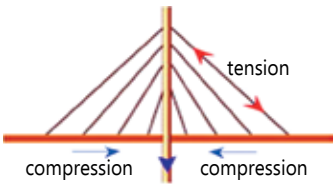


This type of bridge is among the oldest ones mainly because of the fact that a well-designed arch is mainly stressed only by compression.

This kind of load transfer enabled arches to bridge over greater distances with a material with low tensile strength, as for example brick or stone. For a structure of this type, the compression forces arising from a heavy load at the arch top can be transferred by the masonry between the single arches, thus ensuring satisfactory stability of the structure even in extreme cases.

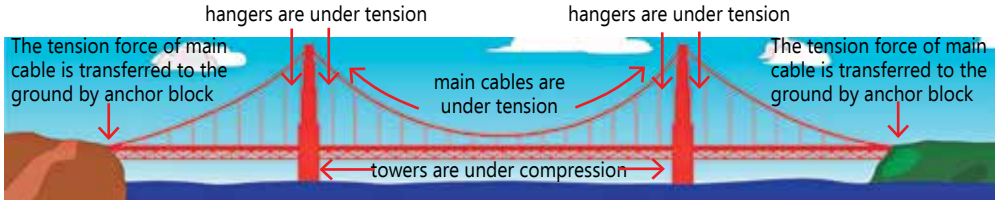
Many of these bridges, especially from the days of the Roman Empire, have been preserved till modern times. The structural action of an arch bridge is more efficient than that of a beam bridge, which allows spanning longer distances. The world's biggest arch bridge is the Chaotianmen Bridge built in China which has a span 552 metres long; the arch itself is configured as a truss. For example, the maximum span of the Apollo Bridge is 231 metres, but it has a bowstring arch (the main girders have the function to act as ties for the arches). In Slovakia, the stone bridge with the longest clear span of its arch (16.2 m) is in Gelnica.

CABLE-STAYED BRIDGES



The basic structural behaviour of cable-stayed bridges may be best described by the diagram, where it can be seen that, for example, the pylon and the deck are subjected mainly to compression and the stay cables to tension forces (the pylon and the deck are at the same time subjected to bending moment).

In this case the load is transferred from the deck to the stays and subsequently through the pylon and pier into the ground. The arrangement of the stays may vary, while each is not necessarily structurally equally effective. Less effective solutions may be chosen for architectural and construction reasons (a structurally more effective system may be much more difficult to construct). The most efficient is a symmetrical system with stays anchored as close to the top of the pylon as possible (various inclined pylons and asymmetric cables are structurally less effective but could be aesthetically more pleasant). Cable-stayed bridges with a low pylon, compared to the span, are called extradosed bridges. The most well-known cable-stayed bridge in Slovakia is the SNP Bridge in Bratislava, which was in the time of its construction (1972) unique in the world with the main span being 303 metres. At present, the cable-stayed bridge with the longest span in the world is the Russian bridge Russky, with a main span of 1,104 metres. The bridge was completed in 2012.



Suspension bridge

SUSPENSION BRIDGES

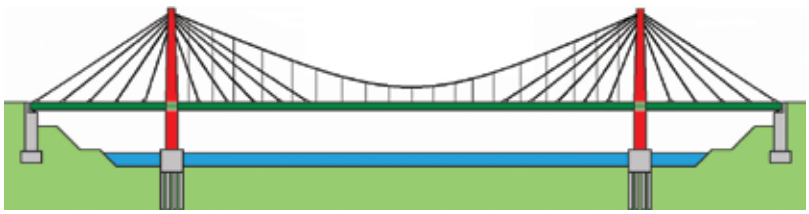
It is believed that the first suspension bridges were built around the year 300 BC in China (however, these were only simple pedestrian bridges suspended by natural ropes).

Present-day modern suspension systems achieve spans up to 2 kilometres. The load from the deck is transferred to the hangers and then into the main cables, which transfer a part of the load into the towers and a part of it into the ground through massive anchorage blocks. Finally, the load, through the towers and the anchorage blocks, reaches the ground. In Slovakia, suspension systems have only been used for pedestrian bridges or in some cases for pipeline bridges. There has been no road suspension bridge built so far in our country. The longest suspension bridge in Slovakia is the pipeline bridge in the port of Bratislava, with a span reaching 156 metres. The bridge with the longest span in the world is the Japanese bridge Akashi Kaiko, a span of which reaches 1,991 metres. However, currently the building of a suspension bridge between Italy and Sicily is planned – the Messina Bridge, which would have an incredible span of 3 300 metres.

HYBRID AND OTHER SYSTEMS

Many bridges are built with so called hybrid structural systems, which could be described as a combination of the systems mentioned before, for example that of suspension and cable-stayed systems or of arched and truss systems.

The most well-known hybrid structural system is to be found in the USA – the Brooklyn Bridge. In Slovakia, the foot-bridge in Piešťany is an example of this kind.



Hybrid structural system: combination of the suspension and the cable-stayed system

The structural design of a bridge is much more complicated than one might presume at first glance. Different random loads combine to interact, which may change their position and direction, they may act together or one by one, cause resonance, oscillation and so on. In addition to the basic types of strains from compression, tension or bending, twisting of the beams must also be considered. When we also add the evaluation of local stresses, the evaluation of construction phases, time dependant phenomena (for example concrete creep and shrinkage), and the geotechnical design of the foundation, even a simple bridge with a span less than 50 metres may have 200 or even 300 pages of calculations and drawings. Such detailed structural analysis provides quite good assurance that no unpredicted event will occur during the building of the bridge or during its service life.

BASIC TECHNOLOGIES OF BRIDGE BUILDING

CAST IN PLACE OR ASSEMBLY ON FALSEWORK

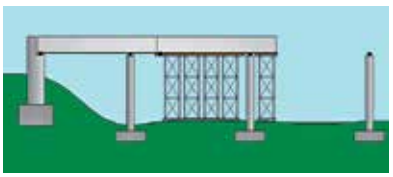


photo: ŽSR MDC

Bridge false work

This method is among those used most frequently in bridge building and is mainly used for bridges with smaller span and in places where falsework can be temporarily built.

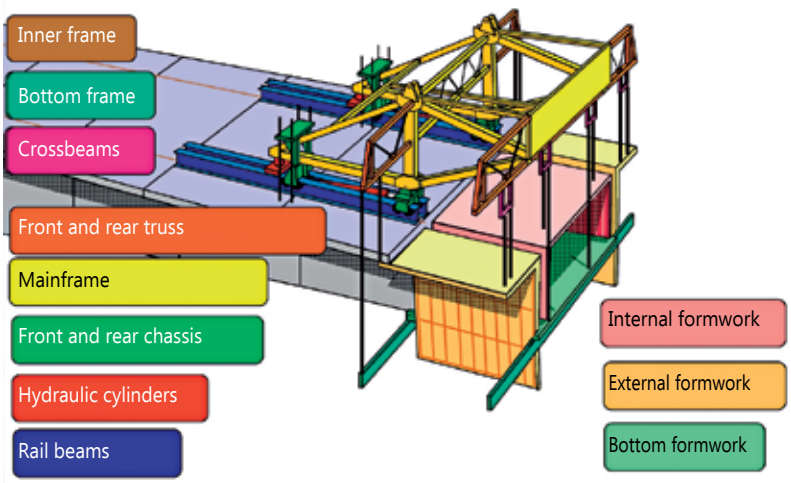
It is ideal for bridges lying quite low above the ground and when the access to the area under the structure may be temporarily restricted. This technology is used for concrete, stone, brick or steel bridges. In the case of concrete bridges, casting is mostly done directly on the falsework, sometimes however, only the precast concrete elements of the bridge are assembled together on the falsework (for example with precast segmental or girder technology).
Within Slovakia, the bridge with the longest span built on a supporting falsework is the bridge across the river Váh in Komárno. The clear span of its main span is more than 112 metres. It was built in 1953.

A special kind of a formwork is the so called movable scaffolding system, which is not placed directly on the terrain, but on the built bridge piers. It is used for the construction of bridges with several spans, while the falsework is gradually moved by means of mechanical devices. This method is most often used for concrete flyovers. In Slovakia, it was for example used during the construction of the concrete flyovers of the Port Bridge (Prístavný most) and also during the construction of bridges near Považská Bystrica and Nitra.

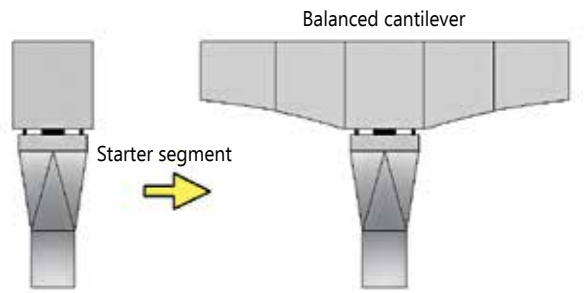
Movable scaffolding system

CAST IN PLACE FREE CANTILEVER METHOD

As its name indicates, this technology is used in the building of concrete bridges.



Free cantilever method

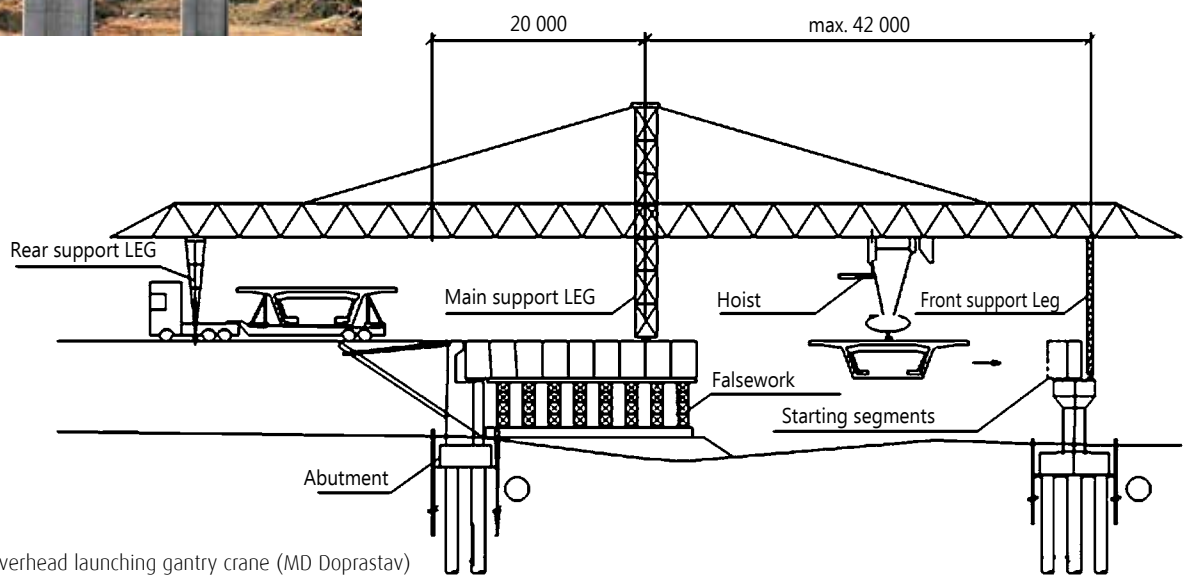


In Slovakia, it was first used during the building of a bridge in Nové Mesto nad Váhom finished in 1963. Ever since this bridge was completed this technology has been among those used most frequently in the field of concrete bridges with spans between 60 and 150 metres. The bridge is gradually built from the piers, and mostly done symmetrically to assure balance. Segments are cast with the help of a form traveller anchored in the already finished section. Slovakia's biggest bridge built with this technology is the before mentioned Lafranconi Bridge (span 173 metres). This technology was also used in the building of the highway bridge in Považská Bystrica and in many other important bridge structures.

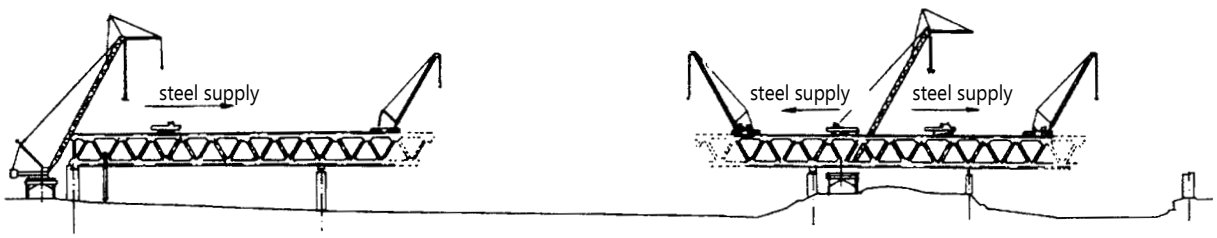
SEGMENTAL CANTILEVER METHOD

The cantilever method is applied to concrete and also steel bridge construction.

In this technology, the segments are progressively connected to the already finished structure. Construction can proceed by balanced cantilevers or by a system of one-sided cantilevers with sufficient stabilising of the structure during its construction by means of stays or temporary supports. In the case of a concrete bridge, special falsework is mostly used, the so called overhead launching gantry crane, which is able to move on the finished part of the structure. The launching gantry is equipped with a crane by which single precast segments are lifted, transported and attached to the already finished part of the superstructure. In Slovakia this technology is most often used in concrete highway bridge construction, but it has failed to be accepted in railway engineering. The paradox is that within Europe it was in Slovakia where the first precast segmental concrete bridges were built on railway lines. These first segmental bridges were the bridges in Margecany and Jaklovce built in the year 1966.



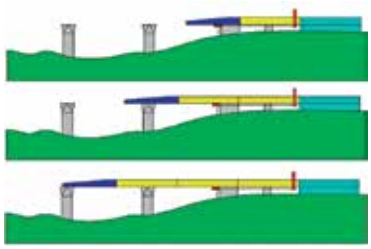
Overhead launching gantry crane (MD Doprastav)



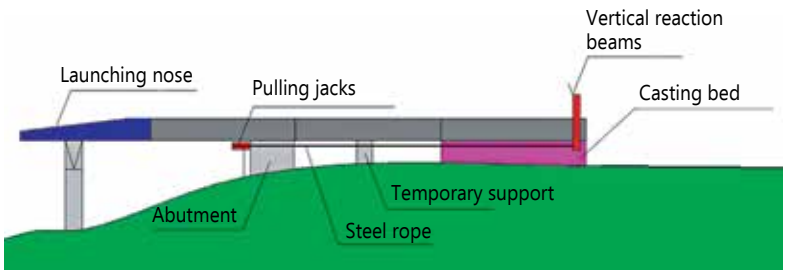
Steel truss bridge – cantilever erection method

INCREMENTAL LAUNCHING TECHNOLOGY

Incremental launching technology is used both in concrete and steel bridge building. Its principle lies in constructing the bridge in one place, from which the completed part of the structure is launched across and above the valley by the means of hydraulic jacks.



During the launching process, there are slide bearings placed on each pier on which the structure moves. In the case of a concrete bridge built by incremental launching technology, use is made of a so called steel launching nose placed at the front of the superstructure. It serves to lower the stresses in the superstructure during the launching (because the nose is much lighter than the concrete superstructure which is being built). This technology allows rapid construction; however, it may be used only with bridges with some specific geometric parameters. In Slovakia, this technology was used for the first time in the year 2005 during the building of a concrete bridge near Štrba village. Since that time, it has been used during the building of highway bridges near Považská Bystrica, Nitra, and Levoča and also during the building of the steel-concrete composite highway bridges near the village of Skalité.



Launching nose

NUMBER AND STATE OF BRIDGES ON THE TERRITORY OF SLOVAKIA

Since there are no nationwide bridge statistics in Slovakia, for this overview, information from several sources had to be collected.

ROAD BRIDGES

BRIDGE TYPE	STRUCTURAL MATERIAL	TOGETHER quantity (pc)	length (m)	area (m²)
Temporary bridges	timber	1	2	16
	steel	22	535	2 495
	reinforced concrete	1	5	34
Temporary bridges		**24**	**543**	**2 546**
Permanent bridges	stone	222	891	6 740
	stone-concrete	1	21	187
	steel	114	1 354	11 615
	steel, plate girder	124	2 246	22 232
	steel, truss girder	14	1 503	12 950
	composite: steel-concrete	16	245	1 649
	precast prestressed concrete	1 578	64 626	709 523
	precast reinforced concrete	1 920	14 373	140 441
	prestressed concrete	204	40 712	456 746
	plain concrete	235	1 063	9 234
	masonry	32	151	1 113
	reinforced concrete	3 203	28 006	255 411
	other material	7	760	8 519
	not specified	118	254	2 482
Permanent bridges		**7 788**	**156 204**	**1 638 841**
Total		**7 812**	**156 747**	**1 641 387**

Slovak road administration, 2010

RAILWAY BRIDGES

BRIDGES	QUANTITY
Steel bridges	504
Concrete and masonry bridges	1 781
Total	**2 285**

www.rail.sk, 2001

BRIDGES ON LOCAL STREETS AND ROADS

REGION	PERMANENT	TEMPORARY
Bratislava region	221	1
Trnava region	436	7
Trenčín region	1 279	17
Nitra region	740	12
Žilina region	1 640	41
Banská Bystrica region	1 807	59
Prešov region	1 950	53
Košice region	1 071	19
Total	**9 144**	**209**

Statistical office of the Slovak Republic, 2009

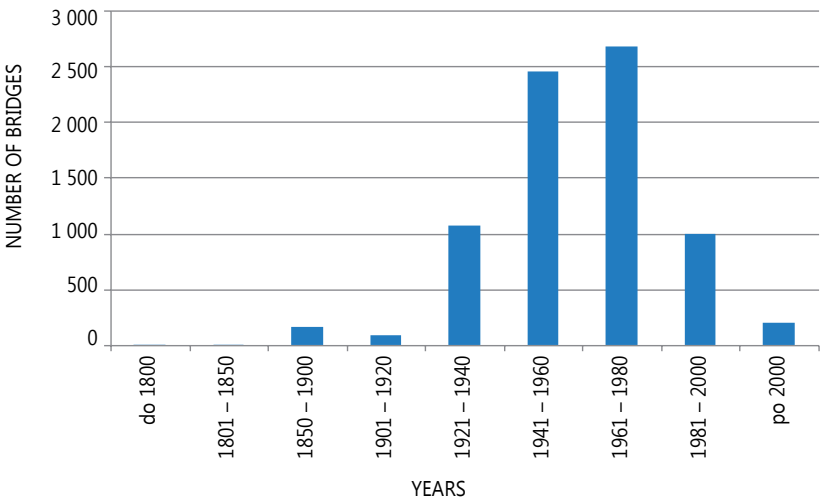
PEDESTRIAN BRIDGES

Total	**3 557**

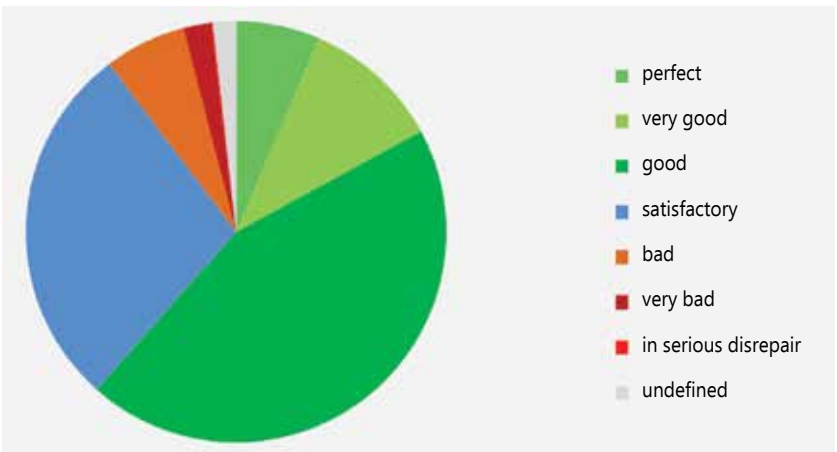
Statistical office of the Slovak Republic, 2009

A problem also arises as to whether the numbers of bridges are up-to-date, or if some data may be duplicated (for example, if the local authorities include the bridges on 3rd class roads in the category of bridges on local roads, which may already be included in another category). Road bridge statistical data are well processed and clearly documented by the Slovak Road Administration – available to the public on the website. Bridges on railways are registered by the Slovak Railways; however, the only publically available data is from the year 2001 together with an up-to-date map of railway bridges (without mentioning the overall count). Bridges on local roads and footbridges are registered by the Statistical Office of the Slovak Republic, the data of which are also available on their website. The number of bridges listed by the Slovak Road Administration and the Statistical Office correspond almost exactly. The only information which I unfortunately did not manage to find is the number of pipeline bridges, which are probably administered by Transpetrol on the Druzba Pipeline and by the SPP (Slovak Gas Industry) on gas pipelines. I also did not succeed in finding any official numbers on their websites.
In summary, there are approximately 23 000 bridges in Slovakia excluding pipeline bridges. The overall combined length of the road and railway bridges is 235 km. Since it is impossible to mention all the bridges, their photos and information, I chose those which I find the most interesting.

NUMBER OF BRIDGES IN SLOVAKIA BUILT IN A CERTAIN PERIOD



TECHNICAL CONDITION OF BRIDGES IN SLOVAKIA



With the available information about the road and highway bridges we are able to construct a graph indicating how many bridges have been built.
The highest number of bridges built within a 10 year period was between the years 1961 and 1971. There were 1 681 bridges built in Slovakia in this period.
If the combined lengths instead of the numbers were shown in this graph, it would probably be slightly different, but this suffices for the general overview.

The graph about the condition of the bridges, classified by experts from the Slovak Road Administration, was constructed from the same database.

From this graph it can be seen that most of our bridges are presently in a good technical condition.

A BRIEF COMMENT ABOUT THE INFLUENCE OF WORLD WAR II ON BRIDGE BUILDING

Many bridges built in the period before World War II in Czechoslovakia ranked among the most impressive structures of their times.

Both Czechoslovak and the former Hungarian bridge building had very good reputations in that era and many specialists from the field of civil engineering were among the world's best engineers of that time. However, the major part of their magnificent masterpieces, as if at one stroke, disappeared during the few final months of World War II. This is the reason why alongside some bridges in the book there are also some historic photographs of their forerunners and for almost every important railway bridge, there is information about its destruction.

The retreating Wermacht, trying to slow down the advance of the Red Army, destroyed or seriously damaged more than 1,900 railway bridges and 2,000 road bridges. These, in total 3,900 bridges, at that time represented around 70% of all the larger bridge structures in Slovakia. The result was the complete paralysis of the function of most bigger cities. There was hardly any passable continuous railway line remaining. The engineers and the specialists faced a difficult task – to restore the most important road and railway routes needed to supply the towns with coal and groceries in as short time as possible. To build a bridge when there is enough time and finances it is one thing, but to react in short time in the conditions dominating the period immediately after the war was much more difficult. The progress of renovation was mainly hampered because of lack of building materials, tools, machines and qualified workers. A considerable complication was represented also by the large amount of unexploded charges and bombs which the German armies had used for destruction of the bridge structures. The reconstruction of railway lines and roads was mostly carried out using temporary timber bridges built only by primitive methods and human power. So called reconstruction unions were formed to coordinate the design and construction works. The Red Army was also of considerable help whose priority was the reconstruction of bridges needed for the transport of military equipment. Within 3 years most of the important roads and railways were passable again. The temporary bridges were built several metres from the destroyed bridges, so that the original bridges could later be reconstructed. The era of replacement of the temporary bridges by permanent structures lasted almost another 10 years. However, the need to build fast had also some advantages. To Czechoslovakia, it brought state-of-the-art methods of calculations and bridge construction methods which increased the efficiency and reduced the construction time needed under difficult conditions. Prestressing technology began to be used on a large scale and new bridge building technologies which were developed at those times have continued to be used, in their refined forms, since then.

photo: ŽSR MDC

photo: ŽSR MDC

In the shortest time engineers and experts had to restore the most important sections of roads and railway lines, which served to supply the cities.

Saint John of Nepomuk

One of the most famous statues of St. John of Nepomuk in Slovakia

SAINT JOHN OF NEPOMUK THE PATRON SAINT AND THE PROTECTOR OF BRIDGES

Photographs of Saint John of Nepomuk's statue appear several times in the book, so in the introduction some basic information about this saint must be mentioned.

His statues date back to times when lack of knowledge in bridge structural analysis was substituted by religious faith which left some splendid masterpieces.

Saint John of Nepomuk's cult fully developed approximately 300 years after his death when the Church canonized him. His statues are to be found in the surroundings of almost every older bridge, since people believed that he can protect pilgrims wandering across the bridge as well as the structure itself from natural disasters or wars.

There are still disputes whether it is a real or a made up personality. However, in general it was accepted that it is a real personality from history – John from the Pomuk born around the year 1340. In 1389 he was named the general vicar or archbishop of Prague, which was the second highest office in the administration of the Roman Catholic parish. Later he got into an argument with the Bohemian king Wenceslaus IV and there he met his fate. The legend says he did not want to reveal the seal of confession which the queen confided to him, so the king tortured him. However, he did not get anywhere and John instead of revealing the seal, chose death. His body was thrown from Prague's Charles Bridge into the river Vltava and several metres away it was washed up ashore, where it was found by local fishermen.

The statues of St. John of Nepomuk are characteristic of some typical features – priest's clothes (a white rochet and a black biretta on the head); he usually holds a cross and a palm leaf as a symbol of martyrdom and victory. There often appears a rendering with stars around his head which probably symbolizes the night sky, since it is said that his body was thrown into the river in the night and in the night – by the star light – he was also found by the fishermen. The number of stars - 5 - symbolizes the 5 Latin letters tacui, which means I was silent.

One of the most famous Slovak statues of this saint was placed back in the 18th century on the so called flying bridge in Bratislava. The statue is quite unique – St. John of Nepomuk holds the biretta in the left hand and the right hand which holds the cross is stretched. The statue was later relocated to the boat bridge of Carolina Augusta built in 1825 that served until the Franz Joseph's bridge has been finished in 1890. After the opening of the first permanent bridge in Bratislava, the statue was moved to the garden of Janko Král on the Petržalka's riverbank. Today it stands forgotten in the chapel of the church called "Kostol Povýšenia svätého kríža". Perhaps it would be suitable to move it, after it has taken a rest, to one of Bratislava's bridges at least as the symbol of the Danube's historical bridges.

One of the most famous statues of St. John of Nepomuk in Slovakia is the one, which was placed on the so called "flying bridge" in Bratislava back in the 18-th century.

THE TOP BRIDGES IN SLOVAKIA

RAILWAY BRIDGES (according to www.rail.sk)

THE LONGEST BRIDGE:
the viaduct near Šenkvice, 740 m long

THE LONGEST CROSS-BORDER BRIDGE:
the bridge between Slovakia and Hungary in Komárno, 510 m long

THE LONGEST ROAD-RAIL BRIDGE:
the Port Bridge (Prístavný most) in Bratislava, together with the connected flyovers, 2 295 m long

THE LONGEST BRICK BRIDGE:
the former Red Bridge (Červený most) in Bratislava 215 metres long, nowadays part of the Marchegg viaduct near Devínska Nová Ves, approximately 185 metres long

THE LONGEST CURVED BRIDGE:
the Hanušany viaduct 389.9 m long

THE LONGEST SPAN:
road-rail Port Bridge (Prístavný most) in Bratislava with a span of 204.8 m

THE BIGGEST REINFORCED CONCRETE ARCH BRIDGE:
the Uľany viaduct with a clear span of 55 m, which was at the time of its construction the biggest structure of its kind in Eastern Europe

THE LONGEST SPAN OF A LANGER TYPE BRIDGE:
the pair of bridges in Žilina with a span of 112 m

THE FIRST WHOLE-WELDED STEEL BRIDGE:
the viaduct Pod Dielom from the year 1959

THE FIRST RAILWAY BRIDGE BUILT BY THE PRECAST SEGMENTAL TECHNOLOGY:
the bridges in Margecany and Jakovce from the years 1964 to 1967, first rank also across Europe

THE OLDEST PRESERVED BRIDGES:
the bridges within the railway Vienna – Bratislava built in the years 1844-1848 (for example the Marchegg viaduct)

ROAD AND HIGHWAY BRIDGES

THE LONGEST BRIDGE:
the viaduct near Považská Bystrica 2,081 m long, road-rail Port Bridge (Prístavný most) in Bratislava is together with the flyovers 2,582 m long

THE LONGEST BRIDGE SPAN:
The SNP Bridge in Bratislava with a span of 303 m

THE LONGEST SPAN OF AN ARCH BRIDGE:
The Apollo Bridge in Bratislava with a span of 231 m

THE LONGEST SPAN OF A CONCRETE BRIDGE:
The Lafranconi Bridge in Bratislava with a span of 174 m

THE OLDEST PRESERVED BRIDGE:
probably the stone bridge in Dravce from the 13th century

THE OLDEST PRESERVED REINFORCED CONCRETE BRIDGE:
the bridge in Krásno nad Kysucou from the year 1891 (still in service)

STONE BRIDGES

THE BRIDGE WITH THE BIGGEST CLEAR SPAN OF THE ARCH:
the bridge in Gelnica – clear span of the arch is 16.2 m

THE LONGEST ROAD BRIDGE MADE OF STONE:
the bridge in Krásno nad Kysucou 53.6 m long

THE LONGEST STONE BRIDGE:
the bridge near to the manor house in Holíč 54.6 m long

MILESTONES OF BRIDGE BUILDING IN SLOVAKIA

11TH CENTURY:
Stone arch bridge above the river Hron near the village Kamenný Most (not preserved)
13TH CENTURY:
The oldest preserved stone bridge near Dravce
1271: The oldest written entry about the bridging of the Danube River in Slovakia
14TH CENTURY:
Stone arch bridge in Leleš
15TH CENTURY:
Carthusian stone arch bridge in the Slovak Paradise
17TH CENTURY:
Stone arch bridge near Poltár
1676: "Flying bridge" across the Danube in Bratislava
1771: Viaduct between Devínska Nová Ves and Schlosshof
1727: Stone arch bridge under the Michael's Gate in Bratislava – the oldest preserved bridge in Bratislava
1780: Stone arch bridge in Bátovce
1808: Stone arch bridge in Spišský Hrhov
1810: The oldest cast iron bridge in Slovakia and also of the former Hungarian Empire in Hronec
1825: Boat bridge of Carolina Augusta in Bratislava
1832: Timber bridge in Kluknava – the oldest preserved covered timber road bridge in Slovakia
1835: Stone bridge in Krásno nad Kysucou – the longest road bridge in Slovakia made of stone
1845: Bridges of the horse railway near Báhoň
1845: Stone ach bridge in Gelnica – stone bridge with the biggest clear span of an arch in Slovakia
1848: The Marchegg viaduct -a part of it is presently the longest brick railway bridge in Slovakia
1848: Red Bridge (Červený most) in Bratislava –original bridge was the longest brick railway bridge in Slovakia
1859: First railway bridges made of wrought iron in the former Hungarian Empire between the towns of Štúrovo and Szob
1873: aqueduct in Banská Štiavnica
1890: Bridge of Franz Joseph in Bratislava – first permanent bridging of the Danube in Slovakia
1891: The oldest preserved reinforced concrete bridge of Slovakia in Krásno nad Kysucou
1892: Bridge in Nové Zámky, at that time probably the longest reinforced concrete bridge in Slovakia (not preserved)
1892: Elizabeth's Bridge in Komárno – the second permanent bridging of the Danube in Slovakia
1896: The Devil's viaduct in Tisovec
1903: Stone bridge in Kráľová pri Senci – by many people considered to be the most beautiful stone bridge in Slovakia
1908: Reinforced concrete arch bridge in Kamenica nad Hronom – at that time probably the biggest of its kind in central Europe
1910: Railway Friendship Bridge (Most Priateľstva) in Komárno – the longest cross-border railway bridge in Slovakia
1931: Reinforced concrete arch Bridge in Piešťany – the Krajinský bridge
1933: Reinforced concrete beam Bridge in Piešťany – the Colonnade bridge
1933: The Telgárt viaduct – among the railway bridges it is the oldest reinforced concrete bridge in Slovakia

1939: The Uľanka Railway viaduct – at the time of its construction it was one of the biggest structures of its kind in eastern Europe
1941: Peterský Bridge in Liptovský Hrádok
1943: Viaducts near Hanušovce nad Topľou – the longest curved railway bridge in Slovakia
1946: The Old Bridge in Bratislava
1949: Orlovský Bridge in Považská Bystrica
1955: Concrete arch bridge in Komárno – outstanding span and construction solution
1958: Arch bridge in Dlhá na Orave – the biggest concrete arch on the territory of Slovakia
1959: Viaduct Pod Dielom – the first whole-welded railway bridge in Slovakia
1961: Concrete arch bridge in Sereď – unique technical and structural solution
1963: The first prestressed concrete bridge built by the free cantilever method in Nové Mesto nad Váhom
1964: The first precast segmental concrete bridge in Czechoslovakia in Sírnik
1967: The viaducts in Margecany and Jaklovce – the first railway concrete bridges in Europe, which were built by the precast segmental technology
1967: Suspension pedestrian bridge in Dolný Kubín – interesting structural solution
1972: The SNP Bridge in Bratislava – at the time of its design was to be the cable stayed bridge with the biggest span in the world.
1972: The first railway bridge in Slovakia designed as a Langer Arch bridge in Dolné Srnie
1981: Pipeline bridge in the port of Bratislava - the biggest suspension bridge in Slovakia
1983: The Podtureň Bridge – at that time the longest highway concrete bridge in Slovakia and one of the longest bridges of its kind in Europe
1983: The Port (Prístavný) Bridge in Bratislava – nowadays the longest bridge in Slovakia (road-rail bridge)
1991: The Lafranconi Bridge in Bratislava – at the time of its construction its cantilever was among the biggest in the world
1992: Timber bridge in Kolárovo – after its extension in 1997 it became one of the longest whole-wooden covered bridges in Europe
1992: bridge in Stankovany –cable-stayed bridge (unique stay configuration)
1994: Timber footbridge in Dolný Kubín
2000: Two bridges on the railway near Žilina designed as Langer Arch bridges, one of the biggest railway bridges of this kind in central Europe
2001: Bridge in Banská Bystrica – the first extradosed concrete bridge in Slovakia
2005: The Apollo Bridge in Bratislava – one of the biggest bridges of the world, which were constructed by rotation on the river
2005: Draw bridge in Moravský Sväty Ján
2006: Cable stayed bridge in Červený Kláštor
2007: Bridge near Štrba – the first concrete bridge in Slovakia built by incremental launching technology
2010: Extradosed bridge in Považská Bystrica – the longest expansion section on the territory of Slovakia
2010: highway viaduct in Považská Bystrica – the longest purely highway bridge on the territory of Slovakia
2010: Steel multi arched highway bridge near Spišské Podhradie

OVERVIEW OF BRIDGES ACCORDING TO THE TOWNS AND VILLAGES

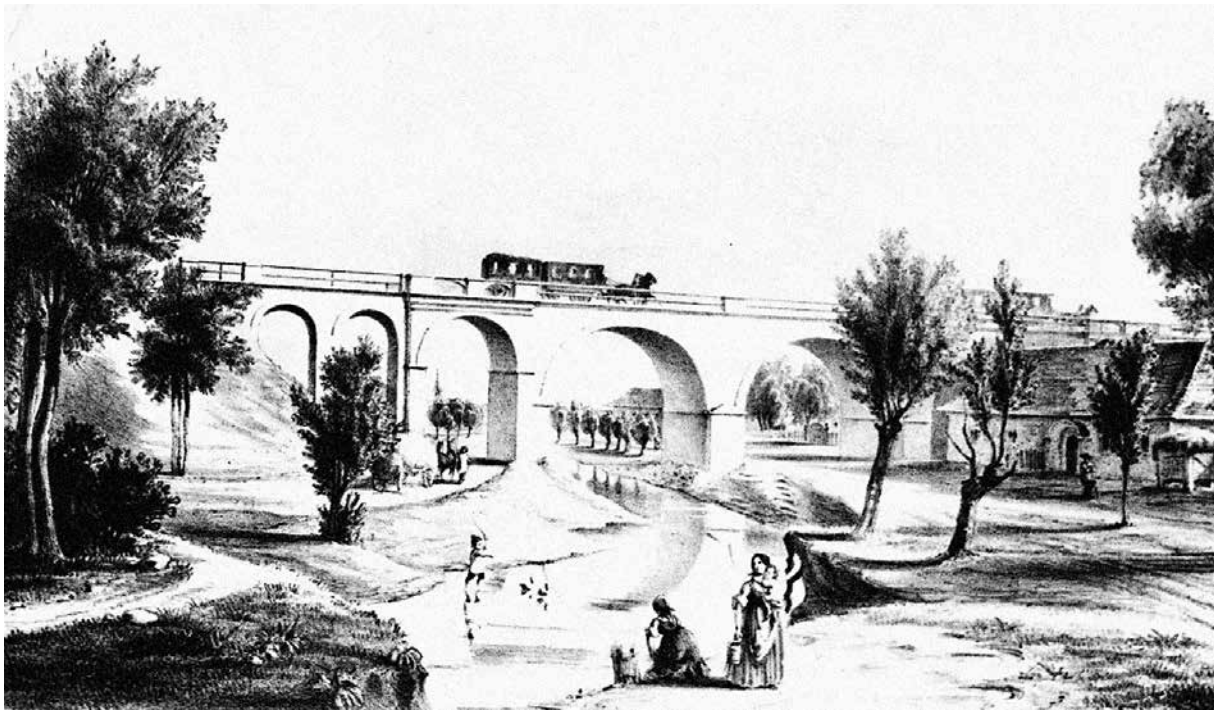
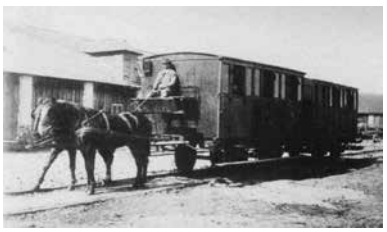


photo: ŽSR MDC

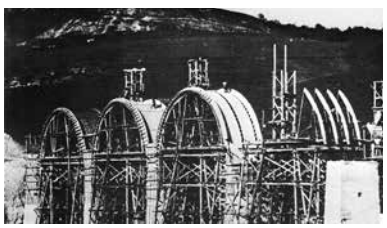


BÁHOŇ

HISTORIC BRIDGE ON HORSE-DRAWN RAILWAY

In 1836 the interest of the Hungarian squires to trade with the Habsburg monarchy led to the foundation of a stock company for the building of the first railway in the Hungarian Empire between Bratislava and Trnava. An important export product was to be mainly wood from the areas in those times belonging to the Pálffys' lands.

The main engineer Hieronymus was selected and his design was approved in January 1838 and in the spring of 1839 building was started by 900 workers. Despite some difficulties with the acquisition of land, the railway's first line between Bratislava and Sväý Jur was finished in the year 1840. One year later, in 1841, the railway was completed to beyond Pezinok, to the forest Bahwal which was in the possession of the already mentioned Pálffys. Because of many problems with financing, but also due to technical issues caused by swamps, the next part was not finished until the year 1846 when the first horse-drawn train was welcomed in Trnava. The merit for the railway's completion to Trnava and its further extension to Sereď belongs mainly to count Esterházy who had much land in the proximity of Sereď and thus it was in his interest to support this project financially. There were 118 horses on the horse-drawn railway taking turns in "working". The horse –drawn railway itself served until the year 1872 when it was rebuilt as a steam railway. The first horse-drawn railway in the Hungarian Empire contained also a unique bridge near the village of Báhoň with 9 arches, the middle 3 of which had clear spans of 30 feet which represents approximately 9.2 m. The other marginal arches had clear spans of 12 feet, thus 3.6 m. The bridge was built to the curve of the railway with the diameter of 810 fathoms (approximately 1 500 m). The loads which the bridge had to withstand (as well as its self-weight) were represented by passenger and freight cars, while one pair of horses drew 2 passenger or 5 freight cars. The weight of the passenger cars together with the passengers was 3.8 tons; however, fully loaded freight cars weighted 8 tons, which by pulling 5 cars made up the overall weight of 40 tons. Bridge was rebuilt at 1940.



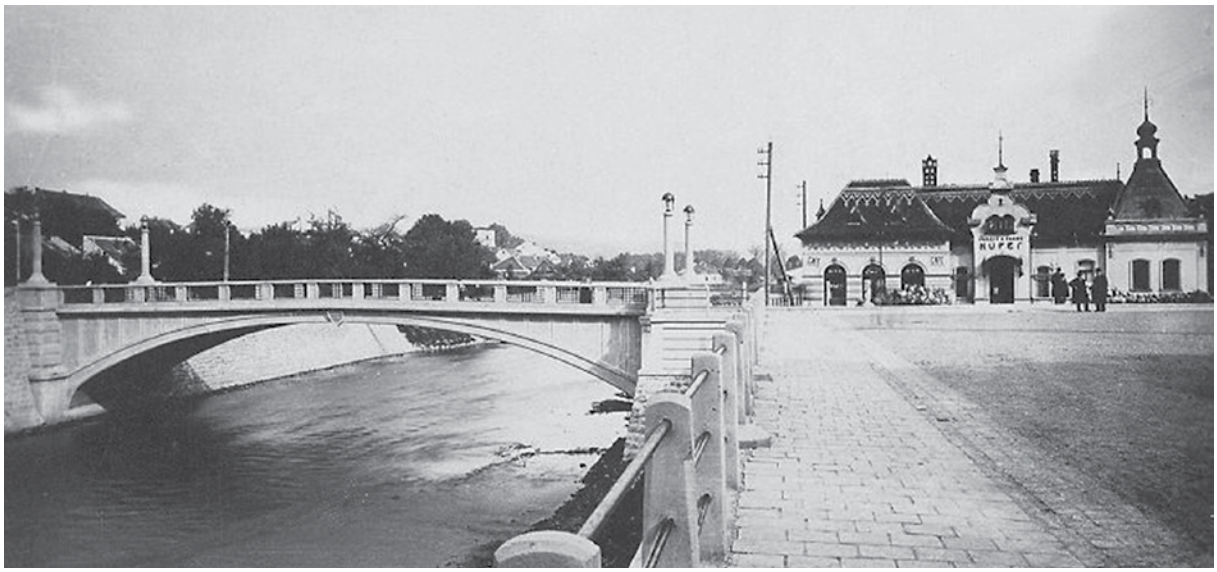
BANSKÁ BELÁ

THE VIADUCT

GPS +48° 28′ 00.30″S
+18° 56′ 46.36″V

The viaduct situated near Banská Belá is among the few monumental concrete arch bridges in Slovakia.

Five arches with clear spans of 15.7 m. cross the valley on the railway line between Hronská Dúbrava and Banská Štiavnica at a height of 20 m. The reinforced concrete viaduct was built within the Youth Railway (Trať mládeže) in 1949 as a part of the rebuilding of the narrow gauge railway from the year 1873.



wooden engraving from the end of the 18-th century

BANSKÁ BYSTRICA

HISTORIC ROAD BRIDGES

Banská Bystrica became a town in 1255 when King Belo IV granted her the freedom of the town.

As with any other mining towns, Banská Bystrica also had fortification which was begun to be built around the municipal office in 1465. This part of the fortification was finished at the beginning of the 16th century; it included watchtowers and a fosse, part of which was also a drawbridge. The major part of the fortification has been destroyed. However, pictures of many old bridges have been preserved on old postcards from the end of the 19th and the beginning of the 20th century, for example the photograph of the bridge on Dolná (Lower) Street (formerly Kossuth Lajos utca). Another bridge which appears on old paintings is the bridge over the river Hron in the place of the contemporary railway stop Banská Bystrica – mesto (town). The bridge is portrayed on illustrations from the 18th century. The origins of St. John of Nepomuk's chapel, which still stands at the site of the former bridge, could be dated back to the year 1766. In the year 1925 the timber bridge had been replaced by a concrete arch bridge, which was later rebuilt to its present-day shape.

Bridge on the Dolná street

Bridge across the river Hron in the contemporary position of the railway stop

Chapel of St. John of Nepomuk

BANSKÁ BYSTRICA

THE KOSTIVARY VIADUCT

GPS +48° 45′ 44.45″S
+19° 08′ 33.65″V

The viaduct built in the years 1936 – 1940 is situated on the railway line between Banská Bystrica – Dolná Štubňa.

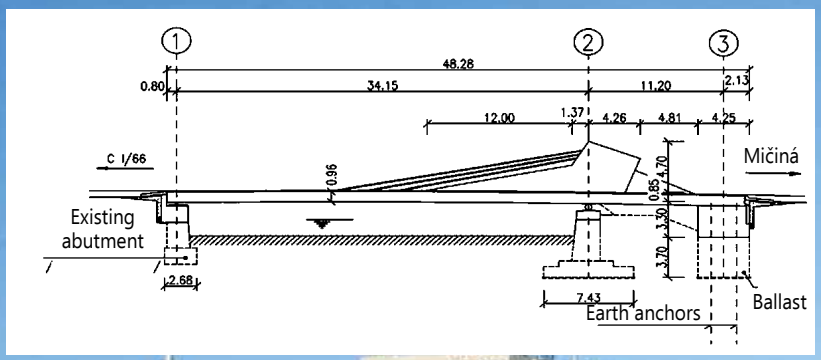
The bridge was destroyed in the year 1945 during the withdrawal of the German troops, after which also the abutments and all the three piers were ruined. Its reconstruction started in the same year which is indicated by the commemorative inscription on one of the piers: "Destroyed by war and rebuilt in 1945". Because of the uncertainty of those times openings were made in the piers for placing explosives in the case of necessity to quickly destroy the viaduct once again. The bridge itself has four 25 m long spans.

BANSKÁ BYSTRICA

THE SNP BRIDGE

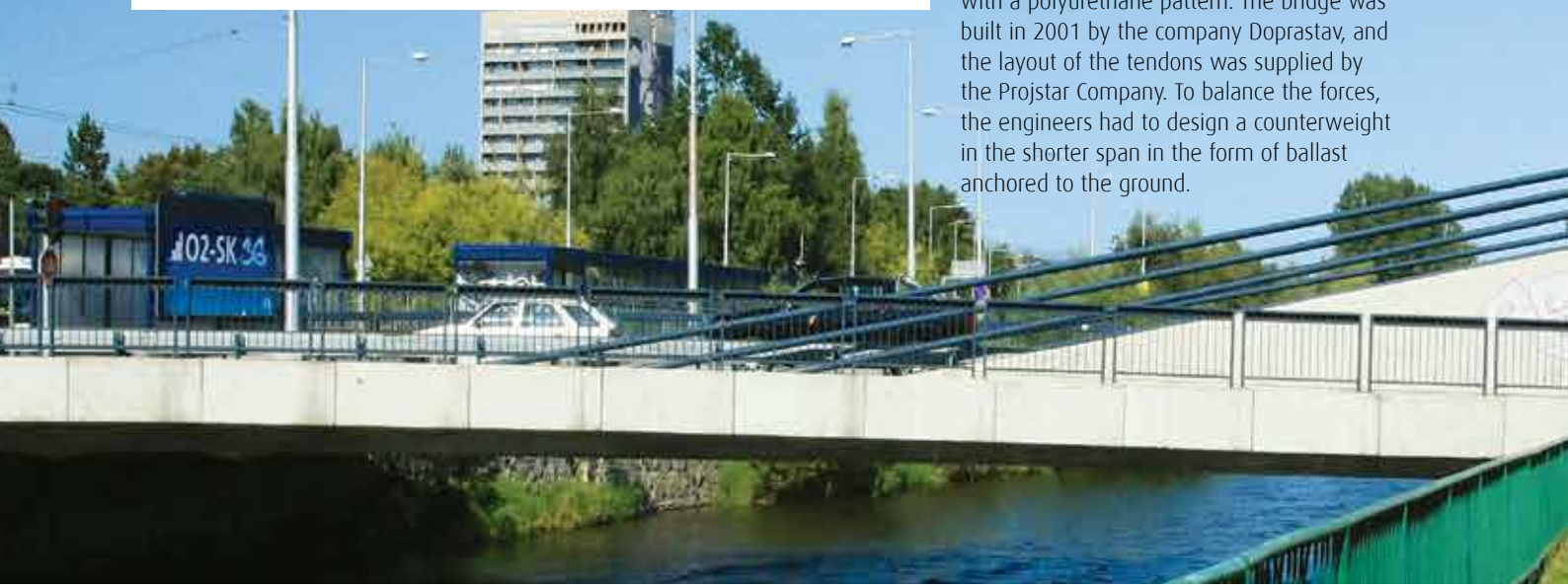
GPS +48° 43′ 58.87″S +19° 09′ 01.33″V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia



The bridge is named in dedication to the memory of the Slovak National Uprising; the three letters correspond to the Slovak equivalent Slovenské Národné Povstanie. The bridge with a span of 34 m is unique not only thanks to the unconventional shape of the superstructure, but mainly because of the extradosed tendons, which are elevated above the bridge deck.

It was the first bridge in Slovakia to use an extradosed solution. The increased efficiency of the prestressing tendons enabled the designer to reduce the depth of the bridge superstructure to less than a meter. For creating the texture of the pier's surface special formwork was used with a polyurethane pattern. The bridge was built in 2001 by the company Doprastav, and the layout of the tendons was supplied by the Projstar Company. To balance the forces, the engineers had to design a counterweight in the shorter span in the form of ballast anchored to the ground.



BLUE RAILWAY BRIDGE

GPS +48° 44′ 02.47″S +19° 09′ 30.82″V

The history of the railway in Banská Bystrica began to be written in 1870 by the first preparatory works on the railway which was to connect Zvolen and Banská Bystrica. In 1873, within the railway building, a timber four span bridge was built with a maximum span of 14 m, which was later in 1893 substituted by a steel truss bridge with a span of 50 m (in the picture below).

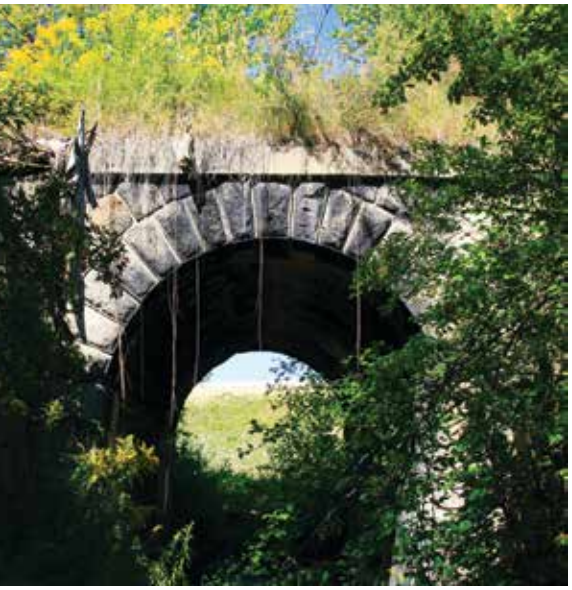
This bridge was destroyed twice during the war. For the first time in 1944, by the withdrawing rebel forces, and subsequently, after its quick reconstruction, in 1945, by the withdrawing German troops. After the war it was replaced by a timber temporary bridge serving until the year 1951 when the new railway station was finished. For the planned railway relocation and the intention to build a new railway station, near to the old bridge (from the year 1892) a new steel one was built with three spans. This bridge miraculously survived the war without any harm. However, it did not start to be fully used until the completion of the new railway station. Since then it served continuously for 55 years until 2006 when it was substituted by a new steel arch bridge with a span of 90 m.

PEDESTRIAN FOOTBRIDGE NEAR THE WINTER STADIUM

GPS +48° 44′ 04.66″S +19° 09′ 23.83″V

The covered pedestrian bridge crosses the river Hron in the proximity of the Winter Stadium.

It was built in 2008 by the company GBR. The pedestrian bridge with a span of 35.6 m replaced the original suspension structure. The bridge was assembled from 6 main parts transported to the construction site as an oversize load.



A SMALL BRIDGE ON THE FORMER RAILWAY

GPS +48° 44′ 23.20″S +19° 11′ 03.33″V

The bridge is located on the disused railway line near the local area Majer between the new railway line and the newly built expressway leading to Slovenská Lupča.

The railway has been out of operation for several years as can be seen from the luxuriant vegetation overgrowing it. The bridge now serves only as a silent monument of the old railway. On the railway lines there are many such little concrete bridges covered with stone facing with clear spans of around 3 metres. Many of them are on abandoned railway lines and they serve only as a backdrop to the natural scenery. I chose this little bridge to represent them, which, as with many similar technical monuments, gives a lonely and at the same time a romantic impression.

Commemorative plaque


Former catwalks along the water channel

BANSKÁ ŠTIAVNICA

THE AQUEDUCT

GPS +48° 27' 12.44"S +18° 55' 37.30"V

The oldest written reference to the town of Banská Štiavnica dates back to the year 1156, when it is mentioned as Terra Banensium – the land of miners. In the year 1763 the Mining Academy was founded here, being the first mining academy in Europe.

This unique bridge is connected exactly with the mining industry, and is also a technical monument. The aqueduct was built in 1873 as a part of a water system supplying the mines with water from higher situated reservoirs. The bridge is composed of massive piers, approximately 11 m high, supporting the steel water channel in which, 30 years ago, water flowed being brought here from the Kolpachy lake. Along the water channel there were catwalks which are now impassable. The span of the aqueduct is approximately 10 m. It was partially reconstructed a few years ago.

Car accident in 1940 on the 7-span bridge crossing the river Topľa

Bridge across the Kamenec (Brežník) stream

BARDEJOV

HISTORIC TIMBER BRIDGES

In the past, there were many covered timber bridges in the surroundings of Bardejov of which, unfortunately, none has been preserved. Timber bridges in Czechoslovakia were researched by Professor MSc Pavel Ferjenčík, PhD and Associate Professor MSc Pavel Dutko, PhD from the Faculty of Civil Engineering of the Slovak University of Technology in Bratislava.

In the year 1925, according to their data, there were 25 covered timber bridges in service in Slovakia, the longest of which was the bridge with 7 spans above the river Topľa in Bardejov – its overall length was 78 m. The bridge was built in 1870. Among others, 2 rare historic photographs of the bridge were preserved showing a lorry accident on the bridge in 1940. Another timber bridge near Bardejov mentioned in their study is the bridge over the river Lukavica with the length of 26 m. In 1872 tolls were collected on this bridge, however, this was successfully avoided by the local citizens by using the nearby ford. The bridge was reportedly constructed in such a way as to be able to carry carriages weighing more than 5 tons. In the surroundings of Bardejov there were other covered timber bridges – a toll bridge, 36 m long, which stood across the stream Kamenec (Brežník) near its inflow to the river Topľa, and a bridge under Calvary, which was 11 m long.

HORNÁ BRÁNA (THE UPPER GATE)

GPS +49° 17′ 24.41″S +21° 16′ 30.51″V

The bridge was a part of the towns' fortification and together with the barbican and the former drawbridge they protected the fortress from the southern side.

The bridge was originally wooden, but in 1770 it was rebuilt as a stone one with 5 arches. Later a fire trumpeter's building and a store house were built on it. For this reason parts of the arches were walled up. For some time, the building served as a part of a hospital. Had the building been preserved, the bridge would be classified among those unique in Central Europe – it would be the Slovak Ponte Vecchio. The clear span of the arches is approximately 4.5 m and presently they serve as the background to summer spectacles (the stage is positioned in front of the bridge and configured as needed for the organization of various social events).

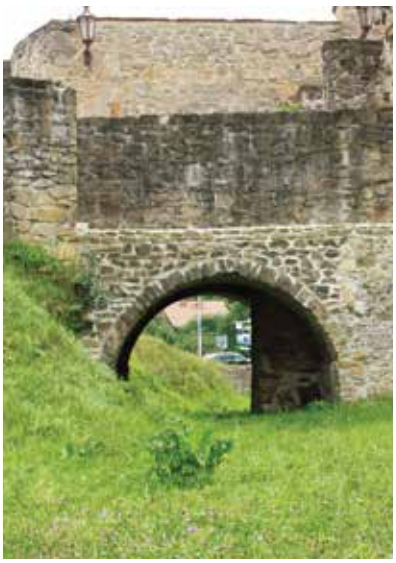
BARDEJOV

DOLNÁ BRÁNA (THE LOWER GATE)

GPS +49° 17′ 39.18″S +21° 16′ 45.44″V

The Lower Gate protected Bardejov from the north-eastern side, thus closing the route from Poland.

The drawbridge was substituted by a stone arch bridge in 1821. Its arches have a clear span of 5 m. Behind the barbican, there is another small stone arch bridge of the same clear span.



STONE BRIDGE WITH A CHAPEL

GPS +49° 15′ 32.81″S +21° 15′ 04.20″V

The bridge is situated on the southern access to Bardejov in the local part called Bardejovská Zábava, where it spans the access road to the family houses on the right side of the road.

This small stone bridge is unique because of its chapel with the statue of St. John of Nepomuk set right above the middle of the arch. Although the statues of St. John of Nepomuk are not rare on older bridges, I have not seen (in Slovakia) any other small bridge with a chapel placed actually on it. The clear span of the arch is 2.65 m. The statue itself is inside, but the chapel also has his sculpture on the back side, so that both ways are protected – the old one as well as the new one.

BARDEJOV

THE FOOTBRIDGE OF FRIENDSHIP (LÁVKA PRIATEĽSTVA)

GPS +49° 19' 56.00"S
+21° 15' 47.00"V

Bardejov was famous for its bath located roughly 5 km from the city centre. It was first mentioned back in the year 1247 in Belo IV's charter in which the area of Bardejov is delimited.

We can find quite early information about the existence of the mineral streams mainly thanks to the fact that they were to be found near to the very important royal route linking the Mediterranean and the Baltic. At the beginning of the 19th century this bath was among the most popular in the former Hungarian Empire. Among the personalities visiting them was for example Austro-Hungarian emperor Joseph II, Mary Luis, Napoleon's latter wife or Russian tsar Alexander I. The Footbridge of Friendship is built right in the area of the bath. It is more than 54 m long and the top of the tower is 11 m. high. As is common, we only learn from the information board the name of the architect, and the names of the structural designer and the constructor both remain unknown.

Statue of St. John of Nepomuk

BÁTOVCE

STONE ARCH BRIDGE IN THE TOWN

GPS +48° 17′ 22.78″S
+18° 44′ 54.95″V

The first mention of Bátovce in documents is from the 11th century under the name of Tribuna de Foro Regine, or de Mercatu Regine which means the place of the Queen's market. It is also said that during the Turkish invasion markets with women took place here.

The baroque bridge from the year 1780 crosses the river Sikenica with three arches each having a clear span of 3.6 m. The shape of the piers was shaped for the river flow so that they would create the smallest resistance possible and so that they would break the potentially floating ice. The inscription above the middle arch is interesting, as well as the statue of St. John of Nepomuk at the end of the bridge. In my opinion this bridge is one of the most beautiful stone bridges in Slovakia.

Piers with cutwaters

Stone plaque above the middle-arch

STONE ARCH BRIDGE BEHIND THE TOWN

GPS +48° 18' 15.87"S
+18° 45' 00.29"V

This bridge with two arches is situated on an important old commerce route, which in the 18th century, linked the Southern parts of the Austro-Hungarian Empire with the mining regions in the neighbourhood of Banská Štiavnica. According to the inscription above one of the arches, the bridge was built in 1800. The clear span of the arches is 5.8 and their height is approximately 3.6 m.

BERNOLÁKOVO

THE BRIDGE ACROSS THE STREAM ČIERNA VODA

GPS +48° 11' 44.98"S
+17° 17' 31.90"V

The bridge was a part of one of the oldest and the most important railways of the Austro-Hungarian Empire linking Vienna, Bratislava and Budapest back in the year 1850.

It crossed a shallow valley of the stream Čierna voda with 5 brick arches until the 2nd of April 1945 when, on Easter Sunday, it was destroyed by German troops. Some similar bridges were preserved in Bratislava near to the Main Railway Station. The destroyed brick arches were replaced by only one small reinforced concrete arch crossing the stream.

photo: courtesy of http://hradceklis.webnode.com/

BRICK BRIDGE BY THE MANOR HOUSE

GPS +48° 12' 05.28"S
+17° 17' 13.68"V

Bernolákovo, once called Čeklís or Cseklész, gained its present-day name in the year 1948 in honour of Anton Bernolák, who worked here as a Catholic priest between the years 1787 and 1791. Anton Bernolák was one of the authors of the first Slovak language standard.

However, the village is mainly linked to the family of Esterházy who commissioned the building of a beautiful manor house. Many important monarchs of the former Hungarian Empire were hosted there. The manor house has a brick bridge across the moat. It has two arches with clear spans of 4 m, its total length is approximately 15 m and the road leading across it is at a height of 4 m above the bottom of the moat. Today the manor house is in the grounds of a golf course and it can be entered only with an entry permit. The bridge is in a relatively good condition, however it is not maintained and so it is overgrown with vegetation which restricts photography of the sculptures at its entrance.

BETLIAR
SMALL JAPANESE BRIDGE

GPS +48° 42′ 33.00″S, +20° 30′ 46.00″V

The bridge is to be found in the middle of a very nicely maintained English park belonging to the manor house of Betliar.

Interestingly the park is included in the list of the world's most important historic gardens. This really unusual small covered bridge with two benches inside it was built at the end of the 19th century; however, in 1971 it was swept away by a flood. The bridge was finally rebuilt in 1978 in accordance with historical documents and drawings. For constructions of this type it is questionable whether to classify them as bridges, but with a span of 3.6 m it fulfils the formal criteria of the minimum span.

AQUEDUCT GPS +48° 42′ 37.03″S, +20° 30′ 37.18″V

The aqueduct is also in the area belonging to the manor house of Betliar in which it forms part of the so called Big Waterfall built in 1823.

Nearby the aqueduct, there is an artificial cave and a water reservoir which, at the beginning of the 20th century, was used by the family of Andrássy for the breeding of ice bears. By an aqueduct, which is roughly 20 m long, the water is led above the little lake and from there it falls from a height of more or less 8 m. The clear span of the arch, which is part of this aqueduct, is 3.7 m and its height is 1.7 m.

BÍŇA

BRICK RAILWAY BRIDGE

GPS +47° 55' 50.66"S
+18° 38' 05.74"V

A Roman military campaign against the Germanic tribes took place in the area of the lower river Hron, which includes also the area of Bíňa.

The strategic position of the present-day village was used back then to build a Roman fortification in which Marcus Aurelius probably spent some time. In this region he wrote his book Taeis heauton and the place of writing was noted right at the beginning: Written in the land of Quadi on the river Granova.
However, the bridge itself is of much later origins, being part of a railway line brought into operation in 1885. It has one arch with a clear span of approximately 10 m (author's note: this is just a rough estimate as taking measurements was thwarted by a swamp and thick vegetation).

BOHUNICE

STONE ARCH BRIDGE

GPS +49° 01' 00.55"S
+18° 12' 03.62"V

The imperceptible little bridge is a part of the old road network in the village of Bohunice.

There are just a few such rural bridges with a stone parapet left in Slovakia. Some preserved ones can be found also in Gerlachovo and Hnilec. The clear span of the stone arch bridge in Bohunice is 3.15 m.

BOJNICE

GPS +48° 46' 50.00''S
+18° 34' 40.00''V

BRIDGES IN THE AREA OF BOJNICE CASTLE

Bojnice Castle is among the most beautiful and magnificent castles in Slovakia with the history dating back to the 12th century when the fortified hill-fort was mentioned for the first time.

The stone castle was built in the year 1302. Among its owners there were many feudal lords from the Gothic period and the Renaissance; among those most famous was Matthew Csak of Trencin or the family of Turza. Finally, in 1643 the castle came into possession of the Páffys family who transformed it into a magnificent residence. One of the largest refurbishments was carried out by John Pálffy, one of the richest people of the former Hungarian Empire, in the years 1889 and 1908. After the birth of the first Czechoslovakia the castle was bought by Thomas Bata and since the year 1950 it has been in the possession of the state. A drawbridge was part of the fortification, but unfortunately it was not preserved. The moat is now crossed by a solid stone wall with stone parapets on the sides. However, within the garden one can cross 2 small bridges completing the pleasant atmosphere of the area. One of them is a small stone arch bridge with a clear span of 2.5 m and the other, steel arch bridge, leads to the rotunda positioned in the middle of a lake.

BRATISLAVA AND SURROUNDINGS

Bratislava before 1676- timber bridge across the river arm

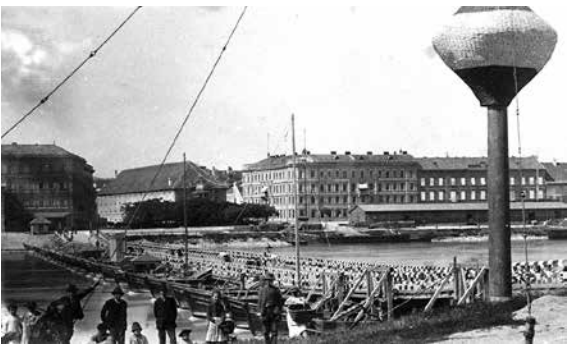
Bratislava around the year 1700 and the so called "flying bridge"

Navy pontoon bridges built between the First and Second World War

HISTORIC BRIDGES ACROSS THE DANUBE

Professor MSc Ivan Balaz, PhD studied the history of Bratislava's bridges in detail for several years. He is a member of the Department of Steel and Timber Structures of the Slovak University of Technology in Bratislava and thus his lectures and published papers are the source of much information.

The first bridges across the Danube in present-day Bratislava were probably built back in the 1st and the 2nd century AD. They were mainly boat military bridges constructed by the Roman army for which the Danube was the boundary river of the Empire. Unfortunately, there is no firm evidence of their existence, but considering the needs of military operations in this region and the proved existence of bridges across the Danube, in Romania for example, it is very probable that some timber or boat bridges were built also in the proximity of Bratislava.
The first historically proven bridges appeared between the years 1271 and 1273 on the demand of Premysl Otakar II who was fighting against the Hungarians at that time. However, it has to be said, that the river bed was different from the present one, since the river arm itself was divided into two almost equal branches – one was flowing in the present river bed and the other through the square Rybné námestie. Since that epoch, wooden bridges across the Danube have appeared in various archive records as boat bridges built on the occasion of coronation ceremonies or as bridges built in front of the Rybárska and Vydrická Gate.
Between the years 1676 and 1825, a new kind of bridge called the flying bridge began to be used on the Danube, although it resembles more a ferry (the first flying bridge was built in Europe in 1657 in the Netherlands). It was composed of a vessel anchored on an island in the middle of the Danube; the rope was placed on several intervening boats.
The position of this bridge varied many times, but we can say it was approximately 200 m downstream from the contemporary SNP Bridge. It was rebuilt and improved many times.
Apart from flying bridges, several temporary bridges were also built on the occasion of coronations (for example the boat bridge built on the occasion of Mary Theresa's coronation in 1741), or were built for military purposes (for example the bridge built by Napoleon's army in 1809).
The only bridge which was not removed after a coronation was the boat bridge of Carolina Charlotte Augusta of Bavaria built on the occasion of her coronation in the year 1825. It was situated approximately between the contemporary Old Bridge (Starý most) and the SNP Bridge. It was built by technical military forces of Austrian sappers under the command of major Magdeburg. Magdeburg afterwards handed it over to the royal trustee and him further to John Kettner, the reeve of the city. The bridge consisted of 23 boats and it was toll-free, so it significantly contributed to the development of trade between Bratislava and the villages on the right river bank (Petržalka, Kittsee, and Berg). The centre of the bridge could be opened and thus enable the passing of ships. This manoeuvre was signalled by a red and white basket pulled up a high column. It was opened daily between 9 a.m. and 10 a.m. and it was disassembled during the winter to prevent its damage by floating ice. The bridge of Caroline Augusta existed in Bratislava up until the opening of the first permanent bridge of Franz Joseph in the year 1890 (this bridge is described more precisely in the part devoted to the Old Bridge in Bratislava). There was a statue of St. John of the Nepomuk placed on the boat bridge, which was previously on the aforementioned flying bridge. Today it is in the area belonging to the church Kostol Povýšenia Svätého Kríža in Petržalka.
Later, during World War I and in the interwar period, many training pontoon bridges were built across the Danube, images of which can be found on several period photographs.



Boat bridge of Carolina Charlotte Augusta, built in 1825

Historical statue of St. John of Nepomuk

BRATISLAVA AND SURROUNDINGS

Franz Joseph's Bridge

THE OLD BRIDGE (STARÝ MOST)

GPS +48° 08' 18.93"S
+17° 07' 01.82"V

General Designer of Reconstruction:
ALFA 04 a.s., Bratislava, Slovakia

Franz Joseph's Bridge. Plans to build a permanent bridge across the Danube were enabled only after the strengthening of the river banks was carried out in the years 1870 – 1890. The discussions about its building had begun in 1877 – a bridge commission was established with count Ernest Esterhazy at its head. However, the works began only in 1889 under the supervision of engineer Doehner, of French origins, who collaborated with other constructors such as F. S. Cathry and I. Linzboth. The bridge was finished in October 1890 and was named after the emperor Franz Joseph. It comprised 7 spans, which were 31.6 + 2 x 75 + 91.5 + 2 x 75 + 31.6 m long. The overall length was 454.7 m. On both river banks toll houses were built for the toll collectors, the one on Petržalka side served also as a first aid station. Later a parallel railway bridge was built on the common piers. It was used also by the tram, which was plying between Bratislava and Vienna.

The bridge experienced the first harsh times after the birth of the Czechoslovak Republic in 1918, when the conflict broke out with Hungary for Petržalka, which was controlled

Czechoslovak soldiers defending the borders in 1919

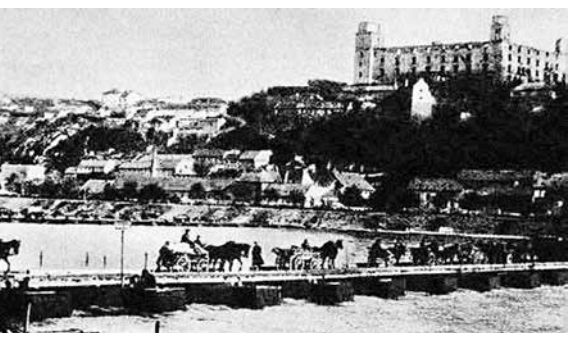
Ruins of the Franz Joseph's Bridge, 1945

by Hungarian troops. At that time, the border passed through the middle of the bridge up until the 21st of August 1919 when the Czechoslovak legionaries took over the right bank of the Danube by crossing the bridge. The bridge was officially renamed as the Bridge of General M. R. Štefánik and it served another 26 years until it was destroyed by withdrawing German troops in April 1945.

The Red Army, or more precisely the troops of the second Ukrainian front, built a temporary pontoon bridge upstream of the contemporary SNP Bridge. At its location commemorative boards are placed today on the river banks. The bridge was in operation from the 5th of April until the 24th of January 1946. Another temporary timber bridge built by the Red Army was founded on wooden piles and was constructed in front of the present-day Slovak National Gallery. However, it was in operation for 2 months only. During its construction, a part of the concrete protective wall along the embankment had to be pulled down. Although it was repaired after the removal of the bridge, the place of the breakthrough was visible until the construction of a new flood protection system of Bratislava in 2010. As well as these two bridges, there was probably a third pontoon bridge of which, however, we lack sufficient information.

The Red Army's Bridge. The renovation of Franz Joseph's bridge began at the beginning of August in 1945 and it was finished at the end of January 1946. However, it was not reconstructed to its previous shape, but a Roth-Wagner system was used for temporary reconstruction. Since one of the piers was seriously damaged and the structure was to be finished by the end of January 1946, it was necessary to build a temporary pier made of steel in the first phase,

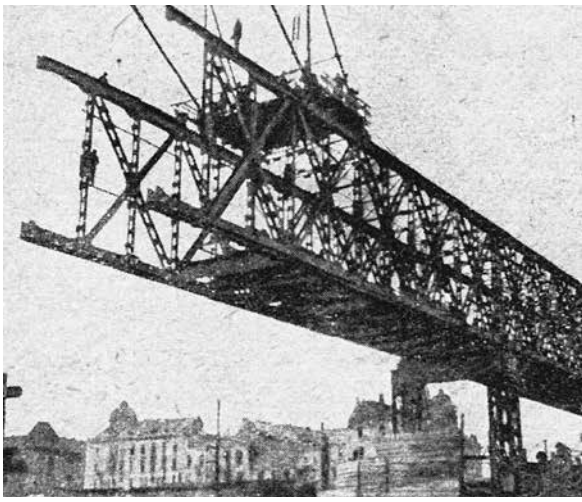
Temporary timber bridge built in front of the contemporary Slovak national gallery



Temporary boat bridge built by the Red Army above the contemporary SNP Bridge.

to assist in assembly of the bridge superstructure. The original pier was reconstructed only later, when the bridge was already in service. At least 600 Red Army soldiers, 450 German prisoners of war and approximately 300 Czechoslovak professionals took part in the reconstruction. A load test was done by a tank weighing 50 tons and on the 3rd of February 1946 the bridge was put into service by marshal Konev. The Red Army's Bridge was after the year 1989 renamed to The Old Bridge. The bridge built in 1945 as a temporary one was eventually serving until the year 2010 when, because of its unsatisfactory condition, it was closed for traffic. Since the year 2007, when discussions about the reconstruction of the Old Bridge began, the opinions on its concept have changed several times. The final solution - a steel truss rhombic system - partially imitates the original shape of the Old Bridge, but its parameters can be classified as modern. There will be a tram service and spacious pedestrian walkways on the sides. During the reconstruction, it will be necessary to remove two old piers and to build new one between them because of the inadequate navigational width for ships. In this way the necessary width for ships will be provided and the main span will extend to 137.2 m. Spans of the bridge after its reconstruction will be: 32.2 + 106.7 + 137.2 + 75.6 + 75.9 + 32.2 m. The author of the final design is MSc Miroslav Maťaščík (Alfa 04 Company) in cooperation with the architects entrusted with the task to create relaxation zones and the surroundings of the bridge. The reconstruction works should begin in the spring of 2014 and finish in the middle of 2016.

Commemorative plaque of the temporary bridge on left river bank of the Danube



The Red Army's bridge under construction

Proposed design of the bridge after its reconstruction (visualization made by the company Alfa 04)

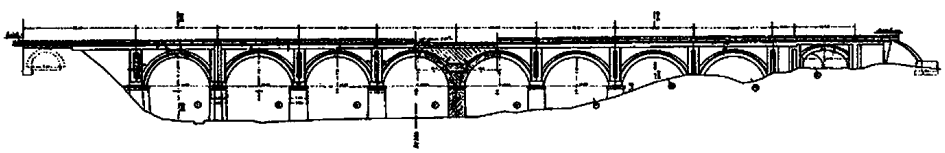
BRATISLAVA AND SURROUNDINGS

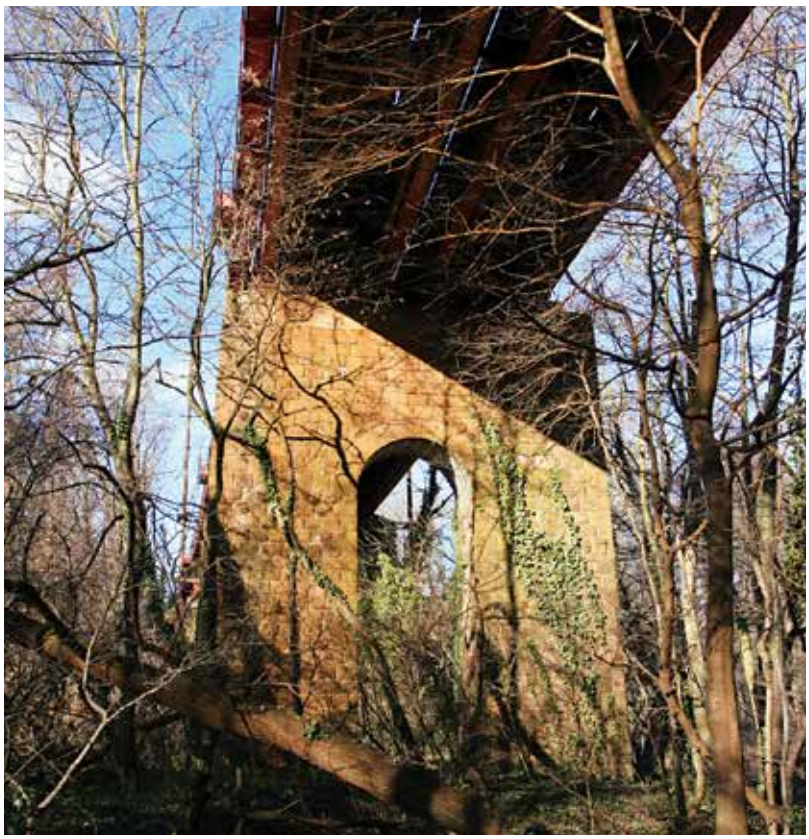
THE RED BRIDGE (ČERVENÝ MOST)

GPS +48° 10′ 26.33″S
+17° 04′ 26.33″V

The single track bridge was built on the first steam railway line connecting Vienna and Bratislava and the first train passed over it on the 20th of August 1848. It crossed the valley of the stream Vydrica at a height of approximately 17 m. Its overall length was 215 metres and it composed of 9 arches with clear spans of 10.7 + 8 x 15.8 m.

Behind the main bridge structure, there was another smaller arch with a clear span of 7 m. In 1881 the bridge was widened to double track by adding riveted beams and by the subsequent building of brick arches between these beams. The bridge was named after the red colour of its structure. Unfortunately, it was completely destroyed on the 4th of April 1945 by the withdrawing German army. However, after the liberation of Bratislava, a new temporary 7 span bridge on timber piers was built in a record time of 7 days. Piers were made of trees from its near surroundings and welded, 21 m long, steel beams were placed on them. The reconstruction project was designed by MSc Arpád Tesár, who later worked as a professor in the Faculty of Civil Engineering of the Slovak University of Technology in Bratislava. The structure of the new bridge was influenced mainly by the requirement to minimize





Only the abutments of the original bridge were preserved

the time for construction, so from three alternatives the one which required minimum time was chosen. The reconstructed bridge has 6 spans with a maximum span of 32.4 m. The newly built piers were – to reflect the original bridge – faced with red stone and shaped to recall at least in part the original arch bridge. The axis of the bridge was moved about 12 m compared with the original structure. The reconstructed bridge was put into service on the 30th of April 1948. Nowadays, this locality is a popular recreation zone.

BRATISLAVA AND SURROUNDINGS

There is an inscription on one of the piers, probably indicating the water level during the great flood in 1876.

photo: courtesy of www.wagonservice.sk

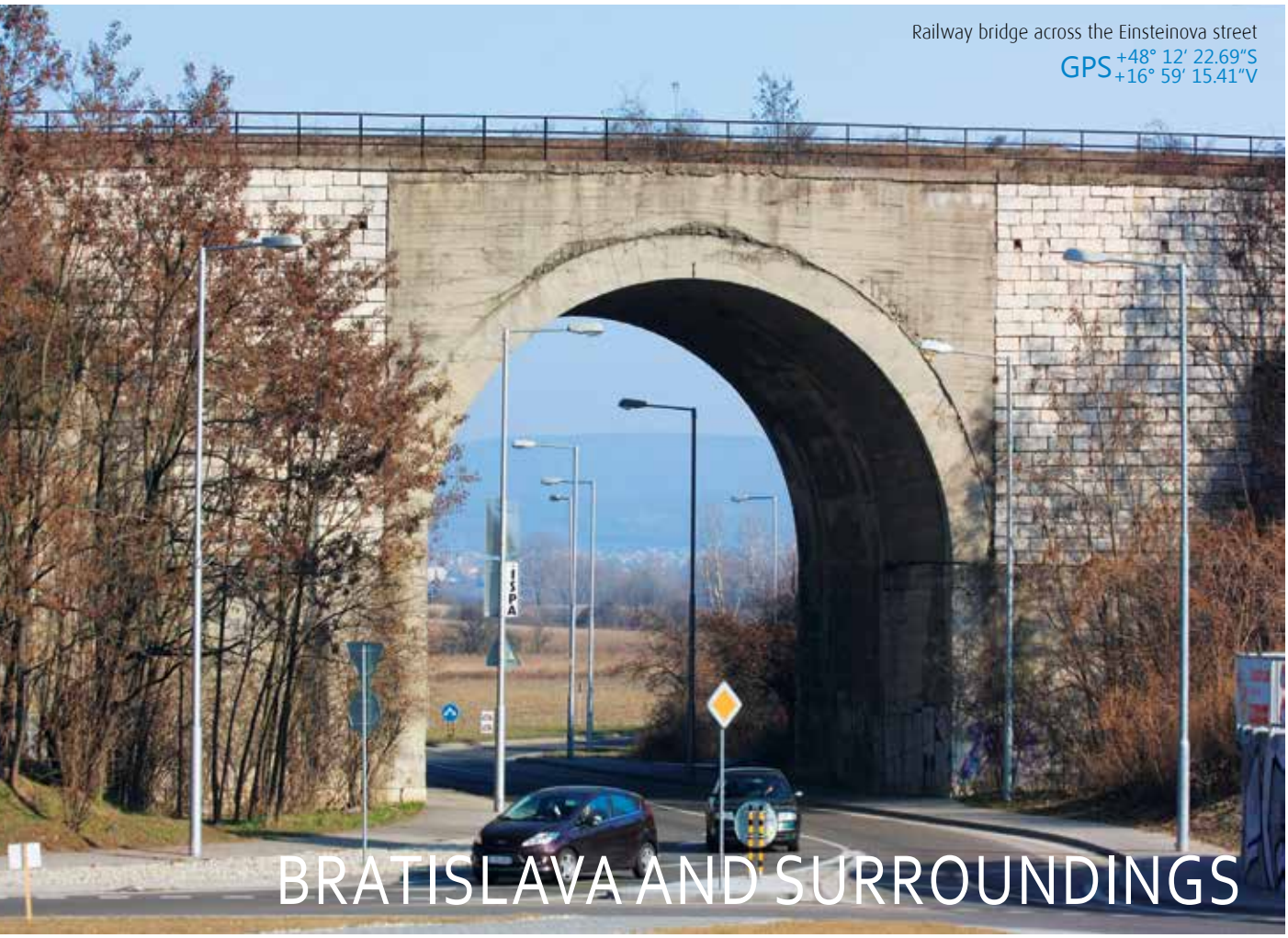
Commemorative plaque on the viaduct, near the steel structure, with the basic data about the history of the bridge.

THE MARCHEGG VIADUCT GPS +48° 14' 27.60"S +16° 56' 55.02"V

Another bridge on the railway between Bratislava and Vienna is the Marchegg Viaduct over the river Morava built in the years 1845 – 1850. With a length of 474 m it was among the longest bridges in the monarchy.

The river itself was crossed by a timber two-span bridge with spans of 43 m long, both sides of which continued as ten brick arches with clear spans of 15 m crossing the flood plain of the river. The timber bridge was destroyed in 1866 in the Prussia-Austrian war by the withdrawing Austrian army. Its reconstruction followed, which was finished in 1868. The original timber spans were substituted with a steel truss structure

with an upper bridge deck. The history of the bridge continues in World War I during which, because of the increase of transportation capacity to the Eastern front, construction of a double track was considered. Although the preparatory works started, it was never finished. Today, these piers running along the original bridge remind us of this intention. After World War I the bridge served until the 6th of April 1945 when it was destroyed by the withdrawing German troops. Reconstruction waited another 14 years. The magnificent brick arches still give an impression of monumentality. Personally, I consider this bridge as one of the most beautiful bridges in Slovakia. Near the Marchegg Viaduct, in the flood plain of the river, there are also other reconstructed bridges (originally also made of brick), which served as military objects during World War II – as a good shelter for the military troops. As a memory to these ill-famed times, a fortified two-storey machine-gun nest has been preserved. The so called "ropík" was cleverly placed under one of the massive arches. It was built before World War II as a part of the defence line of Czechoslovakia.



Railway bridge across the Einsteinova street
GPS +48° 12′ 22.69″S
+16° 59′ 15.41″V

BRATISLAVA AND SURROUNDINGS

Bridge across the Devínske Jazero street

RAILWAY BRIDGE IN DEVÍNSKA NOVÁ VES

GPS +48° 14′ 17.44″S
+16° 57′ 42.21″V

Within the mentioned railway line connecting Marchegg and Bratislava, in the years 1845 and 1850, as well as long viaducts, many small bridges across some smaller streams and roads were also built.

An arch consisting of many rows of bricks is characteristic for them. Most of them have been preserved up until today; however, many had to be reconstructed, strengthened and widened.

BRATISLAVA AND SURROUNDINGS

Bridge across the Sliačska street - one of the preserved bridges of the old railway line

The main railway station at around 1850
photo: ŽSR MDC

RAILWAY BRIDGES BETWEEN THE MAIN RAILWAY STATION AND VINOHRADY

A brick arch bridge once also stood above the railway near the entry to the Main Railway Station in the direction from Vienna. Unfortunately, this one was not preserved.

However, on the railway line itself, there are several brick arch bridges built on the railway linking Bratislava and Budapest, which was put into service in 1850. The bridges usually consist of three arches with clear spans of approximately 9.5 m. Quarry stone was mostly used for the piers, whereas the footings were made of stone ashlars. The brick arches were built on timber scaffolding which was left there for 4 to 6 weeks to prevent unwanted deformations. Water from the gravel track-bed was drained away by small channels the outfall of which above the piers is still visible and functional. Nowadays, some arches are enclosed and serve as storage.

BRATISLAVA AND SURROUNDINGS

GPS +48° 12' 39.72"S
+16° 57' 51.42"V

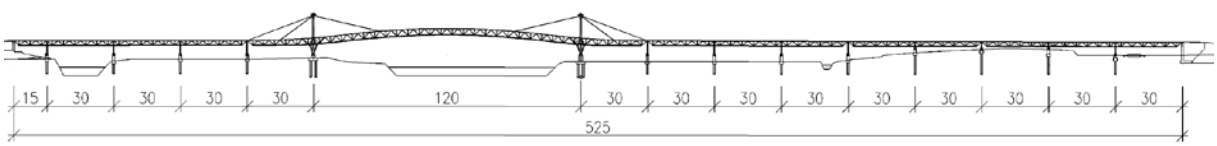
THE CYCLING BRIDGE OF LIBERTY

Image of the original bridge on the historic map

Reconstructed arches, which were originally made of stone

The footbridge for pedestrians and cyclists is special not only from the structural point of view, but also from the historical, since it was built on the site of a historic bridge built on the order of Mary Theresa back in the year 1777. This bridge over the river Morava has influenced many historical events during its existence.

The access roads of the original bridge cross the flood plain on embankments made of quarry stone with several stone and brick arches. These eased the flow of the river Morava in times of floods, with the main part of the bridge structure crossing the main river bed on a timber structure, approximately 270 m long, which was founded on wooden piles driven deep into the bottom of the river. The bridge entered history on many, mainly military, occasions. It is said that Napoleon's cavalry crossed it in 1805 during armed robberies in the villages near Bratislava. Four years later, it was damaged by floating ice, which prevented the fresh Hungarian troops from crossing it during the battle of Wagran. After this battle, Napoleon's troops occupied Bratislava. However, if the bridge had not been damaged and the troops could have crossed it, it is possible that Napoleon would have lost this battle and his whole military campaign would have developed differently. Another war concerning this bridge was the Hungarian revolution in 1848. One of the first battles took place right on it. Approximately 30 soldiers died on both sides and almost the whole wooden part was burnt to ashes. The inhabitants could not use the bridge for very long after reconstruction, since in 1866 it was again demolished during the withdrawal of Austrian troops in the Prussia – Austrian war. The importance of the bridge is indicated by the continuing attempts at its reconstruction, since the bridge was destroyed not only by wars, but also by floating ice and floods. The type of structure resulted in almost annual damage and that is why it needed permanent maintenance. The final blow was, however, brought by the end of World War II, which, as well as its destruction, brought also a new border regime linked to the Iron Curtain. After a makeshift repair, it was in use for another few years, but after the year 1949 it was definitively put out of service. The Iron Curtain literally



deleted it from maps. Renewal was started to be considered only after the collapse of Communism in 1989 and intensifying of negotiations was brought by the programme of trans-boundary cooperation of the Slovak Republic and Austria (2007 – 2013). Within this cooperation, one part of the bridge had been reconstructed already several years ago. However, it cannot correctly be described as a reconstruction, since the original stone bridge was substituted by a concrete bridge with stone facing, utilizing the original stones. On the other hand this work was completed very precisely and the arches of the new bridge have a clear span of 9.5 m. One of the most difficult tasks was the bridging of the main water stream with a span of 120 m, which, in the permanent condition, is a cable-stayed bridge with two 18-m-high pylons. The last part of the span, weighing 28 tons, was placed on the 13th of March 2012. In this phase the central span was still supported by temporary supports. To be able to remove them, adjustment and tensioning of the stays had to be completed. The overall length of the steel superstructure is 525 m. The building of the footbridge was complicated by the changing water level, which stopped the works for several days. Besides other things, protection of the natural environment had to be respected and thus the construction had to be designed for minimum influence on the animals living and nesting there. In the event the constructors did a great job and the opening ceremony of the bridge, which spans a beautiful environment, was held on the 22nd of September 2012. A cyclist-footbridge thus connected the areas which for many years have been divided by a political barrier. And to overcome this kind of barrier is much more difficult than to overcome those made by nature. The design of the bridge was developed by the company Projkon and it was realized by the Doprastav – Ingsteel association.

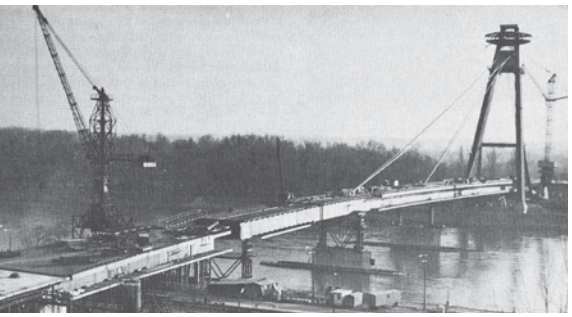
BRIDGE UNDER MICHAEL'S GATE

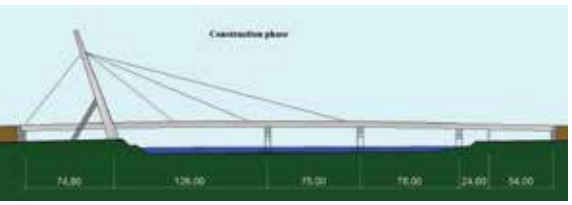
GPS +48° 08' 43.80"S +17° 06' 24.64"V

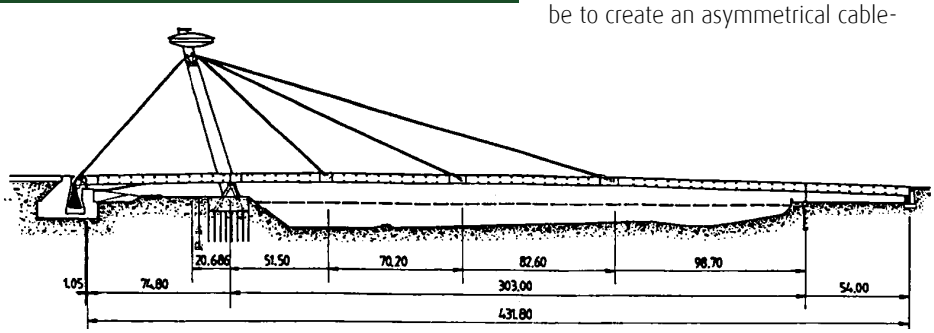
Michael's Gate is the only preserved part of the medieval fortification of Bratislava and it is at the same time one of the city's landmarks.

Near it, there is a 30 m long brick arch bridge serving as an access to the historic centre and also as a summer reading-room situated in the premises under its arches. The bridge was built in 1727 when it replaced the timber bridge spanning the moat. In 1898 statues of archangel Michael and St. John of Nepomuk were placed on it. While St. John of Nepomuk is the patron saint and the protector of bridges, Archangel Michael is described by Christian scripts as an angel able to rescue the soul from the jaws of hell powers. So it should symbolize the protection once provided by the moat, fortification and Michael's gate. The statue depicts the archangel Michael in a Roman robe with a helmet, holding a sword and a convex shield with the emblem of Bratislava and Virgin Mary's initials. Arches of the bridge have a clear span of approximately 5.6 m.

BRATISLAVA AND SURROUNDINGS







SNP BRIDGE

GPS +48° 08′ 16.48″S
+17° 06′ 16.48″V

In planning this bridge several alternatives were developed to solve the bridging of the Danube which would help further development of the Petržalka area and which would improve the traffic connection of the city with the area on the right bank of the river Danube.

One of the major requirements was to keep intact the silhouette of the Old Bridge created by the castle and the St. Martin's Dome. From this point of view, the best solution seemed to be to create an asymmetrical cable-stayed system which would act as the counterpoise to the silhouette of the city. The choice of single cable-stayed plane eliminated the aesthetically not very pleasant view which would be created by the crossing of the stays; however, on the other hand it meant more complex requirements for the structural design. The author of the winning design was Professor MSc Arpád Tesár, who was the main project engineer and structural designer of the bridge. Consulting architects were led by Professor MSc. Arch. Jozef Lacko. Bridge construction was begun by the general supplier, the Doprastav Company, in the year 1967. As well as the Department of Steel and Timber Structures of the Faculty of Civil Engineering of the STU in Bratislava, an important role was also played by the team from the Department of Concrete Structures and Bridges under the leadership of Associate Professor MSc Jozef Zvara.

Construction followed in a number of phases and in these assembling stages the pylon as well as the main girders had to be temporarily supported until the installation of the stays. In the final stage, the backward inclined pylon creates a partial counterweight to the main span, which is 303 m long. As the base for the temporary piers, decommissioned vessels were used which, after some constructive modifications, were floated to the designed positions where they were sunk and filled with stone. Also quite difficult was the construction of the foundation of the pylon and the anchorage block, which by its own weight provides balance of the forces. In both cases huge reinforced concrete blocks are involved, which are, however, mainly situated underground, so they are not visible. For example, the base of the anchorage block itself has the shape of a cylinder with a diameter of 34 m and height of 9 m, while the whole anchorage block is 22 m high. The pylon is set on a huge 4 m thick base plate, which is supported by 56 rectangular piles of size 3 x 0.6 m, reaching a depth of 33 m under the ground. A special attraction is a restaurant on the top of the pylon which offers a beautiful view of Bratislava from a height of approximately 85 m above the water level of the Danube. Since the bridge was named after the Slovak National Uprising, the restaurant was named Bystrica for a long time, after the city Banská Bystrica, where the uprising broke out. After the reconstruction in the year 2005 it was renamed as UFO. In 1990, the bridge had been renamed as the New Bridge, but in 2012 its original name was restored.
During the construction period of 1969 the bridge with main span 303 m was the world record holder in the category of cable-stayed bridges. The bridge had the 4th longest cable-stayed bridge span when it was opened to traffic on August 29, 1972. Nevertheless, it maintained its first place in the subcategory of cable-stayed bridges with one plane of stays long after. In the year 2001 it won the Slovak Construction of the Century award.

BRATISLAVA AND SURROUNDINGS

PORT BRIDGE OR THE BRIDGE OF THE HEROES OF THE DUKLA PASS (PRÍSTAVNÝ MOST)

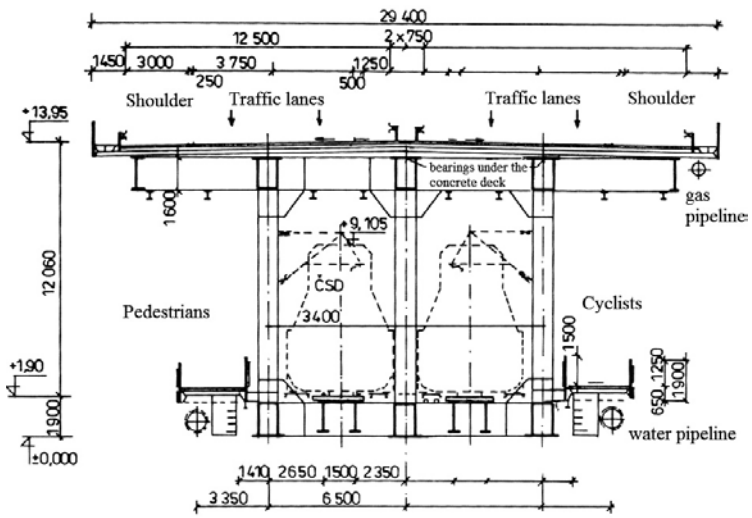
GPS +48° 08' 03.74"S
+17° 08' 22.55"V

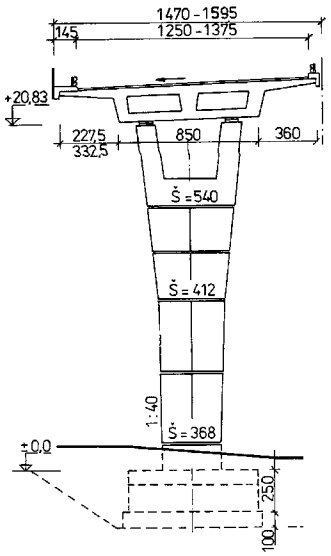
General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The third bridging of the Danube in Bratislava was achieved by the rail-road bridge in the area of the Bratislava port.

The main requirements during its construction were the necessity to keep the required Danube's navigational clearance for ships, being 200 m wide, as well as the requirements of the nearby Bratislava airport. The main function of the bridge was the redirection of the transit and railway traffic from Bratislava and the linking of the housing estate in Petržalka with the city's centre. The highway runs on the upper deck and the railway and the foot paths are situated on the lower deck (see the cross-section of the bridge). Construction began in 1977 and it was completely finished in 1985, but it was partially put into service already in 1983. The main project engineer of the bridge was MSc Rudolf Melcer from the Dopravoprojekt Company. The main designers of the steel structure were the engineers: J. Bustín, L.Nagy and J. Šubr. The main contractor was Doprastav with the subcontractors Hutní Montáže Ostrava and Vítkovice Bridge Building Works. The main part of the bridge has 4 spans of 102.4 + 204.8 + 64.0 + 89.6 m, which continue as highway and railway flyovers.

The main bridge span was constructed by cantilevering from both banks of the Danube, while the side spans were temporarily anchored, so that the structure would maintain stability by not overturning during its construction. The connections of chords and diagonals are



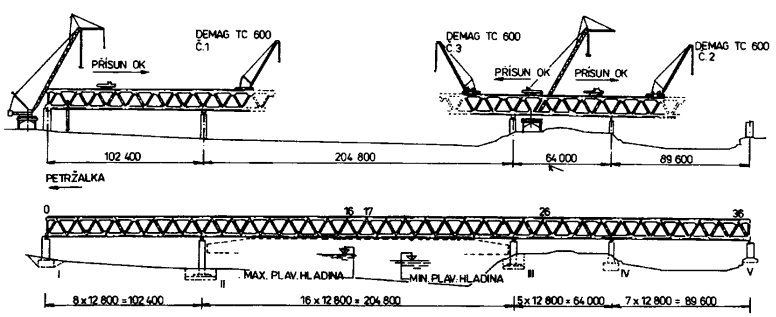


made by means of high strength friction grip bolts.

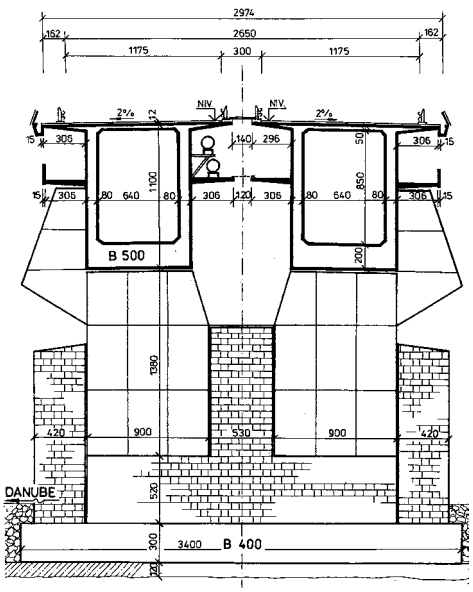
The bridge has a total length of 460.8 m with a span arrangement of 102.4 m + 204.8 m + 64 m +89.6 m. It consists of three main steel continuous trusses (Figure 4.3) framed together in the transverse direction by crossbeams of the carriageway and the railway cross girders. The main trusses are spaced 6.5 m apart and their theoretical depth is 11.7 m. For the main part of the superstructure, 13 200 tons of steel and 323 000 bolts were used. The Port Bridge is probably the most used bridge in Slovakia – 100 000 vehicles pass it every day.

The concrete flyovers of the Port Bridge were built by a movable scaffolding system MVS 40, to the shape of which also the piers had to be adapted. On these piers, for technological reasons, some openings had to be created, which are still visible. The maximum span of the flyover is 41 m. The flyover on the right bank of the Danube consist of 2 parallel bridges, 362 and 368 m long and the flyover on the left bank consists of 2 parallel bridges, 563 and 476 m long. The road flyovers, which are connected to the highway flyovers, were built on falsework and their maximum span is 45 m. After extending the flyovers in 2005, the Port Bridge reached the length of 2 582 m and became the longest bridge in Slovakia.

The railway flyovers of the Port Bridge were built using 30 metre long precast prestressed concrete girders, and also using steel-concrete composite plate girders, with a span of 39 m. The overall length of the railway flyovers is 1 831 m, which together with the main bridge structure represents 2 295 m. So the Port Bridge could also be considered as the longest railway bridge in Slovakia. (However because the main



BRATISLAVA AND SURROUNDINGS



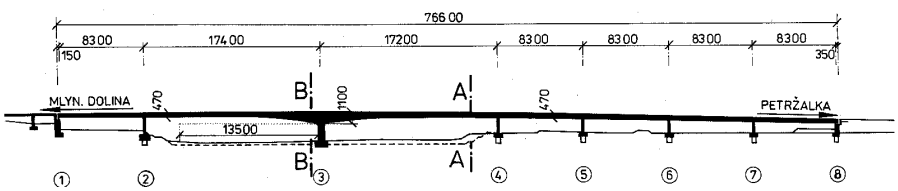
LAFRANCONI BRIDGE (YOUTH BRIDGE)

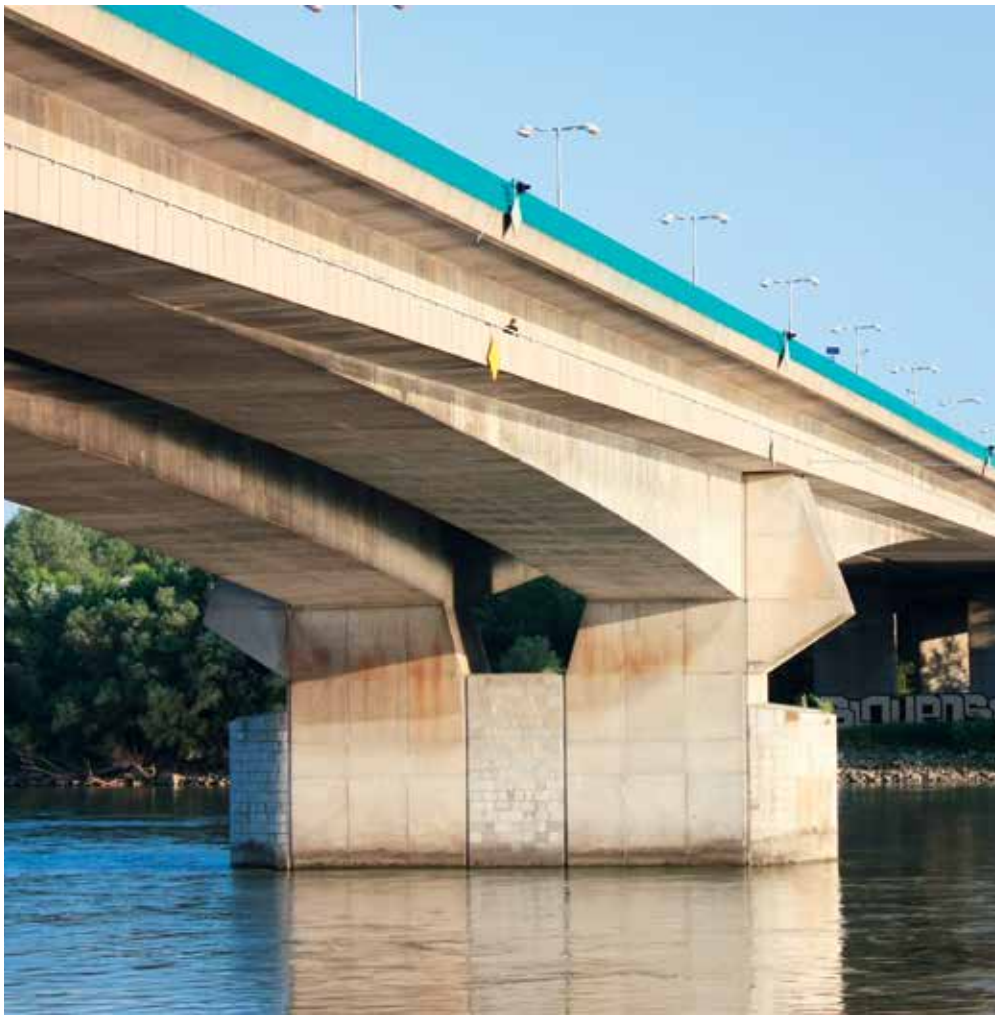
GPS +48° 08' 33.28"S
+17° 04' 30.12"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The Lafranconi Bridge is the fourth permanent bridge built across the Danube in Bratislava and at the same time it is the first concrete bridge crossing the Danube in Slovakia.

The preparation of the bridge began already in the year 1975 by publishing a competition for the design of its main span. However, after the evaluation of the submitted competitive proposals, none of them was accepted. The project committee thus entrusted the former state company Dopravoprojekt to develop the final design on the basis of these proposals and the construction suitability for the Slovak Republic. One of the requirements was that concrete was to be used as the building material, since the usage of steel in the building industry





The inside view of the bridge chamber (above the pier, the chamber is 8.5 meters high)

was considerably restricted at that time. Eventually, the final solution of the structure was represented by a seven-span (83 + 174+ 172 + 4 x 83 m) continuous girder bridge with overall length of 761 m. The depth of the box girder above the pier, which is situated in the Danube, reaches 11 m. The authors of the design were a collective under the leadership of MSc T. Šefčík. The main spans were built by the free cantilever method where each cantilever was 120 m long. Equal lengths of cantilevers in one span would enable to build a bridge with a span of 245 m. This kind of design would rank this bridge among the biggest pre-stressed bridges of the world. Anyway, the 120 m long concrete cantilever was, in the time of the construction, one the world's biggest cantilevers made of pre-stressed concrete. However, the chosen solution of erecting the main spans as two cantilevers of different lengths (120 and 50 m) resulted in many problems which would not exist if cantilevers of equal length were used as was initially proposed. The main problem occurred during the building of the final closure joint, since the cantilevers cannot move until the concrete of this joint reaches the required strength. Unfortunately, the unequal vertical deformation of the cantilevers caused by daily temperature changes reached up to 45 mm, which was unacceptable for the casting of the last closure joint. The final solution to the problem was cooling the cantilevers by water taken from the Danube. A major part of the structural design and mainly the calculations of the deformations were carried out by the Department of Concrete Structures and Bridges of the STU in Bratislava. Doprastav finished construction in the year 1991.

BRATISLAVA AND SURROUNDINGS

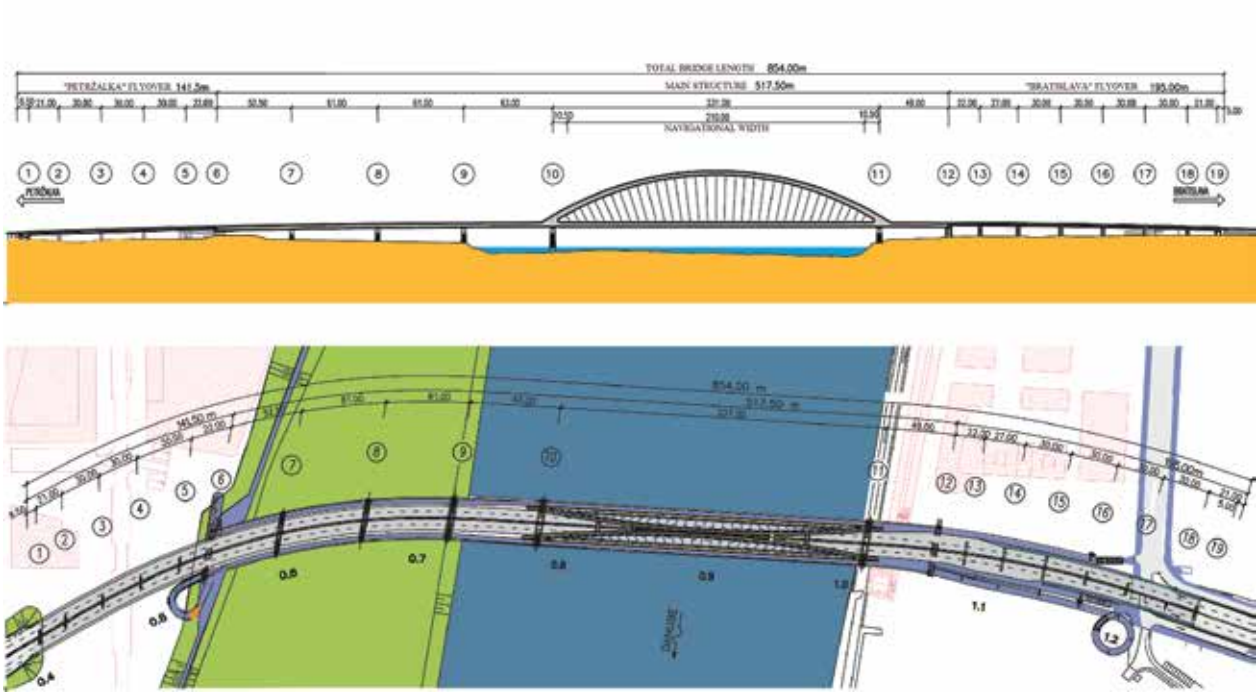


Photo made few weeks after the bridge has been rotated (bridge still doesn't have the pavement and the protectors of the hangers are not installed).

Workers inside the main girder

APOLLO BRIDGE

GPS +48° 08' 14.24"S
+17° 07' 41.15"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The youngest bridge across the Danube in Bratislava is the Apollo Bridge, which had been planned since 1976, but the first cars crossed it only on the 5th of September 2005.

The bridge was named after the refinery which was on Bratislava's side of the Danube, in the place of the crossing of the bridge and the riverbank (the refinery was named after the god Apollo). The maximum span of the bridge is 231 m to which the height of the arch had to be proportioned, this being 36 m. The overall length of the bridge including the concrete flyovers is 854 m. During the design process, various types of bridges, structural materials and hanger arrangements were studied. Finally, after a detailed analysis, a steel arch with an orthotropic steel bridge deck was chosen with a radial arrangement of hangers, which is structurally effective enough, constructively comfortable and aesthetically the most pleasant from the majority of angles. The design was mainly complicated by the skewness of the bridge, curved lines of the bridge as well as its curved vertical alignment

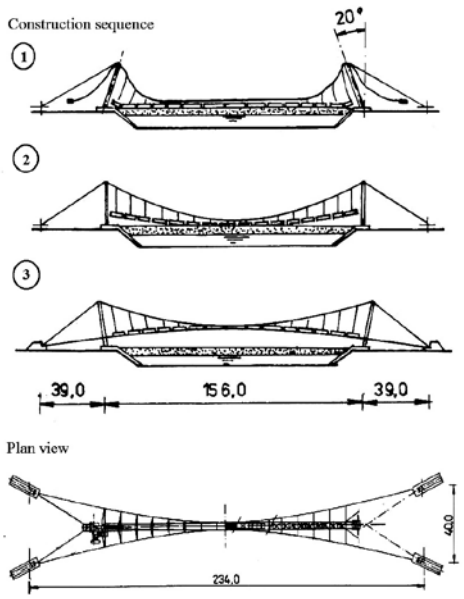
and the inclination of both arches. Thus the geometrical shape of the bridge is very complex and some parts of the structure are designed as "buckled surfaces". These were needed to preserve the harmony of the shape. When it comes to the underside view, the cross-beams of unconventional shape are dominating, which are interesting visually, and also structurally logical. At the sides of the main girders, pedestrians and cyclists walkways are placed, under which there are service corridors for cable lines. The individual pieces of the steel structure were made in the Czech Republic and Hungary, from where heavy-duty vehicles transported them. The structure of the arch was assembled on the left bank of the Danube on the supporting falsework called "Pižmo". One of the most difficult tasks was to fit the last part of the arch, which had to be made-to-measure after measuring the actual shape of the arch structure. A considerable complication was also caused by the thermal deformations of the arch during the day. After welding the last part of the arch to the structure, the arch became self-supporting and the falsework could be removed from it and the hangers could be fitted and tightened. By their tensioning, the whole bridge structure was activated. The arches themselves are accessible as well as the main girders. There is a staircase on the inside of the arches leading to the top of them, where there is an inspection platform.

Construction of the main bridge span was unique, as it was erected on the left bank of the Danube and subsequently rotated on barges into its final position. This rotation needed a special bearing designed solely for this purpose. The operation took 3 days and thousands of spectators came to see it – they filled both riversides. During this process, the level of the Danube was regulated by the water dam in Gabčíkovo and the navigation on the river was stopped. The barges which enabled rotation of the bridge on the Danube River had to be adjusted by controlled flooding of their chambers

photo: Ing. Miroslav Mataščík

they could be balanced during the launching of the bridge structure on them and by this means their overturning was prevented.
The whole moving of the bridge during its rotation was continually surveyed from several points, which enabled the position as well as the inclination of the bridge to be immediately assessed. Also thanks to these technologies, the bridge was highly recognised by various world organizations. It was awarded prizes as European Award for Steel Structures from the European Convention for Constructional Steelwork, awarded in Nice in 2005 and it was one of the 5 finalists in the OPAL Award of ASCE (American society of civil engineers) in Washington in 2006.
The concrete flyovers also have an interesting shape, besides their nice appearance; their shape is also structurally very effective.
The design of the Apollo Bridge was made by the Dopravoprojekt Company; the chief designer was MSc Miroslav Maťaščík. The main building contractor of the bridge was the Doprastav Company.

BRATISLAVA AND SURROUNDINGS



PIPELINE BRIDGE IN THE WINTER PORT

GPS +48° 07′ 47.51″S
+17° 09′ 03.19″V

The pipeline bridge is situated in the winter port of Bratislava, where it carries three pipelines and a walkway for pedestrians.

In spite of the quite small span for this type of bridge, being 156 m, it is the biggest suspension bridge in Slovakia. The bridge was built in a very interesting manner, by which, in the first phase, the main girder was assembled on a temporary embankment. Subsequently, the pylon was assembled in 20 degree inclination from the vertical direction and the main cables, as well as the stiffening cables were connected to it. In the third phase, by tensioning of the cables, the pylons moved into their permanent position simultaneously raising the main girder from the temporary embankment. The last step was the final tensioning of the stiffening and the main cables and their anchoring into the anchorage blocks. At this phase also a temporary hinge between the pylon and its foundation was removed. The main project engineer was the team from the Department of Steel and Timber Structures of the Faculty of Civil Engineering at the STU in Bratislava. Construction was by the company Hydrostav and Hutní montáže Ostrava.

BRATISLAVA AND SURROUNDINGS

GPS +48° 08' 28.80"S
+17° 05' 57.87"V

DRAWBRIDGE OF BRATISLAVA CASTLE

Bratislava Castle is not only among the symbols of Bratislava, but also among those of Slovakia. Its history dates back to the days of the Celts and the Romans.

Its strategic place lay in the proximity of the ford of the Danube, which was situated just under it. The first written document about the castle dates back to the year 907, from the days of the Slavic fortification which stood here. The fortress was continually changed, modernized and adapted, while one of the biggest reconstructions dates back to the year 1427, when the major part of the old buildings was destroyed. This modernization also predestined it to become a crowning residence of the Hungarian kings after the battle of Mohacs in 1526. Mainly because of the Turkish thread, another reconstruction followed in the successive years, the purpose of which was to improve its fortification. According to Giuseppe Priami's design, a star shaped fortification was to be built around the castle, which, however, was only partially finished. Within this fortification, Leopold's Gate was also added in 1674, part of which was also a drawbridge, which was approximately 4 m long. Today, its place is recalled only by 2 openings situated over the gate, through which the bridge lifting chains led.

STONE ARCH BRIDGE IN OLD PHEASANTRY

GPS +48° 04' 57.80"S
+17° 05' 10.13"V

The bridge is located in Petržalka, near to the Austrian village – Kitsee, in a little forest of the former Pheasantry, which was probably founded for pheasant breeding back in the 17th century.

Also Joseph II, Mary Theresa's son, used to hunt here. The bridge was originally spanning the meander arm of the Danube, however, today the remains of its two arches with clear spans of 5.3 and 5.0 m cross only the dry river bed. Nowadays, it is abandoned and instead of magnificent carriages it only has to carry the luxuriant vegetation.

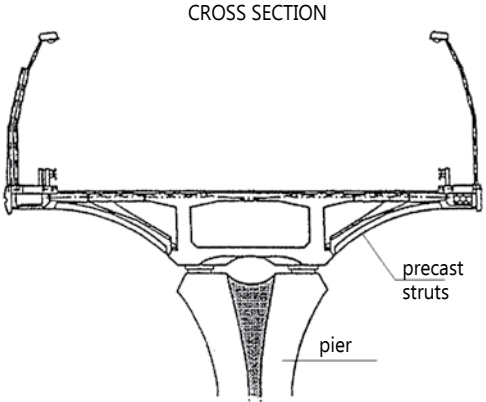
BRATISLAVA AND SURROUNDINGS

FLYOVER OF PRIEVOZ

GPS +48° 08′ 58.79″S
+17° 10′ 51.20″V

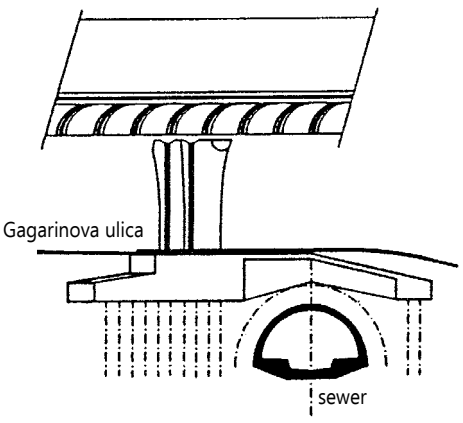
General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

CROSS SECTION



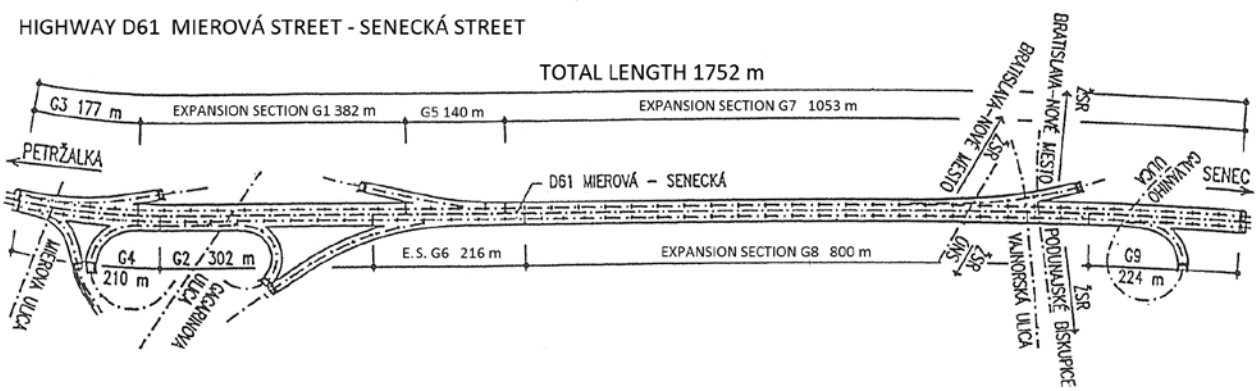
The flyover between the streets Mierova and Senecká connected the highway in the direction from Trnava with the Port Bridge. It significantly improved the road transport conditions in the city.

Since the flyover crosses the urban area of the city, as well as the structural requirements, it has to fulfil particular aesthetic criteria. Because



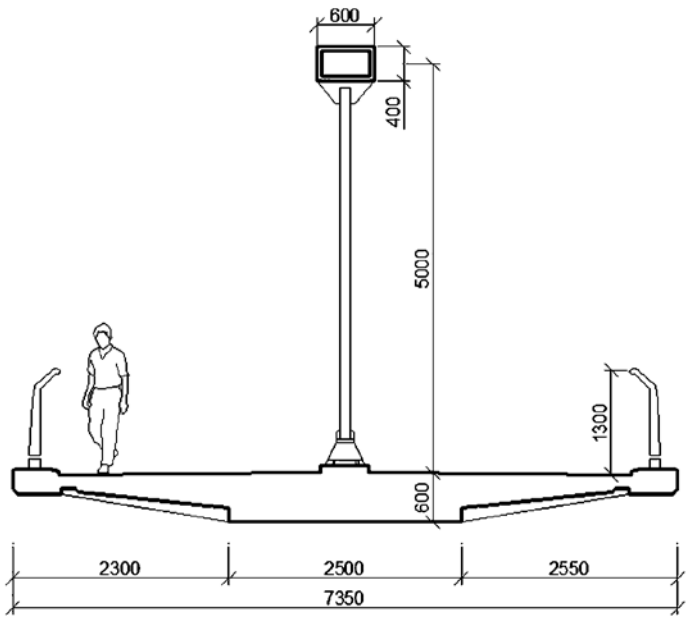
of this, the 139 piers and the shape of the superstructure had careful attention. A non-standard solution of the structure is achieved mainly by the unconventionally shaped struts supporting the upper slab of the box girder, which, together with the piers, forms an interesting appearance.

Foundation of some piers was complicated by sewers passing under the bridge, for example, that under Gagarin Street with the diameter of 4 m. These sewers were bridged by the footings, which were formed like small pre-stressed "underground bridges". The Prievoz flyover has all together 115 spans and in its construction 88 000 m^3 of concrete was used. Construction started in May 1999 and the first cars crossed it on the 19th of August 2002.



BRATISLAVA AND SURROUNDINGS

FOOTBRIDGE NEAR AUPARK



Cross section

GPS +48° 07′ 53.75″S
+17° 06′ 28.94″V

The 113.5 m long reinforced concrete footbridge is stiffened by a five metres high arch in the central span, which enabled reduction of the thickness of the superstructure to 0.6 m preserving a span of 34 m. The footbridge was designed by the Geoconsult Company and its constructor was the Doprastav Company. It was finished in 2004.

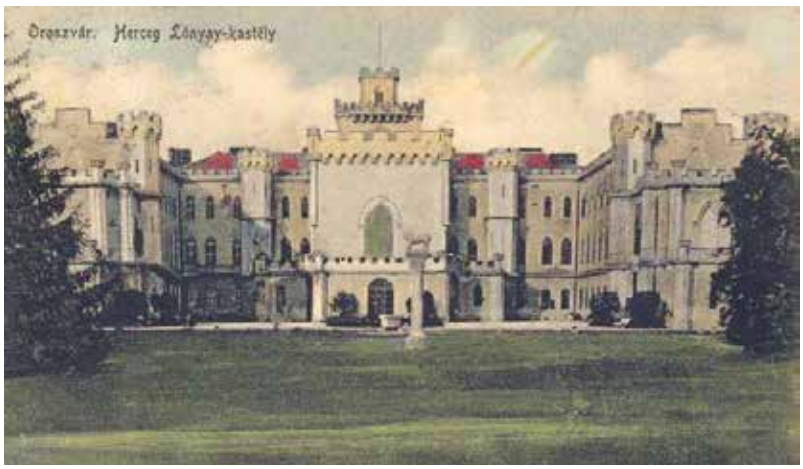
A similar footbridge was also built near the Incheba exhibition centre, where the arch is painted in blue colour. The construction of these footbridges was complicated by tight space constraints and by the busy Einstein Street above which the structure was being built.

BRATISLAVA AND SURROUNDINGS

LITTLE BRIDGES IN AREA OF RUSOVCE MANOR HOUSE

GPS +48° 03' 12.22"
+17° 09' 10.68"

The history of the manor house dates back to the 13th century, when in the historical documents Uruzwar castle is mentioned, however, the biggest expansion of the residence came in the 17th century by the arrival of the Zichy family.



The Manor House was reconstructed several times and until the end of World War II it was a magnificent residence. During the World War I it served as a military hospital and in World War II it was first occupied by a German squad and later it was completely plundered by Soviet troops. Since 1950 the Manor House has been in the possession of SLUK (Slovak Folk Artistic Collective). The park of the Rusovce Manor House is among the most beautiful relaxation places in the surroundings of Bratislava. The park is traversed by a small arm of the Danube river which is crossed by several little concrete bridges. The year of their origin is not known and they are not exceptional, but they are a nice example of how a simple and cheap structure can fit into its surroundings.

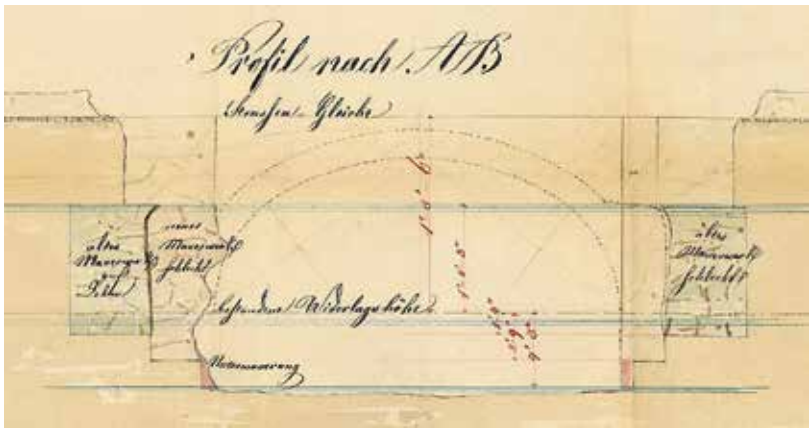
BRATISLAVA AND SURROUNDINGS

AIRPORT'S LIGHTING BRIDGE

GPS +48° 09' 11.31"S
+17° 14' 20.18"V

During the extension of the Bratislava airport's runway, its lighting system also had to be moved.

The new position had to be placed above the Little Danube and a bridge had to be built. However, any piers would significantly interfere with the flow of the river, so the bridge had to be constructed without them. Considering the width of the river bed, the requirements of the minimum navigational clearance for ships and the maximum permitted height of the structure it was quite a difficult task. The most acceptable alternative, although scarcely used in Slovakia, was to build a bridge designed as a stressed ribbon structure with the thickness of 0.8 m and a span of 117 m. A disadvantage of these structures is their small stiffness and large deflections, but since the bridge serves only for the lights, the deflection does not influence its function (the designed sag of the bridge is 3.2 m.). After approximately 20 years of service, its state was classified as being structurally deficient. The main reason was the advanced corrosion of the pre-stressing tendons and it had to be strengthened and reconstructed in a short time. Today, this unusual bridge is fully functional and it daily welcomes and sees out thousands of travellers, who do not have even the slightest idea of its existence.



BUČANY

BRICK BRIDGE

GPS +48° 25' 19.70"S
+17° 41' 40.42"V

The bridge is situated right next to the main road linking Trnava and Leopoldov. Here it bridges the river Dudváh with a brick arch with a clear span of 9.5 m.

Next to the bridge, there is a statue of St. John of Nepomuk with an engraved year 1725. The bridge is from the 1850s, when it substituted the older timber bridge. The original geometry sketch is from the year 1851.

BYTČA

BRIDGE ABOVE THE RIVER VÁH

GPS +49° 12' 58.42"S
+18° 34' 10.63"V

In the years 1904 – 1944, there was a steel truss bridge, which after World War II, in 1951, was replaced by a new beam bridge.

The superstructure is stiffened by prestressing tendons running under the beams. The bridge is 256 m long with 6 spans (one made of concrete and five made of steel) with the maximum span of 49 m. This steel girder bridge with a concrete deck was the first major composite road bridge built in Slovakia.

BOWSTRING ARCH BRIDGE OVER THE HRIČOV CANAL

GPS +49° 13' 56.15"S
+18° 33' 24.46"V

Nowadays, the only steel arch bridge in Bytča is the bridge from the year 1991 which spans the Hričov Canal at a height of approximately 4 m and with a span of 105 m.

Its 16-m-high arches are created from 9 straight sections, which made construction easier, but on the other hand rather spoil the overall aesthetic impression. On the photograph, a parallel concrete bridge across the canal can also be seen.

BYTČA

CONCRETE BRIDGE

GPS +49° 13′ 55.55″S
+18° 33′ 23.75″V

The bridge with a span of 63 m was built around the year 1962 within the building of the Hričov Dam and the Hričov Canal, which is spanned by it.

For this bridge, the arrangement of the prestressing tendons is unusual, since they are located outside the concrete section. The box-girder of the bridge, which starts above the pier ends roughly in the quarter of the main span and from there the soffit slab ends and three solid girders continue, which are connected by a cross beam at the midspan. The prestressing tendons passing across it generate an uplift force that improves the structural behaviour of the bridge. However, the bridge is currently out of service, because the traffic was diverted to the new steel arch bridge built in its immediate proximity.

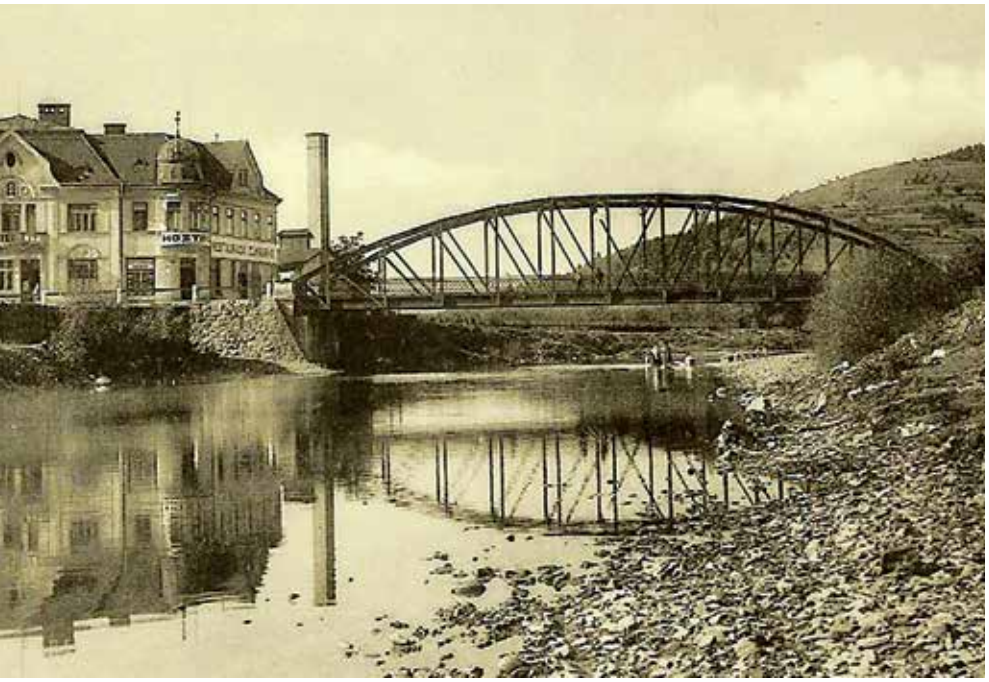
BRZOTÍN

TRUSS BRIDGE

GPS +48° 37′ 20.50″S
+20° 29′ 50.50″V

The bridge is on a railway line traversing the Slovak Karts, which, since the year 1973 has been a nature conservation area and in 2002 was declared a national park.

The bridge was chosen as a representative of the common type of truss railway bridges. It can be considered as structurally simple and economically the most favourable and it could be said that its beauty lies exactly in the classic structural simplicity.



ČADCA

FORMER STEEL TRUSS BRIDGE

In front of the present Kysuce Museum, since the beginning of the 20th century, there was a steel Pratt truss bridge standing over the river Kysuca, which replaced the original timber bridge.

The bridge was destroyed in World War II.

ČACHTICE

GPS +48° 42' 55.55"S +17° 47' 12.73"V

LITTLE STONE ARCH BRIDGE

Čachtice became famous mainly due to the presence of the Countess of Blood, Elizabeth Bathory, at the turn of the 16th and the 17th century, who entered the Guinness World Records as the greatest murderess of all times.

The arch bridge built probably in 1496 spans the road at a height of 5 m.

On the 10-metre-long bridge, there are parish stairs; the bridge links the church with the nearby parish. In this parish, a momentous meeting of the Tatrín association took place, on which the prominent personalities of the then national movement decided on the Slovak orthography. The baroque gate of the bridge from the year 1697 placed at its end is also interesting.

ČERVENÝ KAMEŇ
(NEAR THE VILLAGE ČASTÁ)

GPS +48° 23' 31.05"S
+17° 20' 05.88"V

BRIDGE OVER THE CASTLE MOAT

There is an interesting legend connected to the building of the castle Červený Kameň, which says that 12 wise men discussed where to build the castle and 11 of them proposed the hill Kukla (being in front of the hill where the castle stands today).

Only one of them, the youngest, proposed the present place, because in his opinion, the hill Kukla was a meeting place of ghosts and he thought they would not like the disturbance caused by building there. However, most of them agreed on Kukla, so already on the first day, the workers built a great part of the foundations and some walls. But at night, strange things were happening. Good fairies lifted the structure and moved it to the neighbouring hill. How big was the surprise of the workers when the next day they did not find anything on the original place? So the board of elders met again and admitted that the youngest member was right. The castle was left in its new position and it could be peacefully built into its beautiful shape. However it was, the first castle stood here as early as in the 13th century. In the 17th century, it was completely rebuilt and came into the possession of the Pállfy family and remained so until World War II. Its name meaning Red Rock takes its name from the red colour of the quartzite rocks to be found in this area. The castle bridge is 15 m long, 7 m high and it crosses the moat with 3 spans with clear spans of approximately 3 m. The bridge deck is 5 m wide and from the sides it slopes towards the middle, from where the water is drained.

ČERVENÝ KLÁŠTOR

FOOTBRIDGE FOR PEDESTRIANS

GPS +49° 23' 39.25"S
+20° 24' 38.37"V

Červený Kláštor (literally Red Monastery) takes its name from the red roofs of the monastery buildings which were started to be built back in the 14th century by the monks belonging to the Carthusian monastic order.

The cross-border footbridge between the Slovak village Červený Kláštor and the Polish village Sromowce Nizne spans the river Dunajec – a famous touristic attraction offering rafting in the beautiful environment of Pieniny mountain range. According to the archive records from the year 1914, the Polish village, still being a part of Hungary at that time, in the same year requested the superior authorities to build a bridge over the river. The straightforward reason for building it was that the inhabitants of the place did not have any connection "with the world". However, the bridge was awaited for 92 years – until 2006, when the footbridge was completed. The footbridge itself is an example of an interesting cable-stayed structure with a span of 90 m and an inclined pylon almost 27 m high.
From the Polish side of the bridge, there is a statue of St. John of Nepomuk, who is, according to old habits, protecting the bridge. Within sight of the footbridge in the direction of the stream, a hill called Tri Koruny (Three Crowns) is seen behind it, which is the most interesting and outstanding hill of the Pieniny mountain range (982 m above sea level).

ČUNOVO

BASCULE BRIDGE

GPS +48° 01′ 50.30″S +17° 13′ 37.02″V

The water dam Čunovo was built as a part of the Gabčíkovo waterworks. Its main function is to produce electricity, to divert flood water and to allow the flow of water also into the old riverbed of the Danube and into the Mosony branch.

Within the water dam Čunovo, there is one of only two bascule bridges in Slovakia. It is composed of two, approximately 12 m long cantilevers. It was finished in 1996 by the company Steel O. K. Levice.

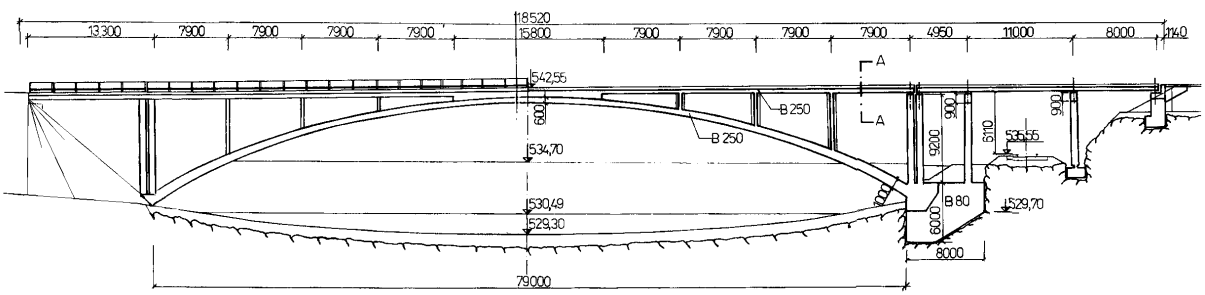
DLHÁ NAD ORAVOU

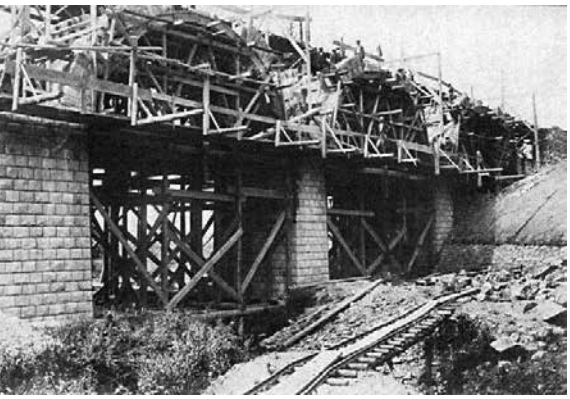
CONCRETE ARCH BRIDGE

GPS +49° 16′ 15.44″S +19° 27′ 37.33″V

In the year 1924 an approximately 64 m long reinforced concrete bridge was built near the village Dlhá nad Oravou, which is also referred to as the bridge of Masaryk.

However, in 1945 it was destroyed by the German army as were many other bridges. After the liberation in the years 1956 – 1958 a new arch bridge was built in its place, with a clear span of 79 m and a rise of the arch of 9.5 m. With this clear span it is still the biggest concrete arch bridge in Slovakia. This bridge, spanning over the Orava River and the railway, is remarkable for its quite flat arch and for its light structure, which harmoniously fits into the surroundings. The 185 m long bridge was built by the Doprastav Company.





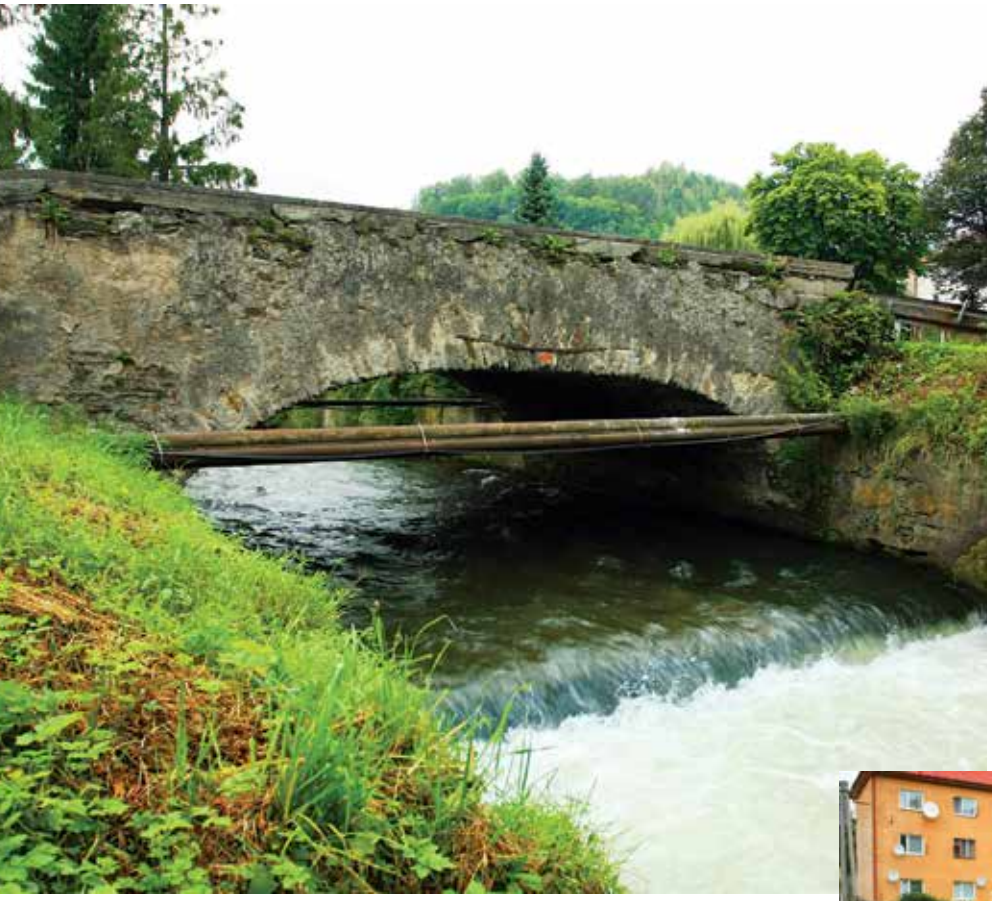
DOBRÁ NIVA

VIADUCT OF DOBRÁ NIVA

GPS +48° 26' 57.75"S
+19° 06' 17.49"V

On the railway line completed in 1925, connecting Zvolen and Krupina, 120 bridges had to be built because of the rugged terrain. For the construction, mostly so called tamped concrete was used, covered with stone facing.

Some bridges have only one arch, but some of the viaducts are several tens of metres long. One of these long bridges is also the 83 m long Viaduct of Dobrá Niva, crossing the valley with 6 arches with clear spans of 11 m at a height of approximately 13.5 m.



DOBŠINÁ

STONE ARCH BRIDGE

GPS +48° 49′ 13.80″S
+20° 22′ 06.07″V

The small town of Dobšiná was founded around the beginning of the 14th century and it was prospering thanks to its raw materials that were mined there.

At the beginning, it was mainly copper ore, later nickel, cobalt, and asbestos. The stone bridge with the parapet faced with round stones spans the stream Dobšiná with a single arch with a clear span of 8.3 m. The arch of the bridge, which is strengthened in the middle by wrought iron reinforcement, appears to be very flat at first sight. Unfortunately, I did not succeed in measuring the rise of the arch.

DOLNÉ OZOROVCE

STONE ARCH BRIDGE

GPS +48° 43′ 44.27″S
+18° 14′ 33.69″V

In a local part of Bánovce nad Bebravou, a stone arch bridge was built in 1898, with clear spans of approximately 7.3 m, crossing the stream Svinica at a height of 5 m.

The voussoir arches transfer the load into the central pier and into the abutments. After 110 years in service, the bridge is still in very good condition.

DOLNÉ PLACHTINCE

CONCRETE BOWSTRING BRIDGE

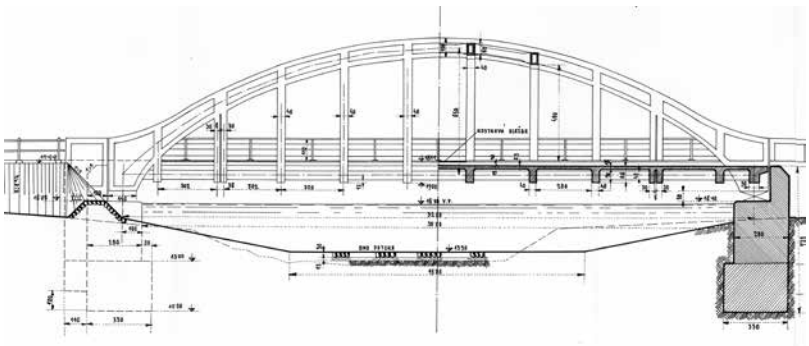
GPS +48° 12′ 10.57″S
+19° 18′ 38.85″V

Beam bridge (1935)

Bridge built in the year 1937 before its reconstruction

The concrete bridge was built in 1937 after the floods in 1936 which had swept away the original concrete beam bridge with a span of 20 m.

The new bridge survived World War II with a great deal of luck, since the bomb which exploded near its bearing did not cause serious damage to it. This bridge served without any problems until the end of the 20th century, when its state was classified as structurally deficient. To assist its reconstruction, the original drawings were found in the National Record Office. The objective was to respect the original shape of the bridge. Such a precise and elegant reconstruction is quite rare in Slovakia. Normally, the old bridge is simply destroyed and a new one is built, or the reconstruction is done very insensitively (for example the reconstruction of a similar bridge in Svrčinovec). The reconstruction in Dolné Plachtince was carried out in the year 2011, and was made by the CEMOS Company.



Bearing of the bridge

Bridge after reconstruction (*photo: Ing. F. Brlit*)

DOLNÝ CHOTÁR

CONCRETE BEAM BRIDGE

GPS +47° 59' 48.62"S
+17° 51' 56.22"V

In the period between the two World Wars, a reinforced concrete beam bridge was built above the stream Čierna Voda, with a span of approximately 17 m. This bridge is a nice example of a structurally effective, economical and at the same time aesthetically satisfactory bridge structure.

An interesting aspect of this bridge is a small commemorative board bearing the name of the constructor MSc Artur Komlóš (originally Kreisler). His company was liquidated during World War II during the anti-Semitic reprisals.

DOLNÝ KUBÍN

RAILWAY AND ROAD BRIDGE

GPS +49° 12′ 48.94″S
+19° 17′ 31.88″V

The bridging of the river Orava in Dolný Kubín is mentioned for the first time in the year 1776 when a timber bridge stood there.

In less than 130 years, there were already 2 steel bridges over the river, one of which was a road bridge, and the other, 88 m long, was the part of the railway line connecting Kraľovany and Oravský Podzámok. Both bridges were destroyed during World War II and today there are two bridges in their place with different structures. After the destruction of the truss railway bridge, a temporary timber bridge made of nailed girders was built and this one was later replaced by a steel truss structure. The road bridge with a span of 46 m was built of reinforced concrete in the place of the original steel bridge in 1949. In 2001, the bridge had to be strengthened due to its bad technical condition; the technique of strengthening by carbon fibre reinforced polymers was used, which at that time was not very well-known in Slovakia. At the time of the strengthening, the 46 m long glued CFRP strip was the longest application of this system in Europe.

GPS +49° 12′ 46.15″S
+19° 17′ 31.57″V

DOLNÝ KUBÍN

GPS +49° 12′ 36.37″S
+19° 17′ 29.95″V

WOODEN COVERED FOOTBRIDGE

The 102 m long bridge was built in 1994 to connect the historic part of the town with the new housing estate Bysterec.

Spans of the bridge, which are 30 m long each, are supported by two piers founded in the river Orava and by two abutments on the riverside, above which the structure is connected to the footpaths. The roofing of the footbridge consists of a wooden structure covered with shingles, which should complete the classical motive of folk architecture. There are four protrusions which form small sales booths. Such a format of a bridge with selling premises, together with the Colonnade Bridge in Piešťany, is unique within the territory of Slovakia. The wooden structure was made by the company of MSc Štefan Antal.

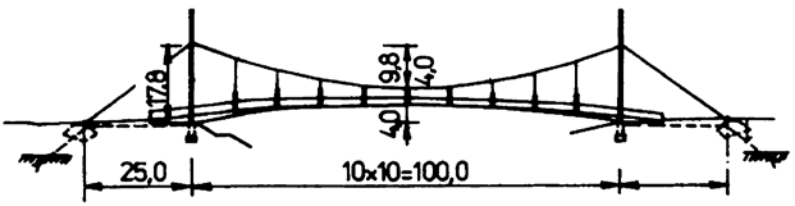
DOLNÝ KUBÍN

SUSPENSION FOOTBRIDGE

GPS +49° 12′ 27.52″S
+19° 17′ 21.11″V

Slovakia can be proud of many unique suspension footbridges, among which there is also the prestressed cable footbridge in Dolný Kubín, with a span of 100 m and the pylons being almost 27 m high.

Thanks to the sophisticated wind bracing by means of the lateral tensioned cables, its vibrations are minimal even in spite of the quite long span. The footbridge has a look of modernity even after 40 years. It was built in 1967 according to the structural patent of Professor Arpád Tesár from the Faculty of Civil Engineering STU in Bratislava.



DONOVALY

WOODEN FOOTBRIDGES

GPS +48° 52′ 32.85″S
+19° 13′ 30.55″V

The first settlements of this area appeared in the 17th century. The inhabitants earned their living mainly by the production of charcoal.

However, at the beginning of the 20th century, tourism began to dominate this region and so in 1936 the first hotel was built. Nowadays, Donovaly is a famous skiing resort where dogsled races are organized every year. Within the growing skiing resort, two wooden footbridges were built above the busy road. Bridges serves both pedestrians and skiers. In 2002, the central footbridge was reconstructed and moved 26 m away. The arch span is 17.5 m.

DRAVCE

THE OLDEST STONE BRIDGE IN SLOVAKIA

GPS +49° 01' 11.70"S
+20° 29' 03.80"V

A small scarcely-noticeable bridge with a Gothic arch with a clear span of 3.6 m is considered to be the oldest preserved stone bridge in Slovakia.

It is situated in the village Dravce, which was once a residence of the royal falcon breeders (from there comes the name Dravce – literally "predators"). The bridge built of quarry stone spans the stream Dvorec near the road from Poprad to Levoča. The first references to this bridge, although not verified so far, date back to the 13th century. However, since that time, it has been reconstructed several times, so it is difficult to say with certainty to what extent its structure is original.

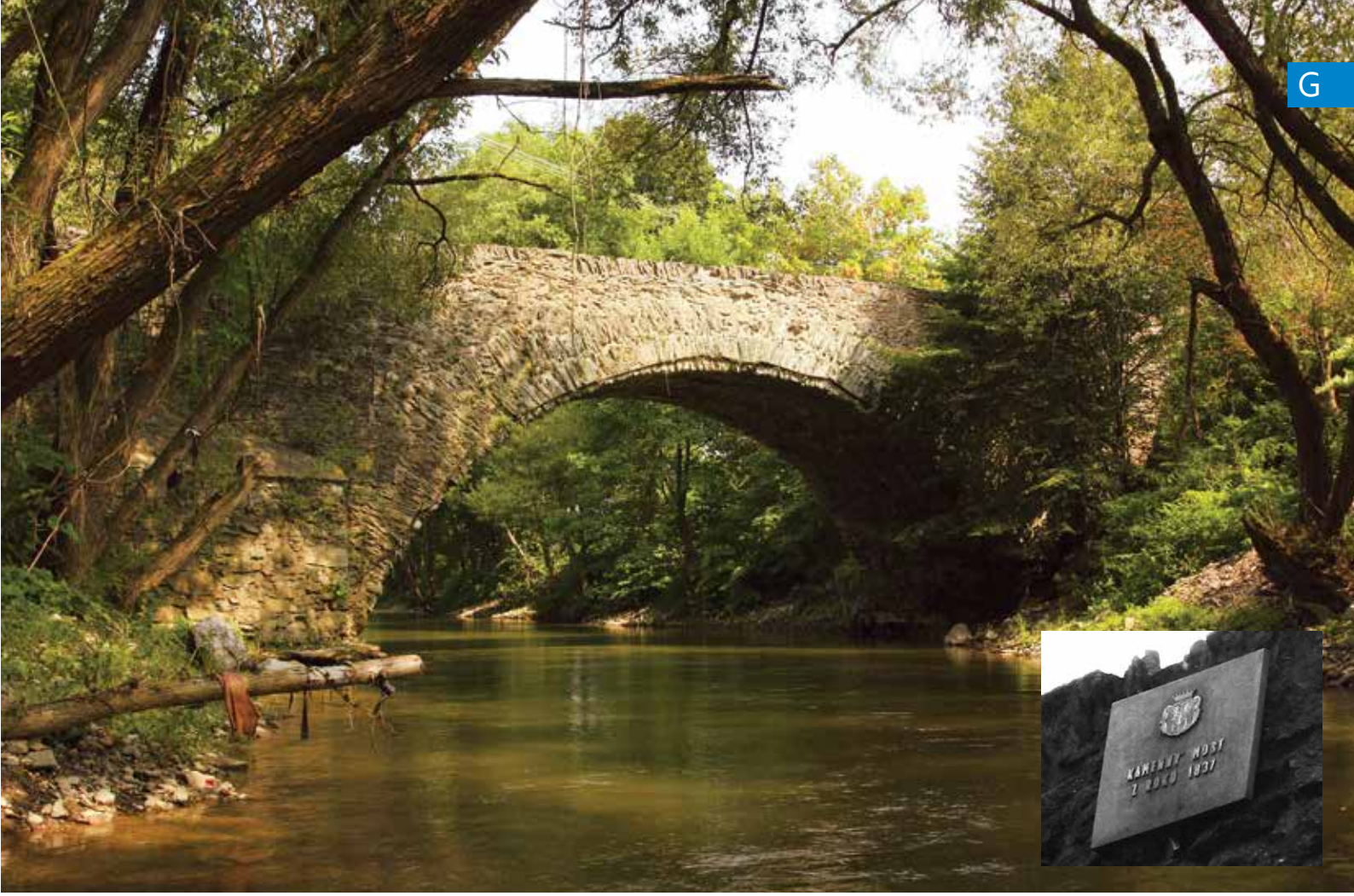
DRIETOMA

LITTLE STONE BRIDGE

GPS +48° 54' 30.80"S
+17° 57' 19.04"V

There are not many preserved stone bridges left in Slovakia, mainly because they had to be rebuilt (due to changing traffic requirements).

Thus, many of them were rebuilt as concrete bridges. Naturally, some of them are known only to the local citizens, who consider them to be a common part of the village. One of the goals of my journey through Slovakia was to map the stone bridges preserved so far. Some are mentioned in older publications dedicated to bridges, but discovered most of these bridges on the Internet or by chance. The little bridge in Drietoma was one of the Internet catches photographed by an unknown photographer without any exact location given. I finally managed to find this bridge on an unpaved road, although, judging from the photo I expected it to be bigger. Its clear span is only 2.8 m.



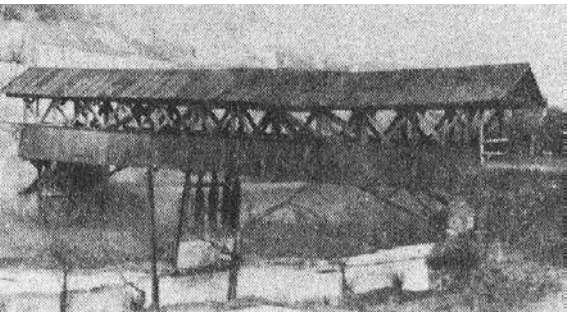
GELNICA

STONE ARCH BRIDGE

GPS +48° 51' 11.16"S
+20° 56' 21.73"V

Gelnica is originally a royal town with rich mining history in which *"the ancient foretimes breath from the cold walls of the ancient buildings and the peaks of mining drifts remind us of the hard work of our ancestors"*.

In the town originally called Golnicz Bánya, there is a stone arch bridge with the biggest span, or more accurately the biggest clear span in Slovakia. The stone bridge with clear spans of 16.2 and 9 m was built during the years 1837 – 1845 over the river Hnilec confirmed by a board placed in the middle of the arch. It was partially reconstructed in 1974. However, today it is not passable for cars and it is used by pedestrians and cyclists only.



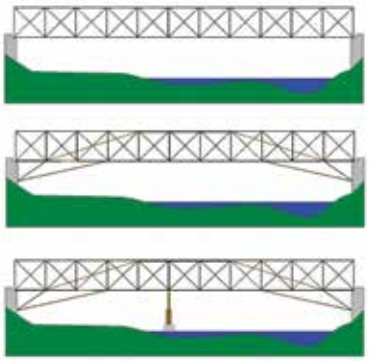
Upper bridge – side view
photo: Monuments Board of the SR

GELNICA

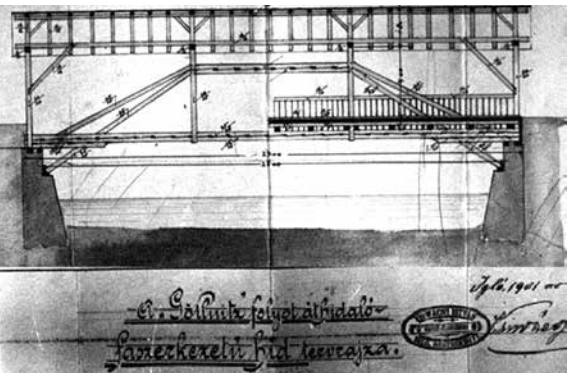
FORMER TIMBER BRIDGES

Except for the stone bridge, there were also two covered timber bridges in Gelnica.

The upper bridge, built in 1831, was after World War II the longest timber covered bridge in Slovakia, still in service at that time. Although its 25 m long superstructure was gradually improved and strengthened, in 1957 it was not suitable for the increasing traffic anymore and it was replaced by a new concrete bridge. The lower timber bridge was built in 1901 on the place of the old, also covered, timber bridge. It was characteristic for its red roof visible from far away. In spite of the maintenance, since 1954 the bridge was passable only by vehicles with weight less than 1 tonne. The original plans, worked out by the carpenter I. Kriwácsy from Spišská Nová Ves, were preserved.



Gradual strengthening of the upper bridge



Lower bridge – original plans of the bridge
photo: The Monuments Board of the SR

Lower bridge – view of the structure

Lower bridge and the view of Gelnica

GEMERSKÁ HÔRKA

GPS +48° 32´ 17.62"S
+20° 21´ 38.80"V

Based on historical military maps, this stone bridge stood here already at the beginning of the 19th century. The bridge was reconstructed in 2001, when it was strengthened by a hidden concrete slab and also its total length was extended to 53.7 meters. The bridge with a clear span of 3.5 meters is characteristic for its orange stones which are very common in this region.

GERLACHOV

STONE ARCH BRIDGE

GPS +49° 05' 50.78"S +20° 12' 31.41"V

The village, after which the highest peak of the High Tatras was named, was founded in the 14th century. Back then it took its present name after its patron saint – St. Gerlach.

The small rural bridge with a drained deck and with a clear span of 3.15 m was built in 1865 and reconstructed in 1943. Both of these years are engraved on the parapet approximately in the middle of the bridge. It is a nice, historically precious memory of folk bridge building in Slovakia.

HALIČ

ACCESS BRIDGE TO THE MANOR HOUSE

GPS +48° 21' 22.48"S +19° 34' 32.50"V

The manor house in Halič was built in 1612 on the site of the castle demolished in 1544.

Thanks to its elevated position, its towers are visible from far distance. In front of the manor house, an access bridge over a moat has been preserved with a span of approximately 6.0 m and a rise of the arch being 3 m. The keystone of the arch is decorated from both sides by a mask depicting a human head covered with leopard skin.

photo: ŽSR MDC

HANDLOVÁ

THE HANDLOVÁ VIADUCT

GPS +48° 44' 13.30"S
+18° 45' 40.77"V

The 200 m long viaduct crosses the town of Handlová, which became famous for coal mining.

The bridge consists of 6 underslung Pratt truss girders with parabolic curved bottom chords. Span arrangement is 2 x 26 + 3 x 31 +26 m. In addition to these spans, there is also one concrete arch by each of the abutments. The viaduct spans the valley between the mountains Žiar and Vtáčnik across which the river Handlovka flows. The bridge was saved from complete destruction during the liberating battles towards the end of World War II only owing to the rapid entering of Soviet troops into the city. Although it was all undermined, the Germans did not succeed in destroying it completely, instead, only the first pier, the abutment and the first two truss spans were destroyed. The necessity to renew coal supplies was the reason to start the bridge repairs on the 24th of April 1945 (only 26 days after its destruction). The temporarily repaired bridge was put into service on the 3rd of June 1945. Full reconstruction began 2 years later.

HANUŠOVCE NAD TOPĽOU

HANUŠOVCE VIADUCT

GPS +49° 01' 24.37"S
+21° 29' 49.79"V

photo: ŽSR MDC

The bridge was built within the railway Prešov – Strážske, which was finished in 1943.

However, the majority of the bridges on this railway line served only 2 years, because most of them were completely ruined towards the end of the war. Among the most damaged bridges was also the one above the town of Hanušovce nad Topľou. It had 8 spans of 42 m and one shorter span of 30 m. The bridge was built at a height of 40 m above the terrain, while the highest pier reaches 28 m. On this pier, there is also a commemorative board reminding us of the destruction of the bridge by the partisans. The bridge was rebuilt after the war and presently it is the longest railway bridge built in a curve in Slovakia.

HANUŠOVCE NAD TOPĽOU

VIADUCT BEHIND THE TOWN

GPS +49° 01' 37.03"S +21° 29' 13.61"V

Right behind the city of Hanušovce nad Topľou, there is another truss railway viaduct, but of a slightly different truss system from that of the viaduct above the town.

The bridge is built in a straight line and has four longer spans of 52 m and two concrete arches by each abutment.

HELCMANOVCE

TIMBER BRIDGE

GPS +48° 49' 28.62"S +20° 50' 51.21"V

Although at the beginning of the 20th century timber bridges were commonly used and they were also able to carry heavy carriages, nowadays it is a rarity to find a longer, all timber bridge also used by some heavier vehicles.

One such bridge is to be found near Helcmanovce – it bridges the railway line there. Though the 23 m long bridge is not one to be proud of, it is in service and, as I mentioned before, it is one of few all-timber bridges intended for vehicles in the Slovak Republic.

HELCMANOVCE

STONE BRIDGES

GPS +48° 49' 42.15"S
+20° 52' 07.08"V

Although stone bridges are quite rare nowadays in Slovakia, in the small village of Helcmanovce there are several of them.

They are mostly situated on the main road leading across the village, where they are spanning some small streams. Their clear spans are approximately 3.5 m.

HLOHOVEC

PIPELINE BRIDGE

GPS +48° 25' 49.05"S
+17° 47' 33.21"V

The almost 340 m long pipeline bridge crosses the river Váh with a steel bowstring arch having a span of more than 100 m.

The pipeline on the bridge brings heat from the nuclear power plant in Jaslovské Bohunice approximately 10 km distant. With the surrounding blocks of flats it perfectly represents the epoch in which it was built.

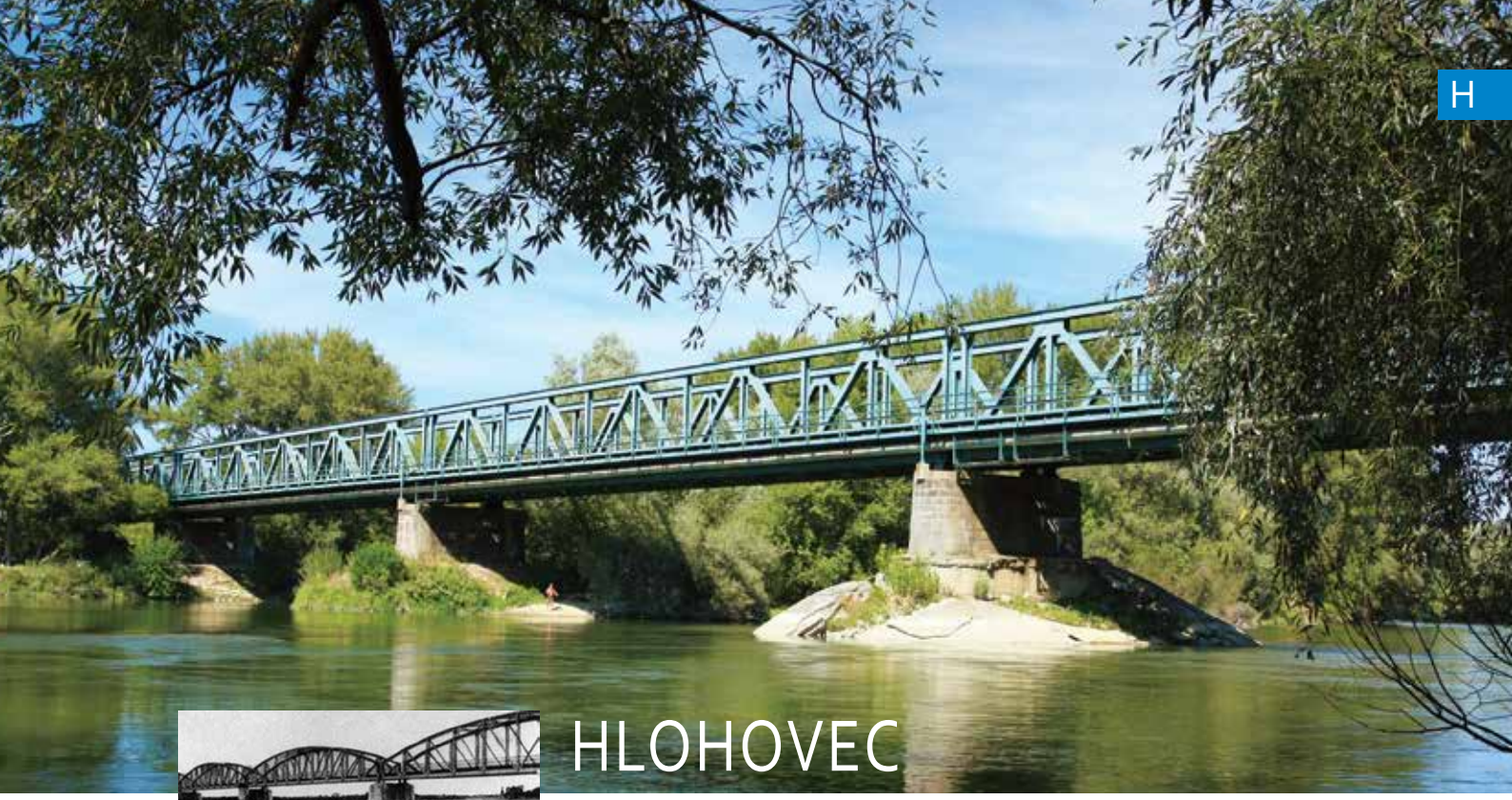
HLOHOVEC

HISTORIC BRIDGE UNDER THE CASTLE OF HLOHOVEC

GPS +48° 25' 30.77"S
+17° 46' 50.24"V

The first permanent timber pile bridge under the Castle of Hlohovec was built back in the years 1350 to 1353, when it replaced the formerly operating ferryboat and also the unreliable ford used by the Roman legions many years before.

The bridge was built with the then standard technology of wooden driven piles and its piers were protected by inclined "cutwater piles". The width of the bridge enabled comfortable two-directional transport of carriages. During its long existence, the bridge was damaged several times by floods and ice as well as by various armies. For the first time it was destroyed by the withdrawing troops of Hussites in 1431. During the Turkish wars it marked the border between the Osman Empire and the Hungarian Empire, so its protection was adapted to this role – by various fortified watchtowers. Also thanks to this fortification it survived the attack of 500 Turk soldiers in the year 1671. After the withdrawal of the Turks, the family of Erdödy had it moved closer to the castle in 1727, where it served until 1905. In 1910 it was replaced by a steel truss bridge with concrete approach spans, which are still standing in front of the Castle of Hlohovec near the village of Šulekovo. The remaining part of the bridge was sacrificed to the withdrawing German troops who destroyed it on the 1st of April 1945. In the river Váh, some parts of the original timber piles of the bridge are still visible.



HLOHOVEC

RAILWAY BRIDGE

GPS +48° 26′ 12.50″S
+17° 47′ 58.22″V

photo: ŽSR MDC

During the construction of the railway between Lužianky and Leopoldov, which was put into service in 1898, a six-span bridge with a maximum span of 50 m was built over the river Váh.

Built as a truss with a curved top chord, the bridge was destroyed towards the end of World War II. Its steel construction was seriously damaged, so reconstruction was not even considered and therefore, after cutting and removing the debris, construction of a new temporary 17-span bridge began in 1945. During four months, more than a thousand workers were working on the construction site. At the beginning of the year 1948, the temporary bridge was replaced by a new, once again six-span bridge with maximum span of 51 m and overall length of 294 m. Nowadays, the bridge is in quite a good condition, except for the artificial island built round the pier, which needs some reconstruction. The surrounding area of the bridge is, also thanks to the cycle path leading under the bridge, popular for leisure visits.

HNILEC

STONE ARCH BRIDGE

GPS +48° 49′ 36.81″S
+20° 29′ 49.23″V

The village of Hnilec was founded in 1290 in the area of the Slovak Ore Mountains (Slovenské Rudohorie). It was prospering thanks to the copper and iron ore mining, which were processed in ironworks and iron mills. After its decline, many families moved to Western Europe or to the U.S.A.

There is to be found one of the few preserved rural stone bridges, similar to those in Gerlachovo and Bohunice. A simple solution using a stone arch with a clear span of 3 m is complemented by long wing walls provided with drainage holes. Despite my efforts, I did not succeed in finding out the year of its origin.

On the way from Hnilec to Gemerská Podhora, there are several smaller stone bridges, but they have more a character of culverts. Their clear spans are less than 3 m.

HOLÍČ

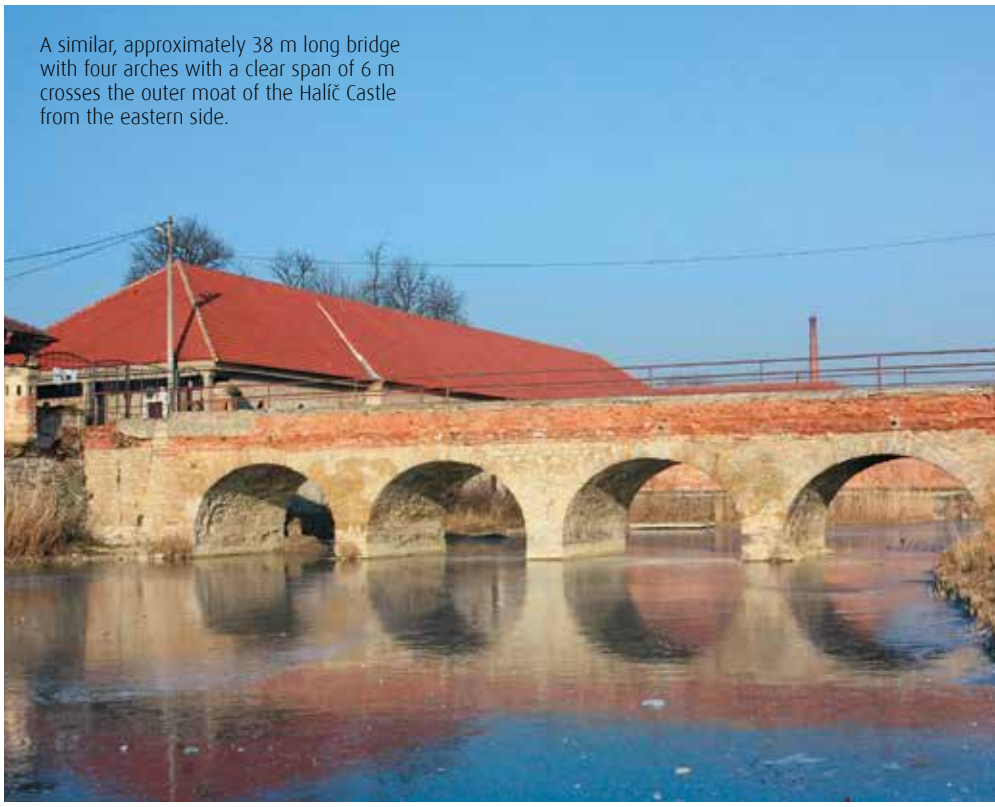
GPS +48° 48′ 30.15″S
+17° 09′ 19.77″V

ACCESS ARCH BRIDGES TO THE FORTRESS

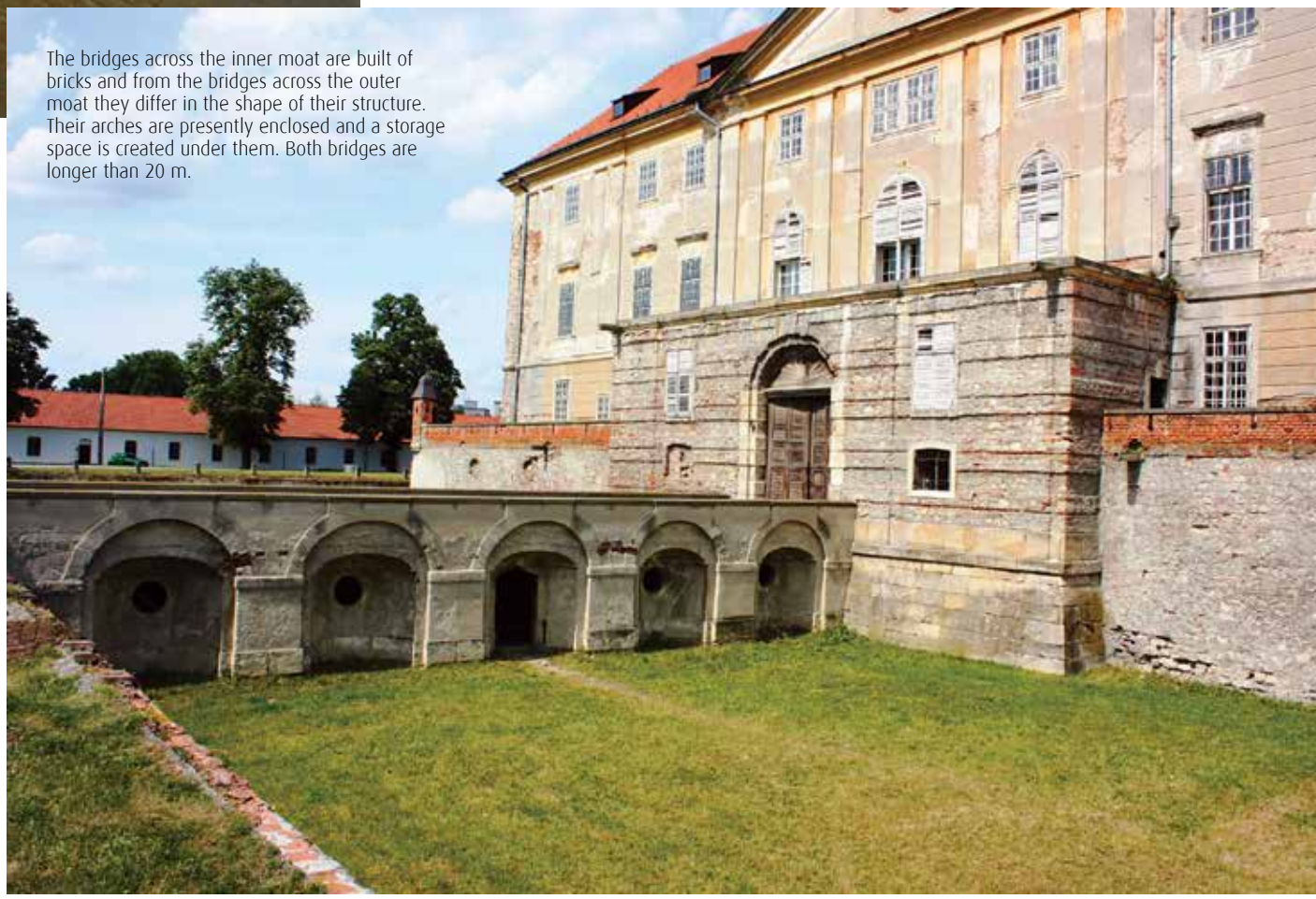
photo: www.holic.sk

The originally wooden water castle was built as a boundary fortress back in the 11th century. However, during the Tartar attack in the 13th century it was captured and burnt down.

At the beginning of the 14th century, Mathew Csak of Trencin built a Gothic palace on its site, which was later gradually enlarged and rebuilt. The first major reconstruction took place in the 15th century and in the epoch of Renaissance it continued with the building of a star-shape fortification against the Turks. It was finished in 1678. A part of the defending system of the fortress, which was in the 18th century rebuilt to a manor house by the Habsburgs, were the outer and the inner moat. There are stone bridges crossing them from the both sides. Across the outer moat on the western side there is a 54.7 m long seven-arch bridge with a clear span of approximately 6 m. There was once a 2.8 m long drawbridge at its end.



A similar, approximately 38 m long bridge with four arches with a clear span of 6 m crosses the outer moat of the Halíč Castle from the eastern side.



The bridges across the inner moat are built of bricks and from the bridges across the outer moat they differ in the shape of their structure. Their arches are presently enclosed and a storage space is created under them. Both bridges are longer than 20 m.

HORNÁ ŠTUBŇA

VIADUCT NA VODE

GPS +48° 50′ 01.25″S
+18° 52′ 49.40″V

The viaduct has 5 spans each built of 25 m long steel plate girders.

Thanks to the quite low depth of the girders, the piers of the bridge give an impression of monumentality. Their height is approximately the same as the span of the main girders. The construction of the viaduct was finished in 1940 and it miraculously survived the systematic destruction of bridges during the end of World War II.

GLOZY VIADUCT

GPS +48° 50′ 04.88″S
+18° 54′ 53.73″V

Approximately 2.5 km from the previously mentioned viaduct, in the direction to Čremošné, there is another similar plate girder viaduct. This one has only 4 spans of 25 m.

Another kilometre further, there is a viaduct called Čierna voda with the same parameters as the viaduct Na Vode (it also has five spans and plate girders).

HORNÉ SŔNIE

BRIDGE OVER THE RIVER VLÁRA

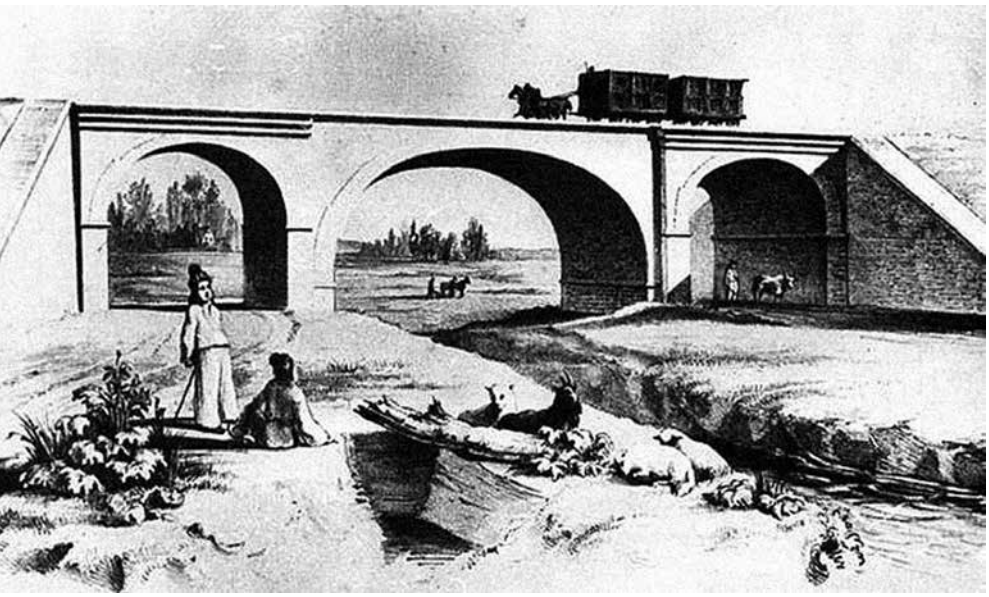
GPS+ 49° 01' 03.94"S
+18° 04' 43.50"V

The bridge is also called the SNP Bridge. It got this name after the renaming of the SNP Bridge in Bratislava to New Bridge.

The original arch bridge built in the 19th century and reconstructed towards the end of the 1960s after having been damaged, gradually ceased to suit the traffic requirements and it was decided to build a brand new bridge. The new bridge, which replaced the 85 year old one with a wooden deck, was finished in 1972. With a span of 63 m it became the first railway Langer Arch Bridge in Slovakia (main girders are stiffened by the arch rib).

HRNČIAROVCE NAD PARNOU

FORMER HORSE-DRAWN RAILWAY BRIDGE

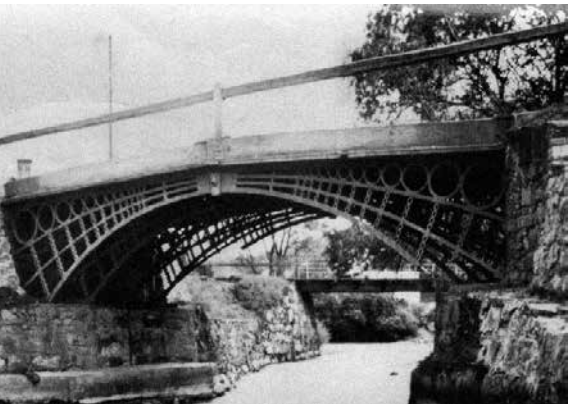


The brick arch bridge with three spans was a part of the horse-drawn railway linking Bratislava and Trnava.

I already described the history of the railway for the bridge in Báhoň. The bridge was built within the railway line Cífer – Trnava, finished in June 1846.

photo: ŽSR MDC

Remains of the bridge built in 1810



Photograph of the third cast iron bridge, which was built in 1815

HRONEC

HISTORIC CAST IRON BRIDGES

GPS +48° 47′ 56.50″S
+19° 34′ 41.00″V

Approximately 30 years after the building of the world's first cast iron bridge in England, three cast iron bridges were made in Hronec in the years 1810, 1813 and 1815, being the first of their kind in the whole Austro-Hungarian Empire.

These three bridges were studied by the students of the Faculty of Civil Engineering STU, Otakar Nesvadba and Milan Plevák in their Student Research Activity. They precisely studied the remains of one of the bridges and also made stress-strain analysis of this cast iron. Thus, most of the information is available from their quite extensive work supplemented by drawings, photographs and information obtained directly in Hronec. Until today, only a part of the first bridge, which served for 152 years until the year 1962, has been preserved. Its width was 3 m and it was composed of 5 arches having an overall length 4.87 m. The bridge deck, made of cast iron plates, used to be covered with clay. Nowadays, its remains (3 arches) could be seen in front of the foundry in Hronec.

The second cast iron bridge built in Hronec in 1813 was little by little forgotten, since its four arches were covered with stone facing. For this reason, the 5 m long bridge was then considered to be one of many common stone bridges. After several repairs, it was removed in 1942. Neither remains, nor photographs were preserved. However, it is known, that it was equally shaped as the first one. The biggest of these three iron-cast bridges was made in 1815 and it was 10.2 m long, composed of 6 parallel arches. In 1945 it was destroyed by German troops and its remaining parts were melted down.

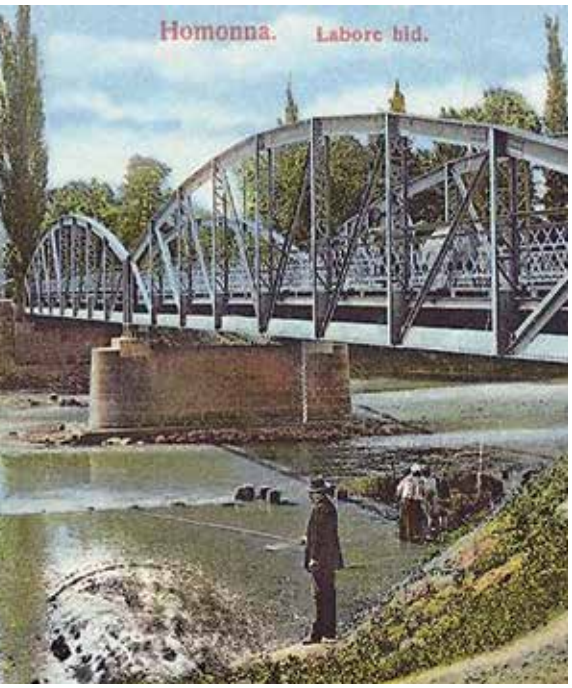
HRONEC

GPS +48° 46' 49.98"S
+19° 35' 30.90"V

BRIDGE OF THE ČIERNOHRONSKÁ RAILWAY

The construction of the railway in the valley of the river Čierny Hron was considered back in 1898, when its economic justification was to be worked out on the suggestion of the Ministry of Agriculture in Budapest.

This proposal was submitted in 1901 when also the design works begun. The building of the first railway line, nowadays still preserved, started in 1908 and already one year later the first freight trains transporting mainly wood were operating between Hronec and Čierny Balog. The railway was gradually expanding and 20 years later, the narrow-gauge railway was already more than 100 km long. However, passenger transport did not start until 1927. The rugged terrain necessitated the building of many bridges, the longest of which was near the station Svatý Ján. It is situated by the route from the Čiernohorská railway to Kamenistá Dolina, which was begun to be built after the year 1923. This timber bridge which was 50 m long (estimation) was rebuilt as a steel one after World War II. Today, trains do not cross it anymore and it is abandoned. However, it seems to be protected by St. John of Nepomuk who is watching the bridge from the chapel placed in the nearby cliff.



HUMENNÉ

OLD STEEL BRIDGE

GPS +48° 55' 43.59"S
+21° 54' 48.74"V

The bridge replaced the old timber bridge in 1900. During low water level of the river Laborec, the remains of its piles are still visible.

The bridge structure is composed of two individual truss girders with parabolic shaped top chord with a span of approximately 30 m. The bridge was undermined during World War II, but it was not destroyed. Today, more than 110 years later, it is still in good condition, but it serves only pedestrians and cyclists. In the middle of the bridge, there are two boards informing about the year of the construction as well as about its constructors.

CHYNORANY

BRICK ARCH BRIDGE

GPS +48° 36′ 33.62″S
+18° 16′ 14.07″V

The bridge was a part of the road network in the village of Chynorany.

Here it spanned the quite broad river arm of the river Nitra with 2 arches having clear spans of 6 m. The arches lean on an intermediate pier, which has also a cutwater and is made of ashlar stones. The shape of the pier eased the flow of the water and indicates that once there was a strong current in this river arm. Today, the bridge is not on the main road traversing the village anymore and only a little stream flows under it. In spite of its former importance, today it is almost forgotten.

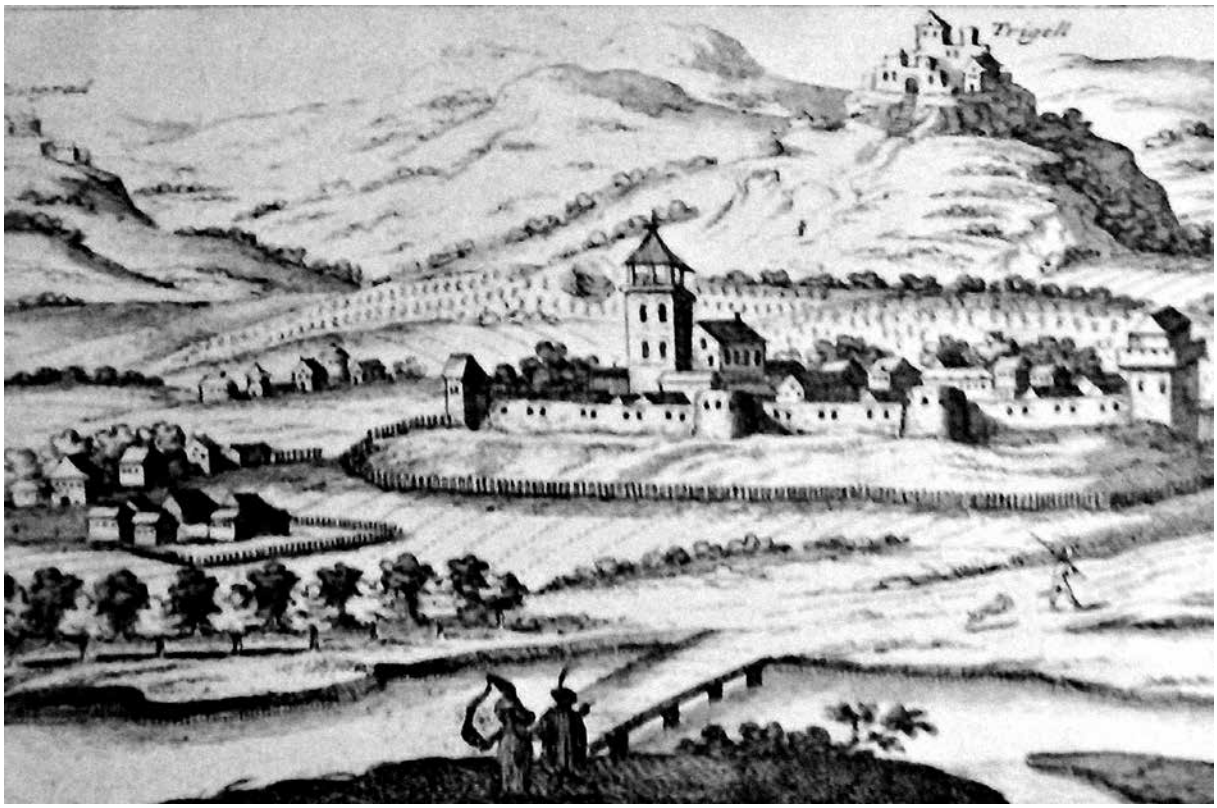
ILAVA

BRIDGE ACROSS THE PORUBSKÝ STREAM

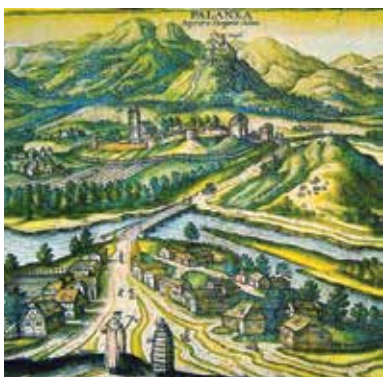
GPS +48° 59′ 45.52″S
+18° 13′ 54.47″V

In the town of Ilava, there was a stone arch bridge until the end of World War II. It was built towards the end of the 18th century.

The two-arch bridge above the Porubský Stream could be seen on various period photographs, most often with the castle in the background, which today serves as prison.. The bridge was destroyed during the withdrawal of the German troops at the end of April 1945. Today, there is a newer concrete bridge in its place. It has a clear span of 4 m. This new bridge was built in 1954 and is covered with stone facing. In this way, it resembles to some extent the former stone bridge, which once stood here.



IPEĽSKÉ PREDMOSTIE
(BRIDGEHEAD OF THE RIVER IPEL)



As the name predicts, there once led an important route near the village, through the river Ipeľ in the direction of the present Hungarian village Dregelypalánk, and from there to the castle Dregely, which was an important fortress mainly after the conquest of Esztergom and Budín by the Turks. The castle entered history mainly thanks to the heroic battle in 1552, when it was attacked by a great number of Turkish troops. Only a hundred men who refused to give up confronted a great army of 12 thousand soldiers. At the end, they were defeated to the last man. The castle defenders were commanded by Szondy György, who, for his bravery, was buried with all honours by the Turks and even today in Hungary he is still praised for his heroic death. After the conquest of the castle, a Turkish military camp Palanka was built there, from which military expeditions were organized across the bridge in Šahy and a new-built timber bridge over the river Ipeľ in Ipeľské Podhradie. After the defeat of the Turks and their withdrawal from the territory (1685), a stone bridge was built, which is symbolically portrayed on the heraldry of the village. It had 3 bigger arches; the deck was drained by three openings above the piers. Unfortunately, this stone bridge did not survive World War II and until this time, only some photographs and its ruins on the riverbank of Ipeľ have been preserved.

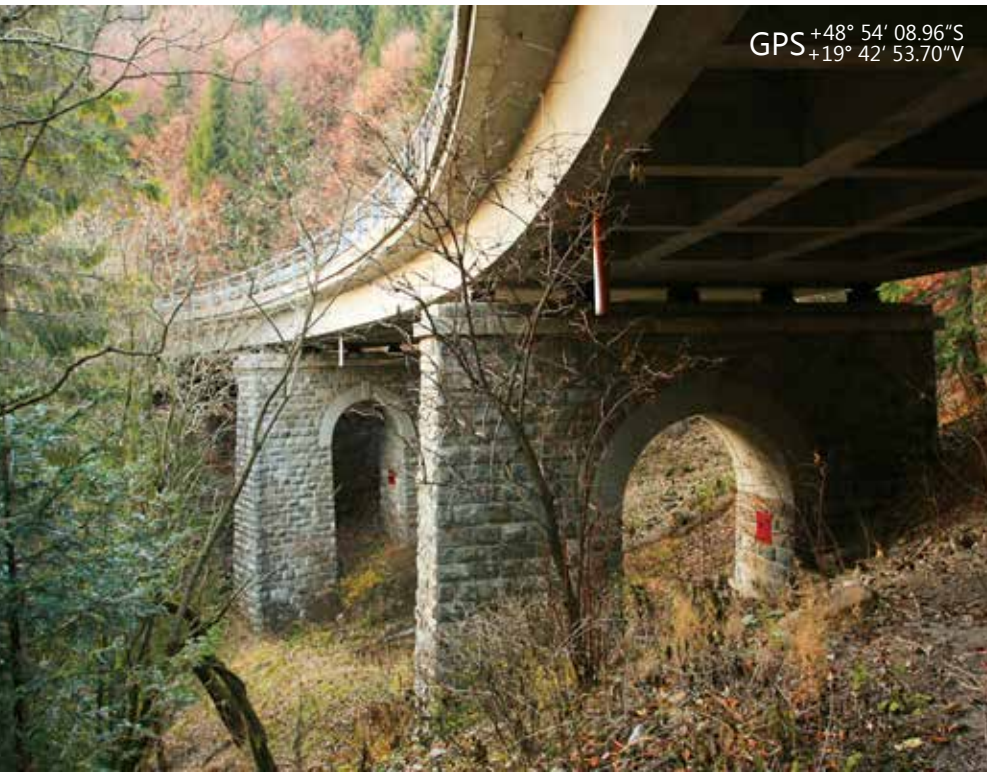
IŽA

TURKISH BRIDGE

GPS +47° 44′ 34.57″S
+18° 14′ 41.55″V

The village of Iža, situated near Komárno, has quite an interesting history connected mainly with the Roman Empire, the confines of which (Limes romanus) stretched in its province Upper Pannonia along the Danube.

From the cultural and historical point of view, one of the most important roman military camps in Slovakia is that of Ižanský Leányvár (Girl Castle) named as Celemantia by an ancient geographer Ptolemy. Equally interesting is the small brick arch bridge, even though it is from a different period. It probably dates from the period of the Turkish occupation and despite being far from the village; it is still used by the local inhabitants on the local route to the Danube. The bridge is enclosed by great trees from both its sides and it has two arches with a clear span of 2 m.



GPS +48° 54′ 08.96″S
+19° 42′ 53.70″V

JARABÁ

BRIDGE ACROSS THE VALLEY OF LAJSTROCH

In a very difficult terrain between the villages of Jarabá and Vyšná Boca, in the uphill turn of the road, above the valley of Lajstroch, a continuous reinforced concrete bridge with three spans was built in 1940.

Its superstructure is composed of grid slab with a maximum span of 21.5 m, which is supported by 13.5 m. high piers covered with stone facing. The calculations of the structure, as well as the construction itself, were quite challenging in the time of its construction. However, they were well mastered and so the bridge serves reliably even after 70 years.

JÁNOVCE
WOODEN "ECODUCT"

GPS +49° 02' 33.00"S
+20° 23' 34.00"V

The bridge across the highway serves as a passage for animals during their migration.

It was built in 2008 and it is composed of glued laminated timber arches, its span is 36 m. The structure of the first wooden ecoduct in Slovakia has a lightened sandwich backfill made of liapor (expanded clay) and clayey sand and by this means a reduced load on the main structure was achieved. The laminated timber arches are set on concrete foundations using steel hinges. The main designer was the Valbek Company and construction supervision was carried out by the company Amberg Engineering Slovakia.

KALNÁ NAD HRONOM

PIPELINE BRIDGE

GPS +48° 11' 18.25"S
+18° 31' 48.44"V

This type of three-hinged arch truss structure is quite a common type of pipeline bridge in Slovakia.

The arch is supported by huge concrete foundation blocks made of reinforced concrete, the major part of which is under the ground. The pipeline itself is placed on the bridge structure by means of small rollers enabling independent movement of the pipeline and the bridge (for example because of different temperatures). The span of the bridge is more than 100 m. In Slovakia, similar bridges can be found near Zelenec and Raškovce.

KAMENICA NAD HRONOM

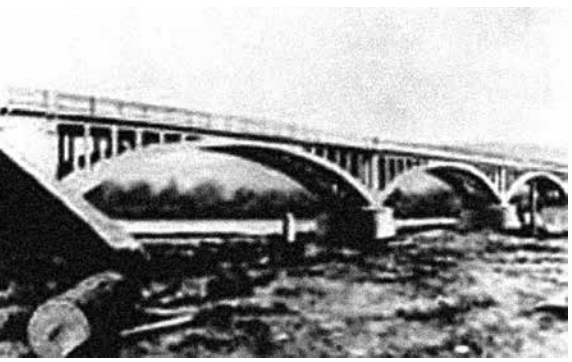


photo: courtesy of Új szó

ROAD BRIDGE

GPS +47° 49' 39.25"S
+18° 43' 12.24"V

The history of the village Kamenica nad Hronom is connected with the Roman military campaign against the German tribes of the Quadi in the area of the lower Hron river, during which a Roman legend about miraculous rain originated around the year 172.

According to this legend, the surrounded Roman army cut off from water during a scorching summer was saved by an unexpected storm. The rain was falling on the Roman legions and quenched their thirst. However, the German troops were struck by lightning and hail-stones. In Rome, on Piazza Colonna, there still stands Marcus Aurelius' arch of triumph, reliefs of which depict the story of the miraculous rain. Jupiter Pluvius stands on the relief with outspread hands, by the right hand there are the Roman legions growing stronger from the rain and by the left hand there are the Quadi struck by the lightning.
The history of the road bridge over the river Hron is just as interesting. Just few know that in the years 1907 – 1908 a road bridge made of reinforced concrete was built over the river. At that time, it was the longest reinforced concrete arch bridge in the Hungarian Empire and according to the period newspaper; it was one of the longest of its kind even in Europe. For its supports and the two foundations of the intermediate piers, 2 000 m^3 of concrete was used. Its builders were the Hungarian constructors MSc Aladár Sebestyén and Kovács József. Unfortunately, it was completely destroyed by the Germans in 1945 and until the year 1961 a temporary timber bridge stood on its place. The new one was built in 1961 from precast girders placed on the piers, which are standing on the foundations of the old bridge. From this information, it can be deduced that the span of the original bridge was approximately 42 m and it must have been longer than 126 m.

KAMENNÝ MOST

STONE ARCH BRIDGE

The village of Kamenný Most near to the village of Kamenica nad Hronom, was in the 11th century under the administration of the Esztergom episcopate, which ordered the building of a stone arch bridge over the river Hron. Tolls were later collected here.

Nowadays, the bridge does not exist anymore. Only the name of the village and its heraldry reminds us of it.

KEŽMAROK

SUSPENSION FOOTBRIDGE NEAR SPINNING FACTORY

The suspension footbridge for pedestrians crosses the river Poprad near the former spinning factory, which was a mechanical spinning mill for flax and hemp yarn in the former Hungarian Empire.

The footbridge was washed away on the 4th of June 2010 during floods, but it was reconstructed in a very short time. Because of the big deflection of the footbridge under load, which is common for these types of structures, a walk across this approximately 30 m long footbridge is a real adrenaline experience.

KĽAK

POKÚTSKY BRIDGE

GPS +48° 35' 12.09"S
+18° 40' 25.57"V

The villages of Kľak and Ostrý Grúň are very well-known villages which were burnt down during the Slovak National Uprising. Together 146 people were killed by the fascist forces, out of which there were 56 women and 38 children. A memorial built in 1959 still reminds us of this terrible event in Kľak. It says: For the memory of 84 citizens of Kľak and 3 wounded partisans brutally killed on the 21st of January 1945 by the fascist murderers."

Besides this sad memorial, there is also a unique monument near the village – a stone arch bridge from the year 1926. It was a part of the logging railway leading through the valley of the Kľak stream. As well as its primary function, it was also a favourite place to take pictures of working groups. The bridge with the arches, clear spans of which are 4 m and 5 m, is the only stone bridge preserved today within the logging railways in Slovakia. Above one of its arches there is a legible inscription saying: STAVENO 1926 (built in 1926).

KLUKNAVA

TIMBER BRIDGE

GPS +48° 54′ 59.54″S
+20° 57′ 06.57″V

Over the river Hornád in the settlement of Štefanská Huta, there is the last preserved all-wooden covered road bridge.

It originates from the 19th century and up to now, cars are still permitted to cross it. Its origins date back precisely to the year 1832. However, it has been reconstructed several times. The last big reconstruction took place in the years 1981 – 1984. Military Engineer troops shifted it to the river bank and they completely dismantled it and rebuilt it. The bridge is roofed with wooden shingle and it is 32 m long.

KOKAVA NAD RIMAVICOU

BRIDGE OF ŠLAMO

GPS +48° 33′ 35.48″S
+19° 50′ 49.50″V

The stone arch bridge, with a clear span of approximately 7 m, situated near the village, spans the Rimavica stream.

Bridge is built on an unpaved road and had lost its parapet a long time ago. During the recent reconstruction, no regard was taken of its original materials and so the remains of its parapet were rebuilt using a mixture of different kinds of stones.

KOLÁROVO

TIMBER PILE BRIDGE

GPS +47° 55' 14.66"S
+18° 00' 04.02"V

The small town of Kolárovo once lay on an important commerce route near the fords over the river Váh and the Small Danube. The area was protected by the so called Castle of Peace (Hrad mieru) built by the queen Mary of Anjou in 1349 fearing the Turkish raids. Today, very interesting bridges cross the rivers.

The most well-known one is the 86 m long covered timber pile footbridge across the Small Danube. Local conservators built it in 1992 as a copy of the previous bridge from the 1950s according to the descriptions of the people who still remembered it. In 1992, the length of the reconstructed bridge was the same as that of the original one – almost 62 m. However, in 1997 it was extended for another 24 m and so it became one of the longest whole-wooden covered bridges in Europe. The major part is made of impregnated acacia wood, which should ensure 150 years of its service life. The bridge leads to the local attraction – an old floating water mill – and is beautified by flowerpots with red geraniums.

KOLÁROVO

STEEL BRIDGE

GPS +47° 55' 49.07"S
+17° 58' 56.38"V

A Pratt truss bridge with curved top chord and with a span of 70.7 m was built across the Small Danube in 1898.

It survived World War II with great deal of luck; the bomb which hit it did not explode, it only damaged the upper bracing. The bridge served without any problems up to the year 2005, when it had to be reconstructed not only because of the bad condition of its bridge deck, but also because of various damage caused by impact from crashed vehicles. During the reconstruction, a pontoon bridge was built next to it, which was able to cope with water level changes. The reconstruction of the bridge was coordinated by the company Banské Stavby in cooperation with the Department of Steel and Timber Structures of the Faculty of Civil Engineering STU in Bratislava.

KOLÁROVO

GPS +47° 54' 51.16"S
+18° 00' 37.47"V

ORIGINAL STEEL BRIDGE ACROSS THE RIVER VÁH

The river Váh near Kolárovo was spanned already when the castle existed, which is proved by some period drawings. One of them is a portrayal of the town dating back to the year 1664, on which the boat bridge is also depicted.

In 1913, an interesting three-span steel bridge was built across the Váh River. Its truss structure was 186 m long and from the structural point of view it was an example of the so called Gerber girder. It must be emphasized, that at the time of its construction this kind of a solution was used very scarcely in Slovakia. The bridge was destroyed in World War II and later, on its foundations, piers were built, which together with the new piers placed in the middle of each original span, supported the temporary bridge. The new concrete bridge was finished just a few metres from the original bridge in the year 1965. In the place of the pier of the original bridge (built in 1913), a small island was created. The local inhabitants named it the Island of Life. The remains of the original steel bridge can be found in the forest on the river bank.

Original steel bridge, built in 1913.

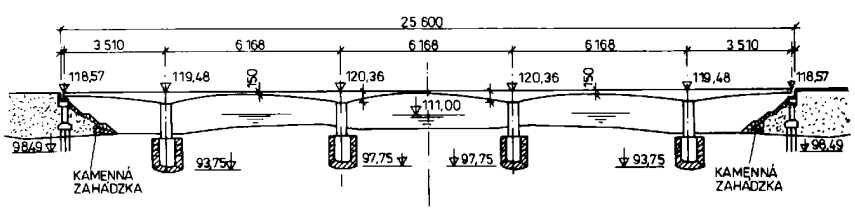
CONCRETE BRIDGE ACROSS THE RIVER VÁH

GPS +47° 54' 51.16"S
+18° 00' 37.47"V

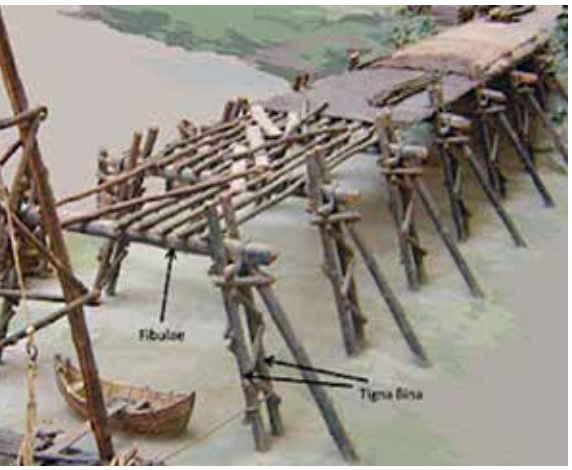
General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The construction of this concrete bridge was one of the first, the biggest and at the same time the most difficult applications of the free cantilever method in Slovakia.

With this 256 m long bridge, the era of concrete bridges built by the free cantilever method using the central hinge has ended. New theoretical knowledge enabled the future construction of such bridges to avoid use of this structurally unsatisfactory detail, which had a negative impact on their durability. The bridge was built by the Doprastav Company.



Island of Life – remains of the original pier



Typical structure of the roman timber bridges

Engraving – boat bridge built in 1594

KOMÁRNO

ELIZABETH'S BRIDGE

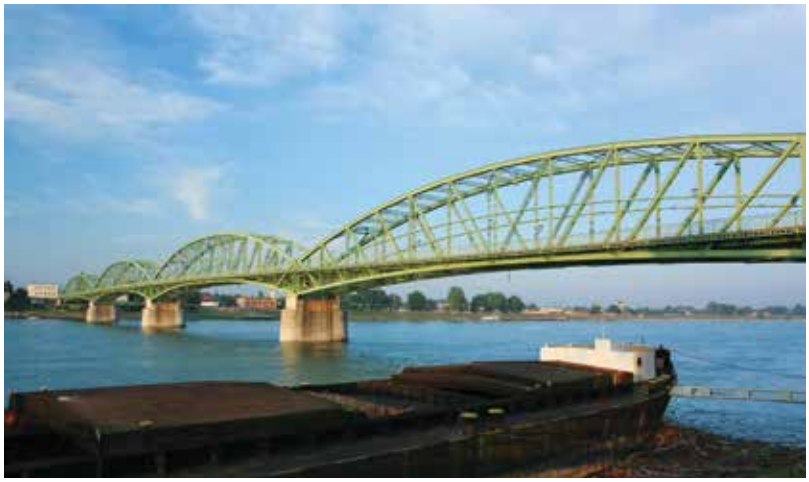
GPS +47° 45' 05.10"S
+18° 07' 15.49"V

General Designer or Reconstruction: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia, Pont-TERV, Budapest, Hungary

The area of Komárno is one of the oldest settlements in the Carpathian fold inhabited already since the early Bronze Age. Near the town, on the right riverbank of the Danube, during the epoch of the Roman Empire, there was a Roman military camp Brigetio with a fortified bridgehead called Celemantia, which was on the left riverbank of the Danube (near the village of Iža).

During the military campaign in 358, a timber pile bridge was built across the Danube with a structure similar to the bridge built across the Rhine under the rule of Julius Caesar. The building of permanent bridges on the borders with an enemy territory was not allowed before due to strategic military orders. This, however, did not prevent the existence of temporary boat bridges serving for military campaign.

Czechoslovak legionaries on bridge in 1919



The first illustration of the bridge built across the Danube in Komárno comes already from Johan Sibmacher's engraving – it depicts a boat bridge during the siege of Komárno by the Turks in 1594. It was built in 1589 by Lajos Jurisich from Pozsony (Bratislava) and it composed of 79 boats.
One of the strategic points near Komárno, except for the junction of the Danube and the Váh, was the little island near the present Winter Port which was used by armies to assemble the troops. The connection between the island and the right riverbank of the Danube was for some time provided by a flying bridge, which was in the year 1838 replaced by a boat bridge. It was 337 m long and during the winter it was dismantled.
The left riverbank of the Danube was connected with a 180 m long all-timber pile bridge. Its history is mentioned later by the description of the bascule bridge.
On the site of the long boat bridge, the first steel bridge across the Danube in Komárno was built.
Elizabeth's Bridge in Komárno was built in the years 1891 and 1892, which is proved also by the commemorative tablet placed on the Hungarian side. Similar plaques were placed also after the reconstruction; both on the Hungarian and the Slovak side. The main span of the bridge, which bears the name of Francz Joseph's wife, reached 100 m.
Like many other bridges, this one was also affected by military events of the 20th century. In the year 1919, after the birth of the Czechoslovak Republic, it was blocked and protected, as well as the other boundary bridges, by the Czechoslovak legionaries. Later, during World War II, two of its spans were destroyed. The border line between Hungary and the Slovak Republic runs approximately through the middle of the bridge. On both its sides, the state symbols of the relevant countries and the heraldry of the Komárno town are placed.
The bridge was built in times when only few pedestrians and horse-drawn chariots crossed it. Today, however, it does not fit the needs of the town anymore and plans for another bridge across the Danube are being prepared.

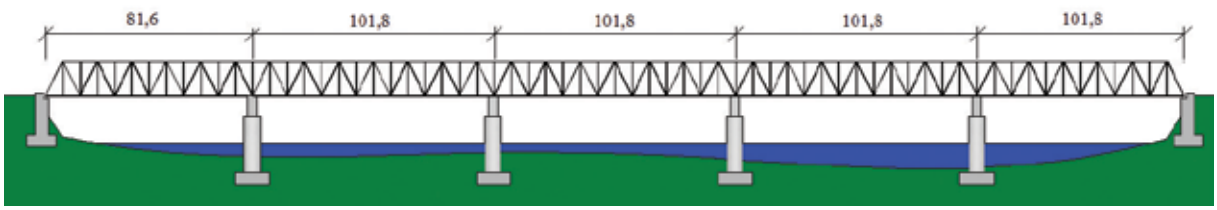
KOMÁRNO

RAILWAY BRIDGE ACROSS THE DANUBE

GPS+ 47° 45′ 26.24″S
+18° 05′ 13.20″V

The railway bridge across the Danube in Komárno was built in 1910 as a five-span bridge with a span arrangement being 81.6 m (single span truss girder) + 4 x 101.8 m (continuous truss girder) and with the overall length of 488.6 m.

After World War I on the 1st of May 1919, battles took place here between the Czechoslovak legionaries and the Hungarian units, which tried to capture the town after it had been allocated to Czechoslovakia. At least 120 Hungarian soldiers and workers died in the battle. They were literally slaughtered and later buried into a mass grave. World War II also affected the bridge directly. Shortly before the end of the war, its supports and piers were destroyed as well as the whole superstructure. Its individual parts were either hanging on the ruins of the piers or completely collapsed and their parts stuck out from the water. To make river transport on the Danube possible, the Red Army had to shoot the part of the structure into pieces, so that they sank to the bottom. The bridge was renewed with cooperation of Czechoslovak and Hungarian companies and the first train crossed it towards the end of December 1954. The opening ceremony of the Friendship Bridge took place on the first of January 1955. However, the problems for this bridge did not end with the end of World War II. In the night of the 20th of August 1968, Warsaw pact tanks entered the territory of Czechoslovakia through it and they partially damaged it. Fortunately, the damage was not so serious, so it was reopened for traffic already 10 days later. Since then, the bridge has been reconstructed several times. The last big reconstruction took place in the year 2012 when its colour changed from silver to green. This 510 m long bridge is presently Slovakia's longest cross-border bridge.



BASCULE BRIDGE

GPS+ 47° 45′ 19.05″S +18° 07′ 19.62″V

Before the present bascule bridge across the arm of the Danube, there was a boat bridge around the year 1780 in its place.

Later, it was replaced by a permanent timber pile bridge providing the connection with Elizabeth's Island (once also called Komárno Island or the Island of the Red Fleet). The timber pile bridge was later replaced by a steel structure which, however, even after its reconstruction and raising in height, did not fit the navigation demands of the ships leaving the shipyard. The bridge was for this reason dismantled in 1957 and the traffic was redirected to a different route. The only solution for this area was to build a bascule bridge, which would not be too high above the surrounding terrain and at the same time it would enable the high ships to leave the shipyard and the winter port. The bridge was completed in 1967. It is composed of two 25 m long pivoted bascules spanning the 44 m wide navigational clearance for ships. The mechanism of lifting is based on counterweights placed on the shorter parts of the bascules by means of two high-volume tanks, which are filled up during the rising process. Both bascules, weighting 350 tons, are perfectly balanced and in case of power failure they could be lifted by the help of a few strong men turning the opening mechanism. Once, the bridge used to open 30 times a day, when the opening took less than 3 minutes. Nowadays it hardly ever opens.

CABLE STAYED BRIDGE (PROJECT)

GPS +47° 45′ 25.00″S +18° 05′ 02.00″V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

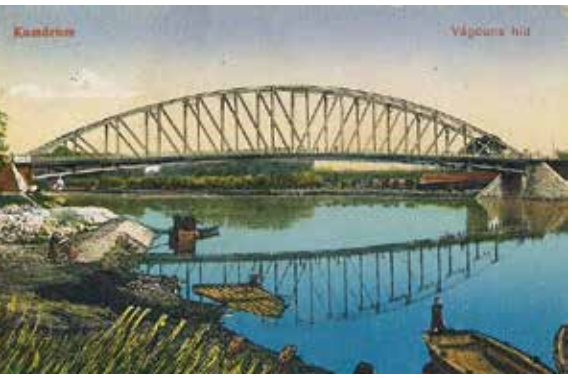
Because of traffic overload on the Elizabeth's Bridge, the town decided to build a new road bridge across the Danube, which would relieve the historical bridge and improve the traffic situation of the town.

Various alternative bridge structures were developed, and finally a cable stayed bridge was chosen with an interesting atypical pylon, which is, however, statically not very convenient. The bridge will cross the Danube with a main span of 252 m and will be more than 600 m long. The pylon will be more than 100 m high. Construction should be started in the year 2015.

architectural visualization: Dopravoprojekt

GPS +47° 45' 43.34"S
+18° 08' 34.78"V

KOMÁRNO

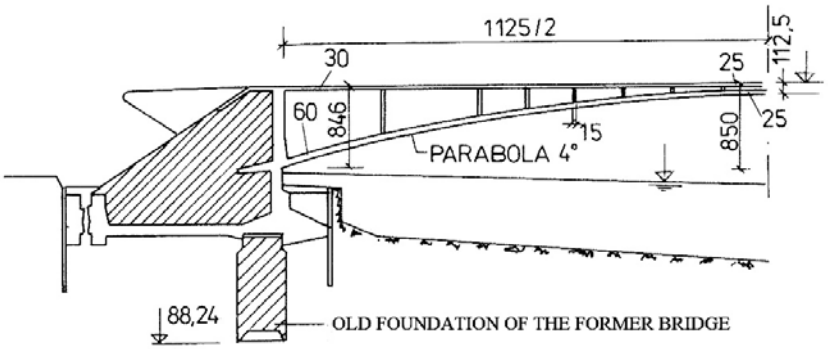


Original steel truss bridge

CONCRETE BRIDGE OVER THE RIVER VÁH

One of the most impressive reinforced concrete bridges of Slovakia stands on the foundations of the steel truss bridge from the year 1913, which had a span of 115 m.

The concrete bridge built in the years 1951 – 1955 on the site of the former bridge, which was destroyed in the war, still gives a magnificent impression and it is among the world's biggest bridges of its kind. Having a clear span of 112.5 m, it has quite a small rise of the arch of 8.5 m. A considerable part of the structure is behind the abutments under the ground, where a reinforced concrete slab was built, which together with the backfill acts as a partial counterweight to the main span. Also the old foundations of the former bridge were used in a very sophisticated way – the whole structure is supported and slides on them. This solution enabled to introduce horizontal forces by means of hydraulic jacks, which have balanced the whole structural system and they can be further adjusted to balance the deformations. However, the bridge has always had problems with large deflections of the main span, mainly as a result of underestimation of the subsoil parameters. By the rise to span ratio this bridge surpassed the previous record holder the Ponte Risorgimento. The calculations and design were made by famous professors Stanislav Bechyně from the CVUT in Prague and Jozef Wünsch from the STU in Bratislava.



KOMÁRNO

RAILWAY BRIDGE OVER THE RIVER VÁH

Near Komárno town, over the river Váh, a four-span bridge was built in the year 1910. It was composed of three spans of 40 m and with one main span being 82 m.

The bridge, as well as all its piers and abutments, was destroyed during the withdrawal of the German troops. A part of the steel structure remained hanging on the ruins of the piers and a part collapsed into the river. The building of a temporary railway bridge began in July 1946 and ended in May 1947 when the connection between the towns of Nové Zámky and Komárno was re-established. The repair of the permanent bridge was finished in July 1953.

GPS+ 47° 46′ 21.42″S
+18° 18′ 21.95″V

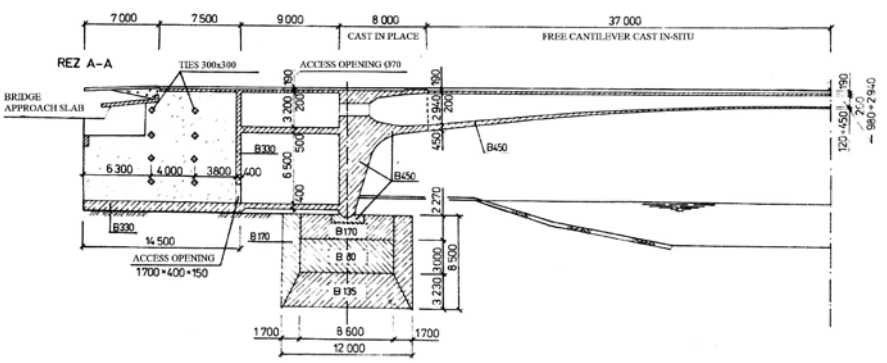
KOMOČA

CONCRETE BRIDGE

GPS +47° 57′ 31.05″S
+18° 01′ 29.98″V

The bridge structure is composed of two cantilevers joined by a hinged joint in the middle, built by the free cantilever method in the years 1967 and 1968. Cantilevers are fixed into the massive abutments, which act as counterweights.

Another bridge with a similar structure was built just few hundred meters away. Both bridges with spans of 90 m and lengths of 137 m are among the biggest structures of their kind in Slovakia (among the concrete bridges built by the free cantilever method with only one span).



Fortification of the town and the bridges across the moat

KOŠICE
HISTORIC BRIDGES

Košice developed from a market settlement of Slavic origin and later it played a major part in various historical events. During its history, it was, for example, the capital city of Upper Hungary, the centre of the anti-Habsburg uprisings of the estates, an anti-Turkish fortress and also the second independent royal town of medieval Hungary.

The urban fortification of Košice originates in the 13th century and during the following years it underwent numerous construction works. The last modifications of the fortification were performed in the years 1706 – 1710 during the uprising of Francis II Rákoczi. From the year 1783 the whole fortification started to be gradually destroyed. One of the preserved fragments is the area of the Lesser Gate. Its moat was filled only around the year 1800. The remains of the gate, composed of a bridge and the Luxemburg Tower, were dismantled by the town in 1827.

An archaeological research discovered four different bridge structures from different time epochs under the Luxemburg tower. All of them bridged the water moat, and the oldest one was wooden. Remains of the grid, on which the wooden piers stood, are preserved. In the second half of the 15th century a new massive bridge with four arches was built above the moat. It was 8 m wide; the piers were made of ashlars and the arches from bricks. In the beginning of the 16th century it was rebuilt into the shape of a covered corridor with two floors. During this rebuilding, a new bridge was also built. It was composed of two stone piers and brick arches while the piers were founded on the remains of the bridge built in the 15th century. Today, parts of the preserved fortification and the remains of the bridges are accessible in the underground museum, which is partly glass-covered and visible from the pavement above it.

STEEL FOOTBRIDGES FOR PEDESTRIANS

GPS +48° 44' 15.09"S
+21° 15' 24.36"V

The pedestrian footbridges are situated on the riverbank Alešovo nábrežie, where they span the arm of the Hornád River.

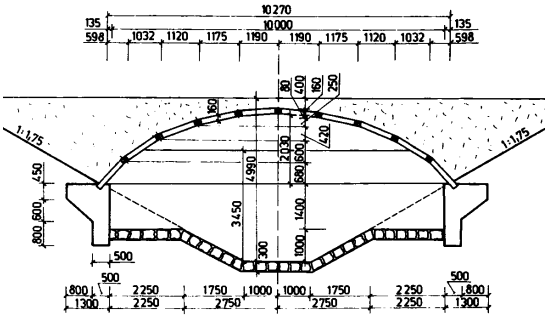
The span of the footbridges is approximately 11 m long. Their abutments are faced with stone. The interestingly shaped steel structure together with the lamps, on which the heraldry of Košice is cast, gives a very romantic impression.

THE TRIUMPHAL ARCH

GPS +48° 45′ 28.49″S +21° 15′ 44.63″V

From quite a recent history a rather unconventional rarity is preserved in Košice from the socialist period, named the Triumphal Arch by the local inhabitants. The bridge was to be built within the construction of a great modern housing estate in the part of Ťahanovce.

It was to have two parts – the northern and the southern. These were to be connected with a four-lane road, however, eventually only the northern part of the housing estate was finished. Thus the four-lane road would remain unused and also the bridge was regarded useless and its construction was stopped. In the end, the already finished part of the bridge was adjusted so that at least pedestrians could pass it. The bridge reminds us of an unsuccessful project of the socialism era and its utopia. Today it is only a sad monument, however, with an eloquent writing perfectly representing it (There are no victories, only arches remain.)



COVERING OF THE MYSLAVSKÝ STREAM

GPS +48° 41′ 15.09″S +21° 17′ 02.03″V

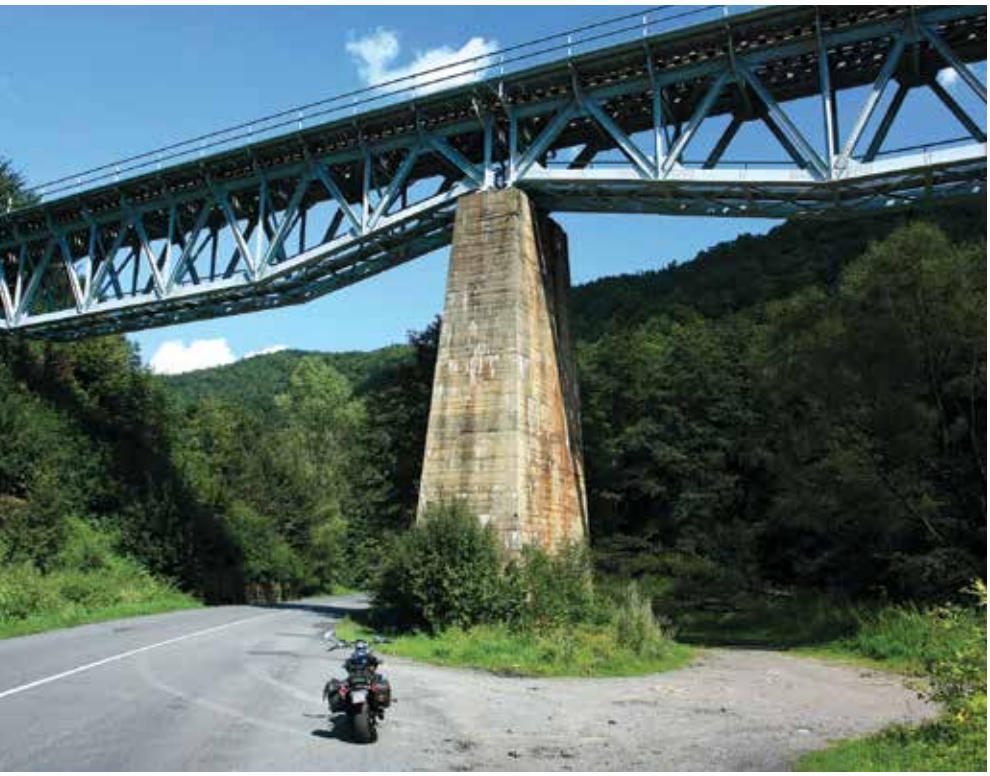
The company Inžinierske Stavby in the years 1971 – 1975 developed a building technology of the overfilled precast top arch system, which was tested on an experimental structure in Košice.

By this technology, the backfill soil is an active part of the structural system and by this means 30% of the construction materials could be saved. The covering of the Myslavský Stream is 600 m long, but many inhabitants of the housing estate do not have even the slightest idea that they walk above one of the unique bridges in Slovakia.

CABLE STAYED PIPELINE BRIDGE

GPS +48° 44′ 05.49″S +21° 16′ 02.54″V

There are many interesting cable-stayed pipeline bridges in Košice. This one crosses the river Hornád with a main span being approximately 70 m long.



KOZELNÍK

THE KOZELNÍK VIADUCT

GPS +48° 31′ 42.19″S
+19° 00′ 16.58″V

The viaduct is situated on the railway line between Hronská Dúbrava and Banská Štiavnica – it crosses a deep valley at a height of approximately 22 m.

Its superstructure is 127 m long and is supported on concrete piers with stone facing. The construction of the bridge began in the year 1948. Assembly of the first and the second span was carried out on the ground from where they were lifted to the bearings on the piers by special lifting equipment. The third span was assembled directly on a supporting wooden falsework. All three spans have the same length of 42.2 m.

KRÁĽOVÁ PRI SENCI

HISTORIC ARCH BRIDGE

GPS +48° 12′ 01.60″S
+17° 26′ 59.32″V

The bridge was a part of a Baroque castle belonging to the Palffys´, which was almost completely destroyed during World War II.

Italian constructors and stonemasons built it following the design of MSc Ján Nagymihály from the year 1903. This 42 m long bridge has a stone arch made of limestone completed by red bricks on the sides. Its three arches have clear spans of approximately 5 m. The bridge was reconstructed in the year 2007 and on this occasion a commemorative stamp was issued.

Photo from 1940

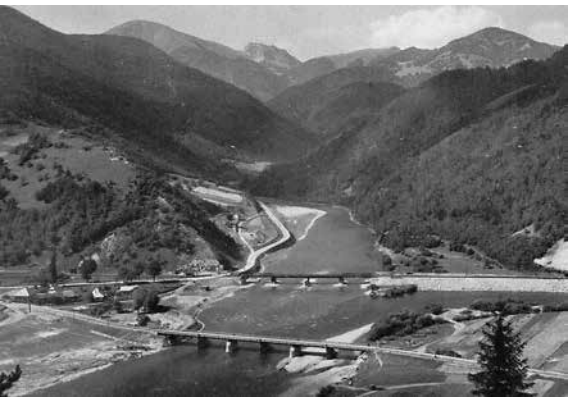


Photo from 1948

KRAĽOVANY

HISTORIC BRIDGES ON THE JUNCTION OF THE RIVERS ORAVA AND VÁH

GPS +49° 09' 14.14"S +19° 08' 22.71"V

GPS +49° 09' 07.04"S +19° 08' 22.63"V

On some historic postcards the image of two bridges is preserved – that of a four-span railway bridge from the year 1872 and a three-span road bridge from the year 1906, which at that time replaced the original timber bridge (photo from the year 1940).

Both bridges were destroyed during World War II and for a certain time they were replaced by temporary bridges (photo from the year 1948). The railway bridge was later reconstructed as a two-span truss bridge, which had to be designed according to the new standards with increased prescribed loads. Through the elimination of two piers, the flow rate conditions in the river Orava were improved at the crossing with the bridge. During the reconstruction of the road bridge, the piers of the original steel bridge, which had 40 m long spans, were partly used. Nowadays a three-span concrete bridge stands there.

The scheme of a bridge of a Monier type and the statue of the St. John of Nepomuk placed in the middle of the bridge.

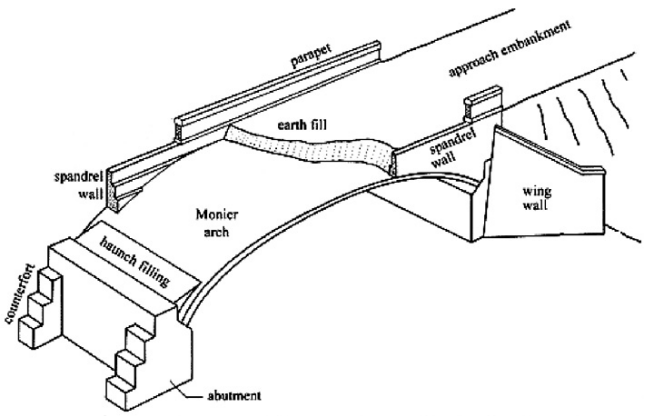
KRÁSNO NAD KYSUCOU

THE OLDEST REINFORCED CONCRETE BRIDGE IN SLOVAKIA

GPS +49° 23′ 57.76″S +18° 50′ 22.97″V

To make clear why this bridge is so unique, some facts from the history of concrete have to be mentioned. First patents concerning concrete reinforced with iron bars date back to the 50s and 60s of the 19th century.

The world's first reinforced concrete bridge was built in the year 1875 by J. Monier, who before had possessed the patent on the fabrication of flower-pots reinforced by iron mesh. The bridge in Krásno nad Kysucou was built in 1891 by the company Wayss. Its two spans have a clear span as much as 16.45 m. This unique bridge, on which a statue of St. John of Nepomuk is placed, is still in a good technical condition even after 120 years in service and several hundreds of cars pass it every day. It is the oldest preserved reinforced concrete bridge in Slovakia.



KRÁSNO NAD KYSUCOU

THE LONGEST STONE ROAD BRIDGE IN SLOVAKIA

The bridge crosses a small valley of a stream at a height of approximately 10 m, with the clear span of the arch being 5.8 m long and 9.4 m high.

Besides its height, mainly its length being 53.4 m is interesting - by this means it easily beats the lengths of all generally well known stone bridges in Gelnica and Poltár. Approximately 1 m longer is only the stone bridge in Holíč, which, however, has a brick parapet, so it cannot be listed as a completely stone bridge. The bridge has drainage openings in the parapets of the 7.35 m wide bridge deck. The bridge gives a stately impression and it is obvious at first sight that the craftsmen who were working on it were very skilful and precise. Tons of stone are placed in it with a geometrical precision and exactness. Such a precision is very rare in Slovakia even in much smaller stone bridges being from 6 to 10 m long. The bridge was built in 1835.

BRIDGE OF THE LOVERS

GPS +49° 23' 33.90"S
+18° 51' 44.23"V

The original footbridge crossing the river Kysuca in the local area of Kalinov was destroyed during the floods in 2007. Therefore the town had built a new concrete bridge, passable also by cars.

Following the examples of different parts of the world, the self-government decided to name it the Bridge of the Lovers and because of this its handrail was adapted – couples in love can clip their locks on it as a symbol of their eternal love and to throw the keys into the river. Unfortunately, the bridge lacks the romantic atmosphere. And so, while in Paris the locks had to be cut off because of the bridge's overloading, on this bridge, opened on the 28th of June 2010, the number of the locks is a little over 50. However, since we do not have a big choice of bridges for lovers in Slovakia, I brought my wife Lenka here.

KREMNICA

STONE ARCH BRIDGE NEAR THE CASTLE

GPS +48° 42′ 24.14″S
+18° 55′ 02.33″V

The legend about the discovery of mineral resources in Hills of Kremnica tells a story about a hunter who came from Šášov village to the mountains in which the settlement of Cremnychbana later came into existence.

On the slope of the hill Volle Henne he shot a partridge with grains of gold in its crop. After this discovery, he continued further upstream to the mountains in which he found an ore-bed containing gold and silver. The oldest mining tunnels and shafts probably date back to the 8th or 9th century and although there is a lack of evidence, it is assumed that the gold was mined here for a long time before the city was founded. At the beginning, it was mined mainly by alluvial mining and shallow underground mining. The independent mining town of Kremnica originated in the year 1328 and in those days the Hungarian king Charles Robert of Anjou guaranteed it the privileges concerning mainly mining of precious metals and coining. Silver mites and denarius were coined here, as well as golden florins and ducats. The mint of Kremnica is one of the oldest in the world and it is one of few which continually operate up to now. For the protection of the town, a castle was built in the 14th and the 15th century, part of which had a wooden Gothic drawbridge near the northern gate. This was, in the year 1886, replaced by a new one with a Gothic pointed stone arch with a clear span of 6 m. There are another two historic bridges in the town. However, they are so overgrown with vegetation that it is almost impossible to take a picture of them.

KREMNICA

STEEL BRIDGE

GPS +48° 42' 43.00"S
+18° 54' 34.00"V

Besides the stone bridges, there are also many other technical monuments in Kremnica directly connected with the mining industry, for example the steel bridges linking the mining tower of Ludovík's shaft with waste rock burrows.

One of them crosses the Mining road leading to the museum with a span of approximately 6.8 m.

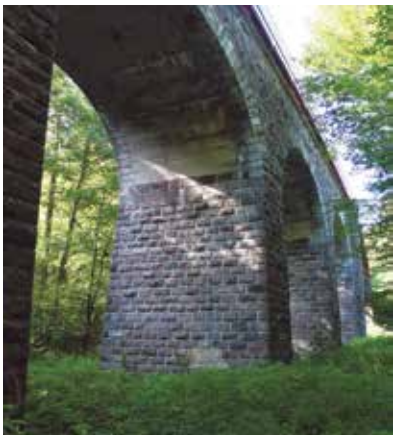
KRUPINA

THE VIADUCT OF KRUPINA

GPS +48° 23' 39.36"S
+19° 05' 17.30"V

The 120 m long viaduct is the longest bridge on the railway line Zvolen – Krupina.

Its major part is composed of 8 concrete arches with a clear span of 14 m. Except for these arches faced with stone, the main span is a steel truss with a span of 35.6 m bridging the stream Krupinica. The railway line was put into service in the year 1925.



KVAČANY

BRIDGE IN THE AREA OF THE WATER MILL

GPS +49° 11' 48.47"S
+19° 32' 25.92"V

The bridge is situated in the Kvačianska Valley between the villages of Kvačany and Veľké Borové, in the part of Oblazy, on the junction of three streams.

In this area, three mills once stood there from which only one has been preserved. This is today one of the national technical monuments. Presently, the water mill is partly reconstructed and it is a local tourist attraction. The nearby bridge, with a clear span of 2.1 m, crosses a little stream. The stone arch is strengthened by concrete.

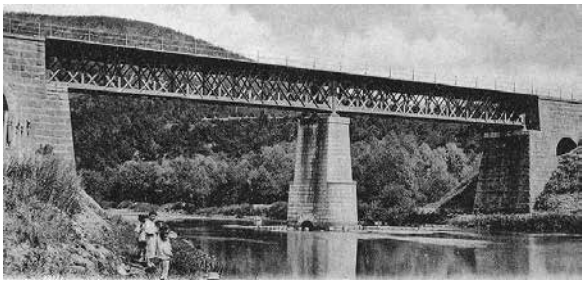
KYSAK

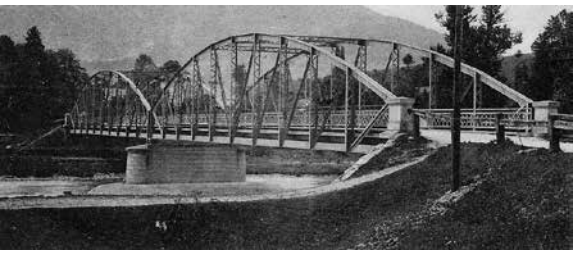
RAILWAY BRIDGE

GPS +48° 51' 31.85"S
+21° 13' 37.23"V

On the railway between Kysak and Prešov, a 50 m long steel lattice truss bridge was built around the year 1872 over the river Hornád.

However, World War II did not give it even a chance to avoid destruction. Since there was a standpoint of a German armoured train in the village, it witnessed many battles and moreover, it was bombarded. More than 70% of the buildings in the village were flattened during the war, as well as the railway station and also this bridge, under which children use to play at the beginning of the 20th century. Today, there is a new steel bridge on its place.





KYSUCKÉ NOVÉ MESTO

HISTORIC STEEL BRIDGE

GPS +49° 17′ 52.21″S +18° 47′ 15.45″V

The town of Kysucké Nové Mesto is the oldest town in the region of Kysuce documented in written archives. The then village is mentioned in the Belo's Chart from the year 1254.

The village gained the freedoms of the town in 1325, when tolls were collected there, on the way to Silesia. Since the road led next to the river Kysuca, there was no need to bridge it and thus, until the year 1875 there was only a raft navigated by those who wanted to cross the river. In 1875 a two-span steel truss bridge was built there, which served until the end of World War II. Its span can be estimated at 40 m according to the type of the truss and the size of the present bridge. After its destruction it was replaced by a wooden temporary bridge. In 1964 a new one was built, with three concrete spans made of precast girders. The length of the superstructure is 80 m.

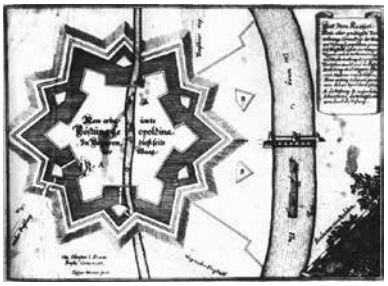
LELES

ST. GOTTHARD'S BRIDGE

GPS +48° 28′ 02.06″S +22° 00′ 58.79″V

The bridge was probably built around the 14th century across the former riverbed of the Tisa, which later became dry by water management interventions in the 19th century.

Presently, the riverbed is shifted several kilometres towards the southwest. The bridge gained its name in the 18th century after a Benedictine monk. His statue stood on the bridge until the year 1848. The bridge is approximately 30 m long and its maximum clear span is 2.5 m. The differentiation of the arch by using white stones is interesting.



Leopoldov Fortress with the representation of the Hlohovec Bridge

Picture of the Leopoldov Bridge taken at the beginning of the 20th century

LEOPOLDOV

BRICK BRIDGE NEAR THE FORTRESS

GPS +48° 26′ 48.29″S
+17° 46′ 15.25″V

The fortress of Leopoldov was begun to be built in 1665, after the city of Nové Zámky was conquered by the Turks. Three thousand workers were building the star-shaped fortress for four years.

On the old drawings, the bridge over the river Váh is also present. It was built in 1362 and the Turks intended to destroy it, however, the soldiers from the fortress of Leopoldov had stopped them. Later the fortress did not have any other considerable role because in 1683 the Turkish army was finally defeated by Christian forces nearby Vienna. Towards the end of the 19th century, the fortress was converted into a prison. From the days when the fortress was built, a brick bridge has been preserved. It crossed the arm of the Váh on the route between the fortress and the settlement, where the workers stayed. The piers are made of fine sandstone ashlars and three arches with clear spans of 7.2 m are made of bricks. At the beginning of the 20th century, there was still water in the arm of the river, today only marshy ground could be found there.

LETANOVCE

BRICK ARCH BRIDGE ON THE ACCESS ROAD

GPS +48° 59′ 03.87″S +20° 28′ 18.99″V

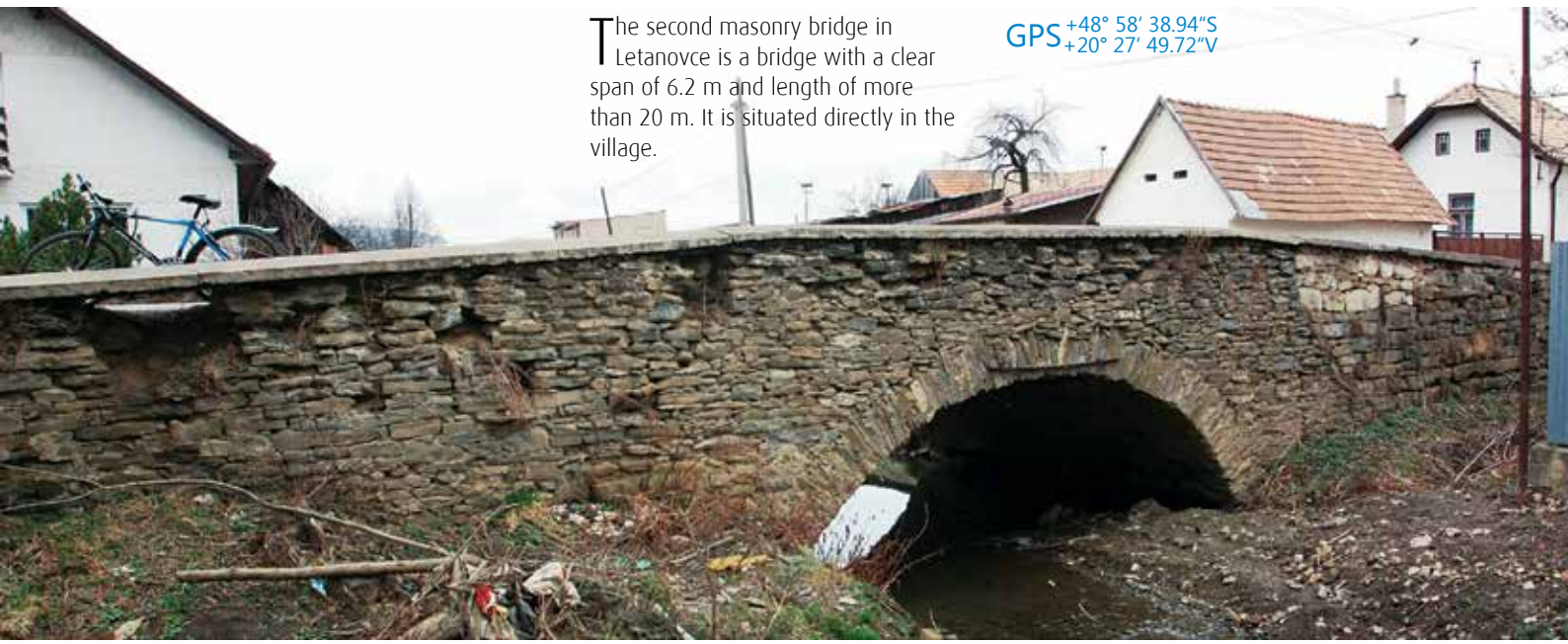
An event of great importance for Letanovce was the decision of the Prior of the Spiš region to call the Carthusian monks to build their monastery in Kláštorisko, located in the Slovak Paradise.

In connection with this decision, Jakub, the bishop of Spiš, gave his part of Letanovce to the Carthusian monks, so that they could earn their living. They took good care of their estate until the downfall of the monastery. On the access road, they built a Gothic stone bridge over the river Hornád and probably also the first bridges across the local streams. Nowadays, there are two masonry bridges near the village, which could be the descendants of those original ones. Clearly, they have gone through several reconstructions in which various stones as well as modern materials were used. One of them with a clear span of 5.2 m crosses the stream on the access road to the village.

STONE BRIDGE IN THE VILLAGE

The second masonry bridge in Letanovce is a bridge with a clear span of 6.2 m and length of more than 20 m. It is situated directly in the village.

GPS +48° 58′ 38.94″S +20° 27′ 49.72″V



GPS +49° 01' 49.73"S
+20° 35' 38.84"V

LEVOČA

SMALL STONE ARCH BRIDGE

The first historical reference to Levoča, a town in the region of Spiš, dates back to 1249. In historical documents from this year, it appears under the name of Leucha.

In those days, the town began to profit from its favourable location on an important commerce road called Magna Via and it quickly flourished into a prosperous town. Later, Levoča became famous thanks to Master Paul's wooden altar, but it was mainly known as a place of pilgrimage, where Slovakia's biggest pilgrimage takes place every year. An old road leads up to the Marian Mountain and to the basilica of the Virgin Mary. On this journey, the believers cross the old stone arch bridge. The precision of its structure is clear at first sight and its arch has a clear span of 4.1 m.

LICINCE

HISTORIC BRIDGE

GPS +48° 32' 20.66"S
+20° 18' 09.40"V

Originally, it was a renaissance stone arch bridge from the 16th century. However, since then it has been rebuilt several times. The original bridge crossing the river Muráň had probably six arches with clear spans of 4.2 m.

The overall length was 55 m. Unfortunately, one part of it was destroyed and the subsequent reconstruction of the middle span was carried out with using of steel girders. As a result, nowadays the middle span is 10.8 m long. I have not succeeded in finding the date when the middle pier was destroyed, but I assume that it happened towards the end of World War II (Slovak Road Administration registers the year 1900 when the bridge was reconstructed, but it is not clear whether the pier existed back then).

LIPTOVSKÝ HRÁDOK

PETERSKÝ BRIDGE

GPS +49° 02' 48.22"S +19° 43' 51.25"V

Hardly any visitors notice the bridge spanning the river Belá between the towns of Liptovský Hrádok and Liptovský Peter. However, its interesting history is pointed out by the commemorative tablet placed on the beginning of the bridge.

In its time (in the year 1941), the main span of this reinforced concrete girder bridge was unusually long – 55 m (the structure is not prestressed). Its shape was fully adapted to the requirements of the structural design with increased depth of cross section over the piers. The bridge superstructure was designed as a Gerber girder. It was designed by a Russian emigrant with Slovak citizenship Michal Piasecký and mainly prisoners of war were working on the construction site under the direction of the centurion František Jesenský. During World War II it served for German troops to transfer military material, as well as civilians. Towards the end of the war, when the Red Army relentlessly proceeded towards Berlin, the German troops on their withdrawal destroyed each strategic point including bridges, so as to slow down the advancement of the enemy. Thus, the bridge in Liptovský Hrádok was about to have the same destiny as many other bridges destroyed by the withdrawing Vehrmacht. However, it was saved by the Partisan Division High Tatras and thanks to Štefan Orfánus, who during a party with the fascists discovered their intention. Right the next day, the 27th of January 1945, the partisans decided to save the bridge. Although the partisan Alexejevič Kolesníkov succeeded in cutting the electrical cables leading to the explosives, gunfire broke out in which eleven partisans were killed. The bridge remained intact. As a sign of gratitude and honor for their heroic fight to save the bridge, the local organization – Union of Anti-fascistic Combatants - built a small memorial on the occasion of the 20th anniversary of the Slovak National Uprising. There is also a statue of St. John of Nepomuk, which was once in the monastery, but in 1939, to protect the bridge, it was placed onto a rock sticking out from a lake situated behind the bridge.

LOKCA

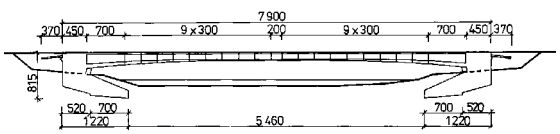
STONE ARCH BRIDGE

GPS +49° 21′ 26.94″S
+19° 24′ 09.18″V

The bridge is situated in the heart of Orava region between the villages of Lokca and Vasilov on the old road leading to Poland. Subsequently, a new road was built in such a way that the old bridge was preserved and a new one was built next to it.

The old stone arch bridge with a clear span of almost 6 m is nowadays covered by grass and bushes. Nevertheless, it is still well visible from the road.

ĽUBOCHŇA



CONCRETE BRIDGE

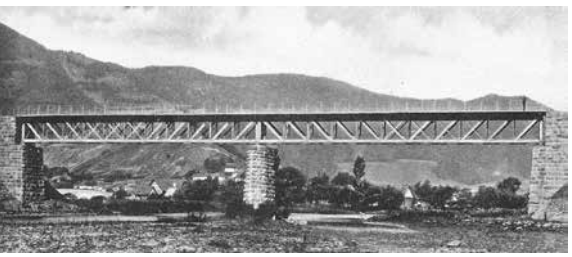
GPS +49° 07′ 22.78″S
+19° 10′ 12.76″V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The original timber bridge over the river Váh, portrayed on the period photograph, was initially constructed for the narrow-gauge railway of Ľubochňa serving for transport of timber. As such transport requirements were gradually increasing, it was just a question of time when the old bridge would have to be replaced by a new structure.

Because of the nature of the watercourse it was clear from the beginning that a type of a technology should be used which would not affect the river flow during construction. After having analyzed various possibilities, the free cantilever method was chosen and the building began in 1966. To improve the overall structural behavior of the bridge, it was necessary to introduce a horizontal force into the cantilevers before the closure joint was casted. This horizontal force, exerted by hydraulic jacks, activated the soil behind the abutments and reduced the final deflections of the bridge. Such a building technique was quite unconventional in those days and it demanded close cooperation between the designer (Dopravoprojekt), contractor (Doprastav) and the university (STU, Faculty of Civil Engineering). This is also the reason why this bridge is listed among the unique concrete bridges of Slovakia.

MARGECANY

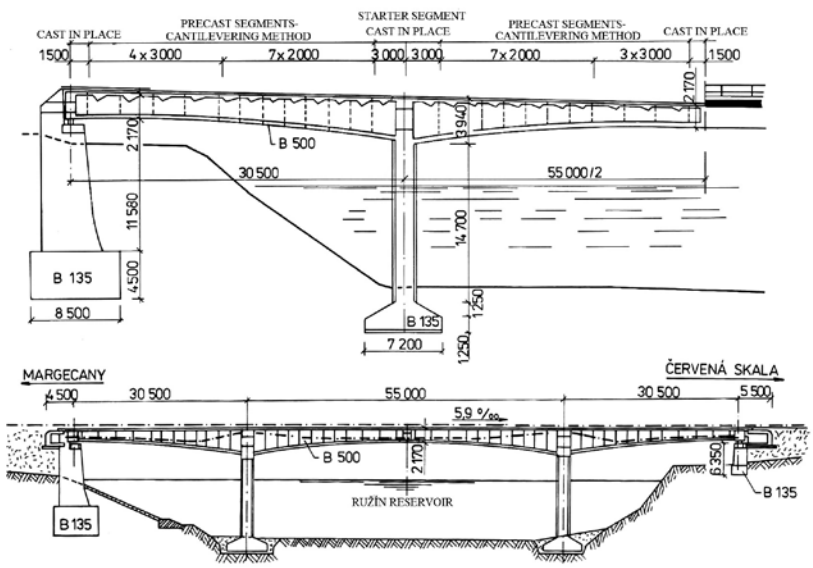


RAILWAY BRIDGE

GPS +48° 53' 15.49"S
+21° 00' 46.51"V

Near Margecany, over the river Hornád on the railway between Červená Skala and Margecany, there was a truss bridge which was later moved few meters downstream using some of the supports of the old bridge. Today, none of them exist anymore, but their abutments and a part of the piers are still visible. Abutments were later used as a supports for the pipeline bridge.

After building the water dam Ružín, in 1967 the first segmental railway concrete bridge in Europe was built there (the second one was built at the same time in Jaklovce). During the design, the impact of railway transport on the segmental structure had not been known, therefore specialists from CVUT in Prague and STU in Bratislava assisted on the design. Unfortunately, this pilot project of railway segmental bridges did not turn out very well. It was mainly because the waterproofing of the bridge was carried out quite poorly and thus this new technology failed to be accepted by the railway authorities, despite the project having been well prepared. The main span of the bridge is 55 m. In the picture, the remains of the piers of the original steel bridge are partly visible, as well as the new pipeline bridge, standing on the abutments of the previous bridges.



MATEJOVCE
FOOTBRIDGE

GPS +49° 04' 50.64"S
+20°19' 30.95"V

One of the most bizarre footbridges is to be found in the village of Matejovce.

The structure with a span of 13 m crosses the stream Slávkov and it is decorated by carved metal sheets and its main span is supported by structurally not very effective "stays". The footbridge is an illustrative example of a structure, in which the aesthetics and functionality had to give way to the designer's intention to figure out something unconventional and at the same time as cheap as possible – at all costs.

MEDVEĎOV
ROAD BRIDGES

GPS +47° 47' 37.36"S
+17° 39' 06.55"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

In 1942 a steel truss bridge with 3 spans of 114 + 133 +114 m was built to replace the steam ferryboat.

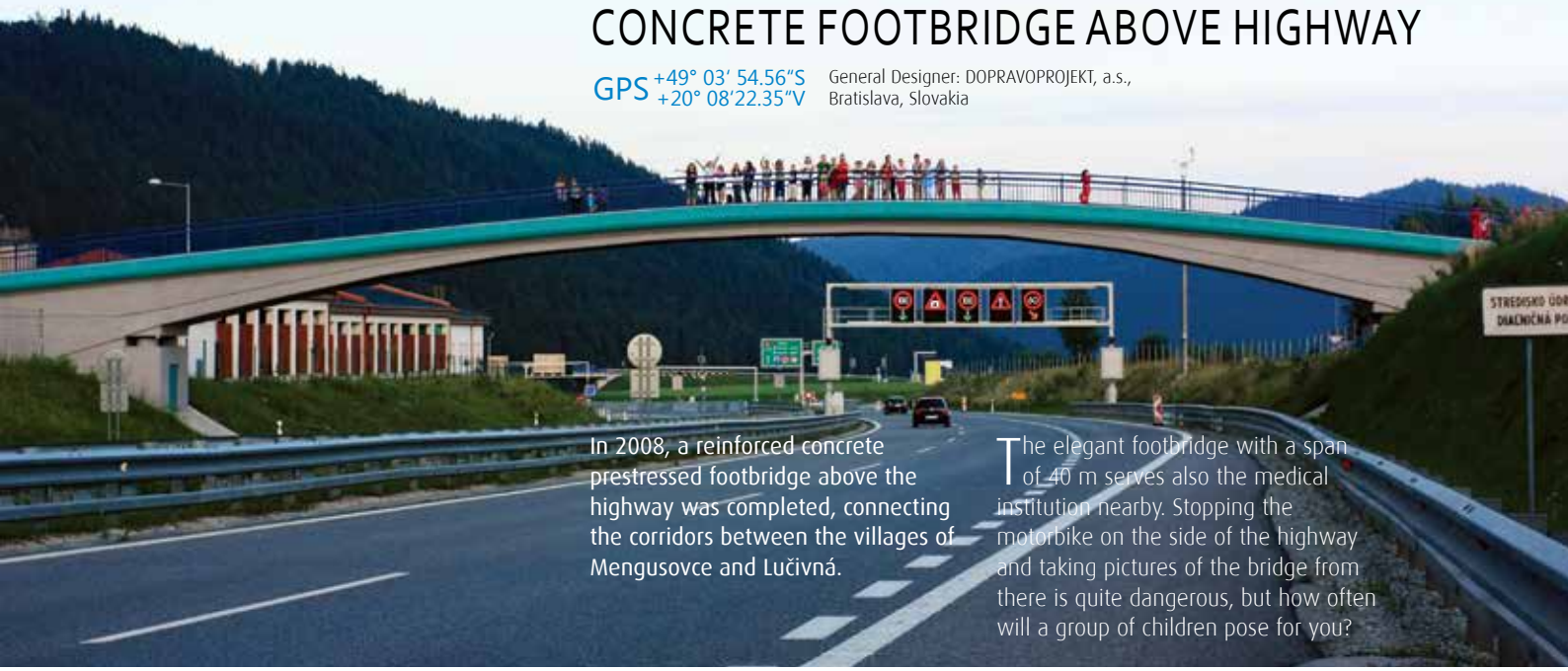
However, the cross-border bridge served only for two years, because during World War II it was destroyed twice. The reconstruction after the war was carried out only after the year 1973 by a Hungarian company Ganz-Mávag. In Medveďov, nearby the bridge, above the Danube's main stream, there is another smaller truss bridge with one span crossing the Danube's arm. It was built in 1960 and its span is 102.6 m. The steel structure was made by a bridge building company Brezno and the building was carried out by the company Doprastav. The design was by the Dopravoprojekt Company in collaboration with the main consultant the Welding Research Institute from Bratislava.

MENGUSOVCE

CONCRETE FOOTBRIDGE ABOVE HIGHWAY

GPS +49° 03' 54.56"S +20° 08'22.35"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia



In 2008, a reinforced concrete prestressed footbridge above the highway was completed, connecting the corridors between the villages of Mengusovce and Lučivná.

The elegant footbridge with a span of 40 m serves also the medical institution nearby. Stopping the motorbike on the side of the highway and taking pictures of the bridge from there is quite dangerous, but how often will a group of children pose for you?

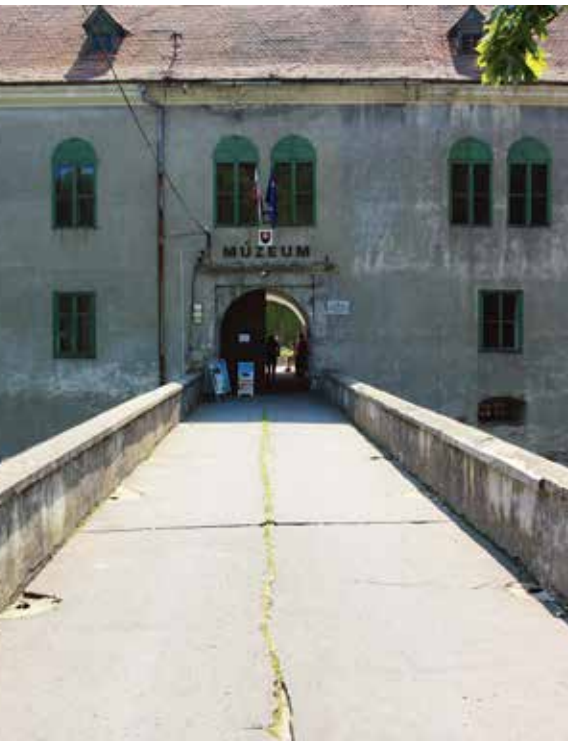
MNÍŠANY

MNÍŠANY (KOPRÁŠ) VIADUCT

GPS +48° 40' 30.29"S +20° 13' 54.94"V

The villages of Mníšany and Kopráš were some time ago merged and they are known under the name of Magnezitovce.

The bridge is the most famous object of the unfinished railway Slavošovce – Chyžnian voda (Lubeník), which was begun to be built after the Vienna Arbitration (1938), when a part of Slovakia was given to Hungary. This resulted in some important industrial areas remaining isolated and it was necessary to connect them with the rest of the state immediately. Thus, new railways, the so called Gemer connectors, were begun to be built. Among them is this imposing reinforced concrete viaduct with the length of 120 m. The clear span of the arch is 52 m and it is 18.7 m high. However, after the war, Slovakia gained back the territory from Hungary and the new, unfinished railway line was not needed anymore. Thenceforth the bridge is standing there, right in the middle of a valley, where it forms the scenery for the grazing sheep.



MODRÝ KAMEŇ

STONE BRIDGE ACROSS THE CASTLE MOAT

GPS +48° 14′ 37.07″S
+19° 19′ 59.97″V

The castle dates back to the second half of the 13th century. Its name, meaning blue stone, derives from the color of the stones in this area.

It gained its renaissance style after the period when the Turks occupied it for 18 years. In 1593, they destroyed the great part of it and reconstruction was necessary. After partial reconstruction it was repeatedly attacked again and damaged in the following years. After these events the owners stopped repairing it. It was only at the beginning of the 18th century that the new owner had built a baroque castle on part of the foundations of the lower courtyard. The rest of the ruins were used as a garden. Over the moat, a 22 m long stone arch bridge leads to the baroque castle. It has 3 arches with clear spans of approximately 3.4 m. The deck is drained with pipes placed above the top of the arches, leading to the moat.

photo: courtesy of www.transmisie.sk

MORAVSKÝ SV. JÁN

DRAWBRIDGE ACROSS THE MORAVA RIVER

GPS +48° 36′ 07.05″S
+16° 56′ 02.91″V

The drawbridge, on the boundary near Moravský Svätý Ján replaced in 2005 the pontoon bridge, which did not meet boat navigation requirements.

The middle span of the new, 134 m long, bridge can be lifted 1.8 m higher by four special lifting mechanisms, so that the boats can pass also when the water level is somewhat higher than usual. The width of the bridge is only 4 m and thus the traffic is one-way and controlled by traffic lights. The lifting mechanisms, designed and provided by the company Transmisie Engineering, are able to lift the weight of 4 x 85 tons. The lifting takes approximately 30 minutes.

MYJAVA

DEVÁN VIADUCT

GPS +48° 46′ 28.40″S
+17° 33′ 49.35″V

Myjava is famous for its folklore festival which annually takes place in a small forest in the local part called Trnovce.

Nearby this site, a 5-span, 209 m long viaduct crosses the valley. It is composed of three truss spans, which are 49 m long and of two side spans made of steel plate girders. The side spans are 24 m long. The bridge is a part of the railway line which was put into service in 1927. The viaduct itself, as well as the majority of railway viaducts built before World War II, had to be reconstructed after 1945.

MYJAVA

MYJAVA VIADUCT

GPS +48° 45′ 26.14″S
+17° 34′ 31.43″V

The bridge is on the railway line connecting the towns of Myjava and Nové Mesto nad Váhom, which was put into service in 1929.

The 197 m long bridge consists of 4 spans, 3 of which have a span of 48.3 m and one is somewhat shorter – 30 m. It crosses the valley at a height of 30 m.

NITRA

CASTLE BRIDGE

GPS +48° 19' 04.70"S +18° 05' 14.85"V

The beginnings of the settlement in Nitra date back to prehistoric times, from which many important archeological artifacts were found. Later, the region was a significant centre of the Celts, Germans (Quads) and Slavs. From the first third of the 9th century, it was the centre of Great Moravia.

In 828, the first known Christian church of the middle and Eastern Europe was built here. The town flourished during the reign of Svätopluk, the ruler of Great Morava in the years 871 - 894. The first references to the castle also date from the era of his reign. During its existence, it had to resist the invasion of the Tartars in 1241, numerous fires and also the armies of Matthew Csak of Trencin, who eventually took hold of it in the 14th century. According to the latest archeological findings, an old stone bridge led to the castle already in the 15th century, while the actual form of the castle originates in the 18th century. There are visible openings on the castle gateway, through which the chains of the drawbridge used to be led, thus a part of the stone arch bridge must have been removed in this part. Since that time the stone arch bridge has been reconstructed and repaired several times. The last reconstruction was finished at the beginning of 2012 when also the statues on the parapet of the bridge were restored. The bridge was in a very bad condition; a part of the area under the arches was used as sanitary facilities and the statues themselves were damaged by ravages of time. However, it must be pointed out, that the reconstruction was performed rather drastically – the arches of the bridge were completely demolished and then built again, which more resembles a rebuilding than a serious and sensitive reconstruction. Except for the statues, today the bridge gives an impression of being of quite recent origins. Nowadays, the clear span of the arches is approximately 3.6 m.

NITRA

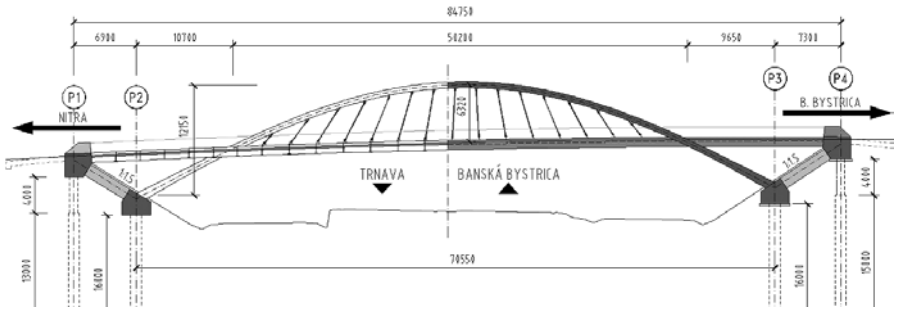
CHRENOVSKÝ BRIDGE

GPS +48° 18' 45.17"S
+18° 05' 37.37"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

In 2011, the bridge replaced the suspension footbridge which spanned the river Nitra on Wilson square for more than 40 years. The new cable-stayed steel bridge also carries cars and has two spans of 16 and 36 m.

Originally, construction was to be finished in 2010, but due to unfavorable weather conditions the building site was flooded repeatedly and thus the completion was delayed.

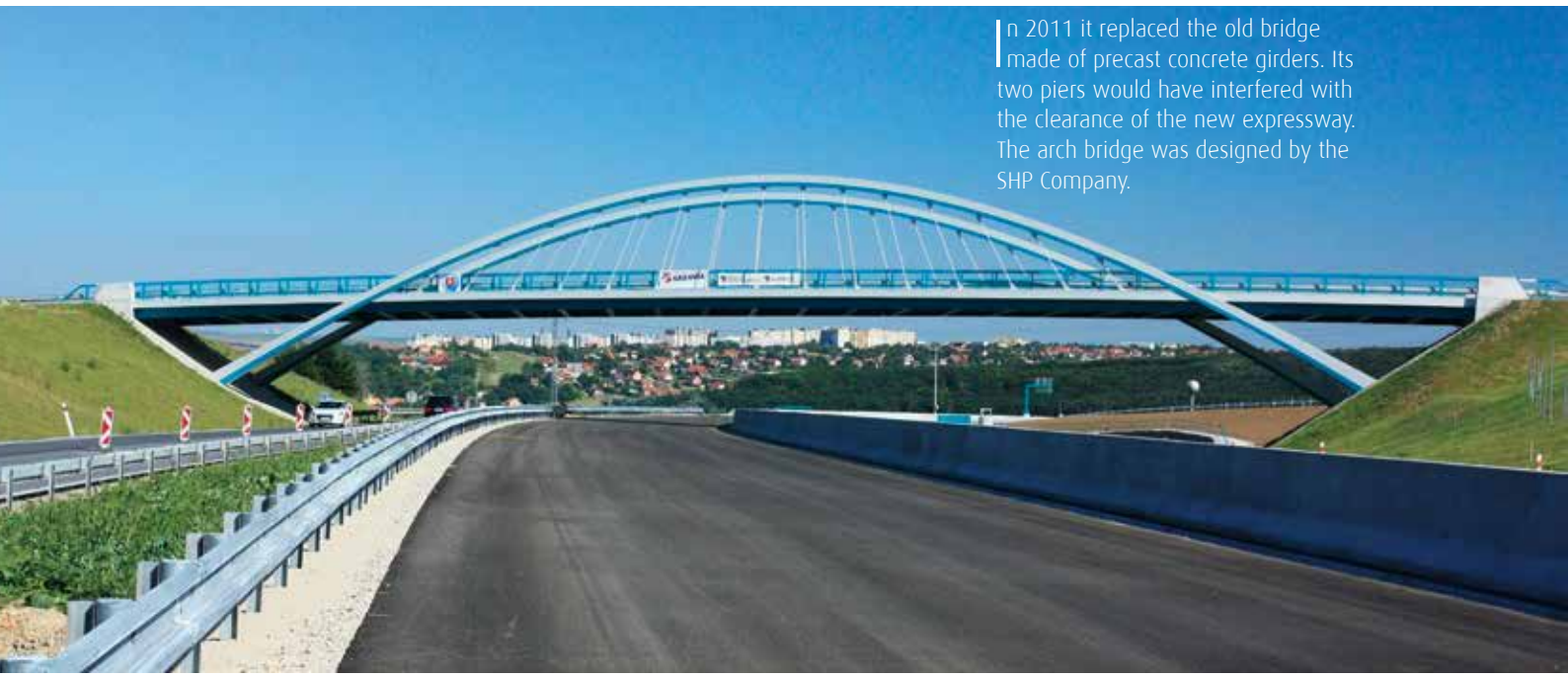


ARCH BRIDGE

GPS +48° 18' 55.30"S
+18° 00' 33.63"V

General Engineering Consultant of R1: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The bridge crosses the expressway R1 nearby Nitra with parallel composite steel-concrete arches with spans of 70.55 m.



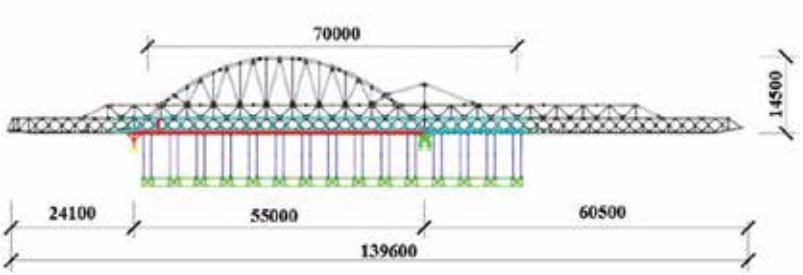
In 2011 it replaced the old bridge made of precast concrete girders. Its two piers would have interfered with the clearance of the new expressway. The arch bridge was designed by the SHP Company.

NITRA

BRIDGE ACROSS HOSŤOVSKÝ STREAM

GPS +48° 19′ 47.33″S
+18° 12′ 46.35″V

General Engineering Consultant of R1:
DOPRAVOPROJEKT, a.s., Bratislava, Slovakia



The bridge was built on the expressway R1 in 2010.

It has 17 spans, the biggest of which reaches 69 m and the length of the bridge is almost 960 m. An interesting aspect of this bridge is mainly the method of its construction; one of the biggest movable scaffolding system in the world was used. It made its way from Portugal to Slovakia on 80 trucks. The length of the 180-ton-heavy scaffolding was 140 m, while the length of the main span was 70 m. The bridge follows the whole highway profile, and the size of the box girder as well as the process of the construction had to be geometrically adjustable. The project was made by the company SHP.

NITRIANSKE PRAVNO

FORMER STONE ARCH BRIDGE

GPS +48° 52′ 28.16″S
+18° 38′ 28.80″V

In the remote past there was an important commerce route connecting the regions of Ponitrie and Turiec crossing the town of Nitrianske Pravno. It was situated under the former hill fort Vysegrad dating back to the Early Bronze Age (1200 – 700 BC).

From the bridge building point of view, an important historical event for this region was the building of the important commerce route commissioned by Ferdinand the first, after the seizure of the southern parts of the monarchy by the Turks. The route is known as Magna Via. The original timber bridge over the river Nitra was replaced by a stone arch bridge in 1636 and it served until the year 1940. An interesting aspect of the bridge was the chapel of St. John of Nepomuk which used to be placed in its middle. After the construction of the new concrete bridge, the saint's statue and the chapel were moved beside the bridge.

NIŽNÁ KAMENICA

STONE ARCH BRIDGE

GPS +48° 45′ 33.53″S
+21° 28′ 47.01″V

The village of Nižná Kamenica was named after the neighboring stone hillocks and the stream which used to be called Kemencze patak.

In the village, there is a beautiful stone arch bridge with a clear span of 6 m. Its arch is highlighted by white colored stones and the parapet is made of atypical flat stones, which adds to the originality and the elegance of this small bridge.

NOVÁ VES NAD ŽITAVOU

TURKISH BRIDGE

GPS + 48° 17′ 26.52″S
+18° 18′ 29.70″V

The bridge over the stream Drevenica probably dates back to the turn of the 18th and the 19th century. Presently, it is no longer on the main road, which was built in 1987 several meters upstream together with a new bridge. The old bridge serves today only as a tourist attraction near the local pilgrimage place.

In the direction of the current, the piers of the bridge have triangular cutwater to guide the water through the spans. The clear span of the arches, which are made of quarry stone, is 3.8 m.

NOVÉ MESTO NAD VÁHOM

ARCH BRIDGE ACROSS THE KLANEČNICA STREAM

GPS +48° 46' 00.84"S
+17° 50' 05.57"V

Reinforced concrete arch bridge across the Klanečnica stream was built in 1932.

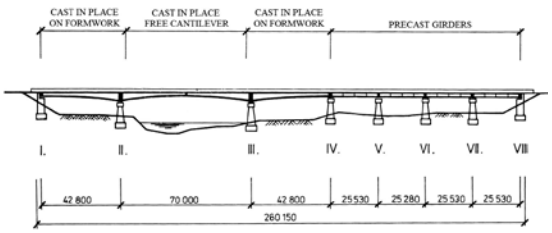
An interesting solution was the use of concrete hangers, which support the bridge deck. However, the concrete is approximately 10 times weaker in tension than in compression, thus the hangers had to be heavily reinforced by steel bars and the concrete serves only as an anti-corrosion protection. The span of the bridge is 32 m.

NOVÉ MESTO NAD VÁHOM

CONCRETE BRIDGE OVER THE RIVER VÁH

GPS +48° 45' 49.75"S +17° 50' 56.30"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia



Scheme of the original bridge built in the year 1963

After appropriate modifications, the original concrete bridge was built in the years 1960 - 1963 on the piers of the previous bridge, which was destroyed in World War II.

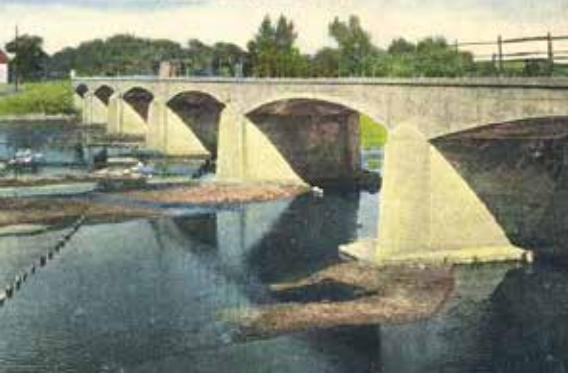
During its construction, the free cantilever method was used for the first time in Slovakia. This technology is nowadays one of the most common bridge building technologies in Slovakia. However, two other methods were used in the construction of this bridge.

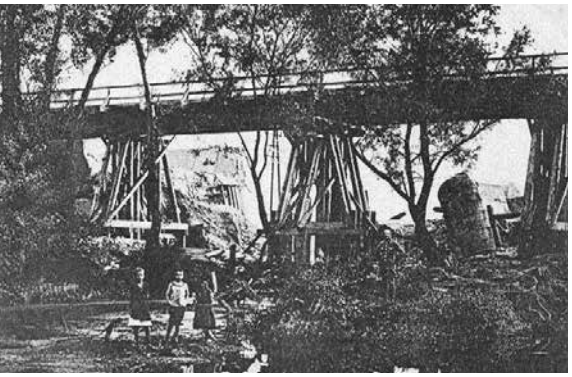
Four short spans of 25.5 m were built of longitudinal precast girders, two longer spans of 42.8 m were casted in place on scaffolding and the free cantilever method was only used for the biggest span reaching 70 m. The design was made by the company Doprastav. However, the bridge had big deflections of the main span (in the place of the central hinge the deflection reached 400 mm), so in 1997 its demolition was necessary and a new modern concrete bridge was built instead (upper photo).

ARCH BRIDGE ACROSS THE BISKUPSKÝ CANAL

GPS +48° 45' 50.44"S +17° 50' 47.83"V

As well as the bridge across the Klanečnica stream, there is another elegant arch bridge in Nové Mesto nad Váhom. It was built in 1953 across the waste water channel of the hydroelectric plant. The span of the arch is 53.3 m.



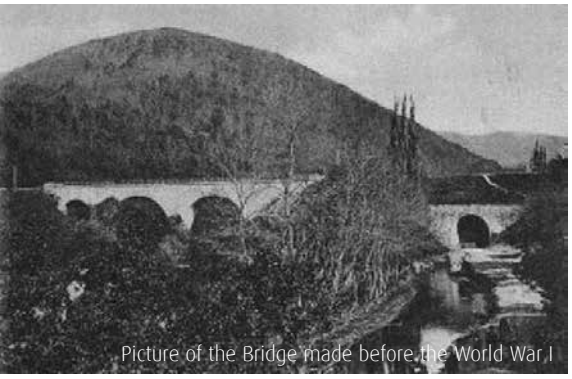


NOVÉ ZÁMKY

VANISHED CONCRETE BRIDGE

In 1892, Josef Schustler built a reinforced concrete bridge over the river Nitra in Nové Zámky in compliance with the patent of Robert Wünsch.

The bridge was the first large application of reinforced concrete in bridge building within the former Hungarian empire. The overall length was 102 m; the spans were 17 m long. The bridge was 6 m wide and the rise of the arch was 1.3 m. Construction took less than 4 months, including the construction of the foundations. It was put into service after the required load tests in January 1893. Unfortunately, this historically significant bridge was destroyed in 1945. On the postcard from the post war period a temporary timber bridge can be seen with the destroyed piers of the original reinforced concrete bridge in the background.



Picture of the Bridge made before the World War I

OBIŠOVCE

BRIDGE ABOVE THE SVINKA VALLEY

GPS +48° 51′ 48.02″S
+21° 13′ 57.62″V

The railway, a part of which was also a stone arch bridge, was built in 1873. At that time, a historic stone arch bridge stood there with four arches.

However, the bridge was destroyed on the 20th of January 1945 by German troops and today there are two modern bridges in its original place. One of them is a deck truss steel bridge with concrete side spans and the other one is a concrete arch bridge with a clear span of 12.5 m crossing the local road.

ONDREJ NAD HRONOM

FOOTBRIDGE

GPS +48° 47′ 27.64″S
+19° 22′ 59.60″V

In a local part of the village Brusno, there is an unusual covered steel footbridge across the river Hron with a span of more than 40 m.

ORAVSKÝ PODZÁMOK

DRAWBRIDGE OF THE ORAVA CASTLE

GPS +49° 15′ 41.21″S
+19° 21′ 31.81″V

The Orava Castle is one of the most beautiful castles in Slovakia. Its rich history dates back to 1267, when the brick castle on the Orava Rock was mentioned for the first time.

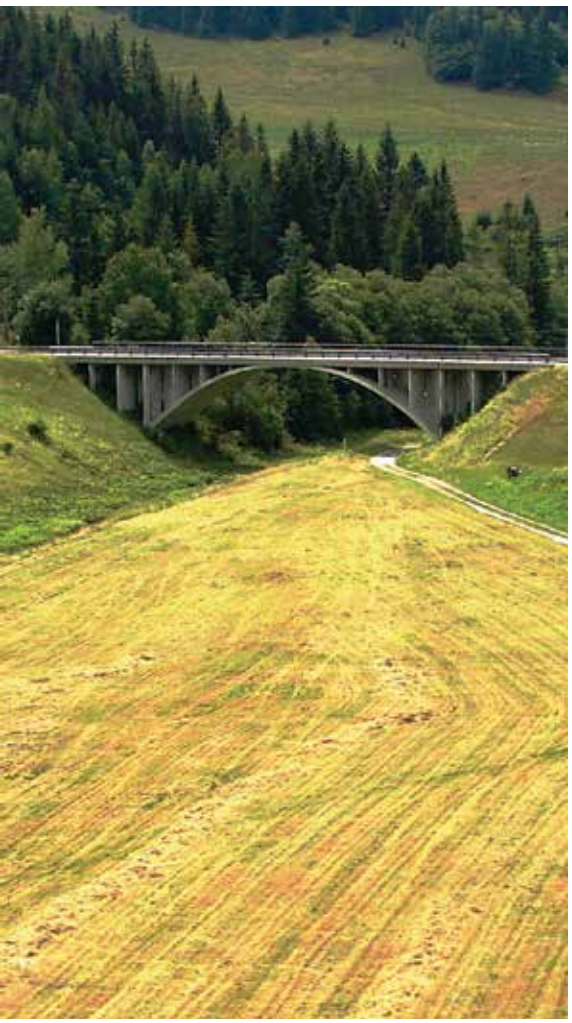
The castle was on a strategic place; on a commerce route to Poland. One of its duties was to prevent the merchants of being robbed. During its existence, ownership of the castle has changed several times. Among the most famous owners, there is for example Matthew Csak of Trencin or the Turzo family. The castle has never been conquered thanks to its excellent defence system, which included three drawbridges. It was damaged only twice. The first time by fire in 1800, when almost the whole castle burnt down, and the second time, by Russian missiles fired to the German observation posts in the castle. Now, one drawbridge has been preserved, which together with its counterweight beam is approximately 5 m long. There is a deep shaft under the bridge which complicated the potential attack. From the remaining two drawbridges, only some parts of them have been preserved.

ORAVSKÝ PODZÁMOK

GPS +49° 15' 38.18"S +19° 21' 36.94"V

ROAD BRIDGE UNDER THE ORAVA CASTLE

Since a long time ago, there has been a bridge under the Orava Castle crossing the river Orava. At first it had a timber structure, then its superstructure was made of steel girders and finally, from the year 1989, the 90-m-long bridge has been made of precast concrete girders.



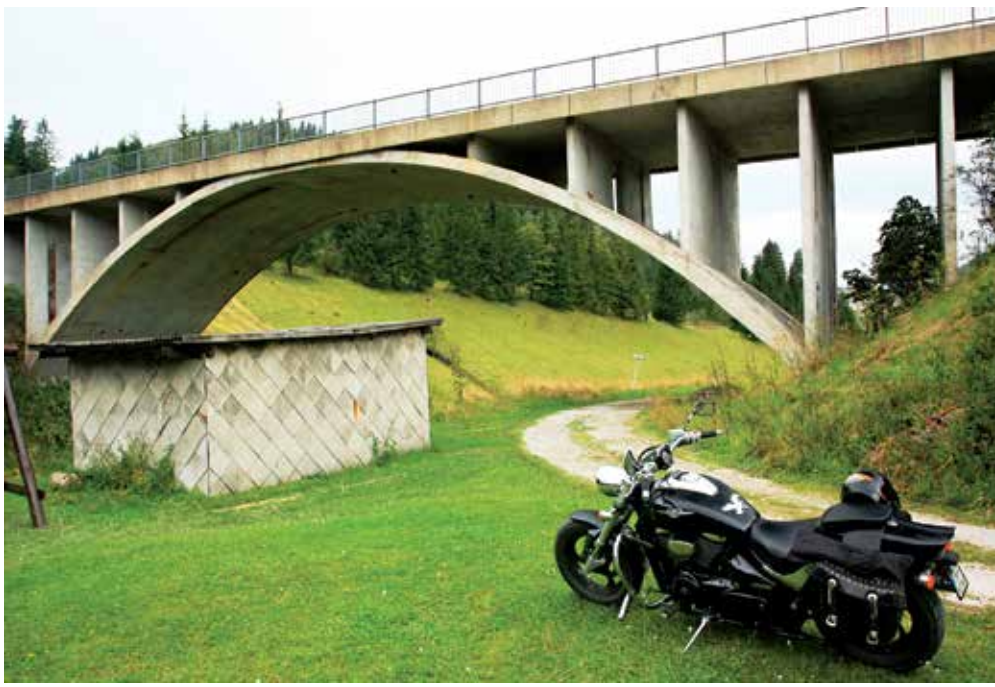
PALCMANSKÁ MAŠA

ARCH BRIDGE

GPS +48° 51' 12.37"S +20° 23' 06.35"V

Palcmanská Maša is a local part of the village Mlynky and at the same time it is the biggest water reservoir in the Slovak Paradise, finished in 1956.

The bridge was built in 1951. It is 58.7 m long and the 9.5-m-high arch has a clear span of 35.5 m.



Abutment under construction
photo: ŽSR MDC

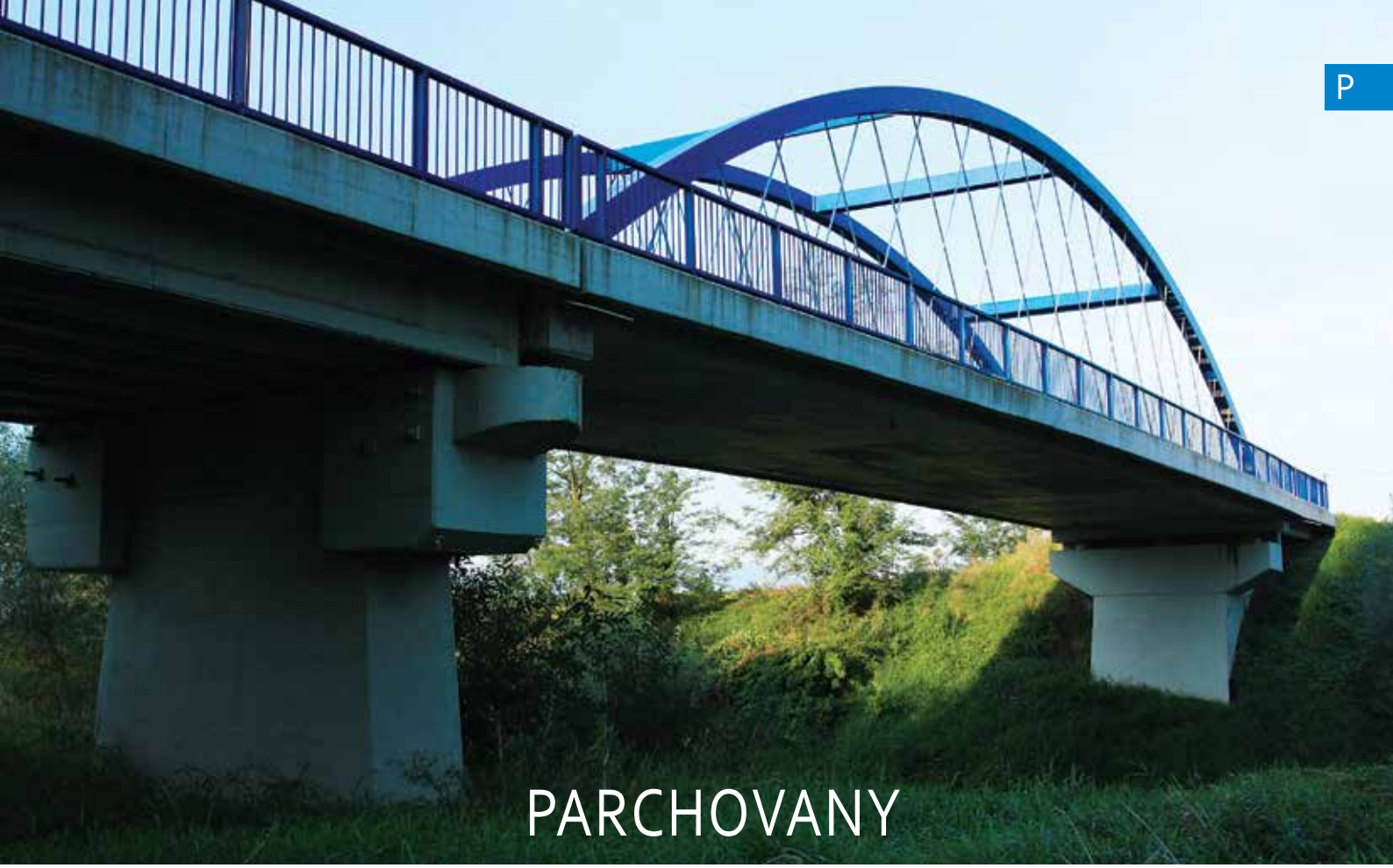
PAPRAD

GPS +48° 46' 48.60"S
+17° 39' 12.30"V

PAPRADSKÝ (ŽANDÁRSKY) VIADUCT OR THE POLICEMAN'S VIADUCT

The viaduct was put into service in 1929 within the railway line between the towns of Nové Mesto nad Váhom and Myjava. It is composed of five spans of 45.6 m placed on 22-m-high piers. The train crosses the valley at a height of approximately 27 m. Both of its abutments have arches with clear spans of 6 m. After the destruction of the bridge, in 1945, 330 workers and engineers were repairing the bridge for almost half a year.

The reason for the local name "žandársky viaduct", meaning policeman's viaduct, was a tragedy which happened there. Policemen of Myjava had a task to pursue and catch two deserters. The policemen Ján Kocourek and Jozef Liberský received the order of their detention on the 20th of April 1854. On their way they bumped into two unknown men sitting by the road and so one of the policemen dismounted the cart to check their identity. Meanwhile, one of the unknown men, pretending to take out his identity card, took out a gun instead and shot the policemen directly into the heart. At the same time, the other deserter picked up the rifle of the shot policemen and used it to kill the other one, who was helplessly sitting on the cart. Consequently, the two deserters escaped and they were hiding in one of the local mills for three days with the help of the miller whom they threatened to shoot. After the investigation ended, the deserters disappeared without a trace. In the place where the two policemen were murdered, a stone memorial stood for a long time. The memorial has been slowly forgotten, but the local name of the viaduct still reminds of the tragedy which had happened there.



PARCHOVANY

LITTLE APOLLO

GPS +48° 45′ 51.50″S
+21° 44′ 03.07″V

In 2006, an arch bridge (Nielsen type) was completed across the river Topľa. Its span is 35 m and its weight is 400 tons.

The bridge is composed of two arches with a circular radius of 31 m which stiffen the main span made of prestressed concrete. Thanks to a new structure, the need for a pier in the middle of the stream was eliminated and so the bridge should withstand even great floods. The middle span is suspended from the arches by means of steel rods anchored in the cross bracing of the steel plates of the arch. The original 74-m-long concrete bridge built in the year 1968 was destroyed by a flood one year before the construction of the new one. Almost 150 people in the area called Božčice were cut off from the rest of the world for several days. The situation was temporarily solved by a temporary steel bridge. The bridge was named Little Apollo due to its resemblance with the Apollo Bridge in Bratislava, although the two bridges are very different in various structural aspects. A similar bridge was also built in the village of Matejovce near Poprad.

PARTIZÁNSKA ĽUPČA

GPS +49° 03′ 51.67″S
+19° 26′ 06.71″V

COVERED STONE ARCH BRIDGE

This village was previously called Nemecká Lupča (meaning German Lupča), but in 1946 it was renamed in the memory of the partisan resistance.

Directly in the village, in 1944, there was a military canteen for the partisans. The staff of the major Makarov and the partisan commander Zajcev also resided here. The village was several times honoured for active support of the Slovak National Uprising, for example it was awarded the Order of the Red Star and the Commemorative SNP Medal. The historic bridge in the centre of the village, with an arch having a clear span of 6 m, was roofed in 2006. As for the old stone bridges, this roofing is quite unique.

photo: ŽSR MDC

PAVLOVCE

RAILWAY VIADUCT

This viaduct, which is more than 200 m long, is one of the three biggest viaducts in the neighbourhood of the town Hanušovce nad Topľou.

GPS +49° 01′ 54.42″S
+21° 27′ 58.82″V

The bridge was put into service in 1943 and it is composed of five truss spans. The truss arrangement is 34 + 3 x 40 + 34 m. Similarly to the other viaducts, this one was also seriously damaged at the end of World War II.

PIEŠŤANY

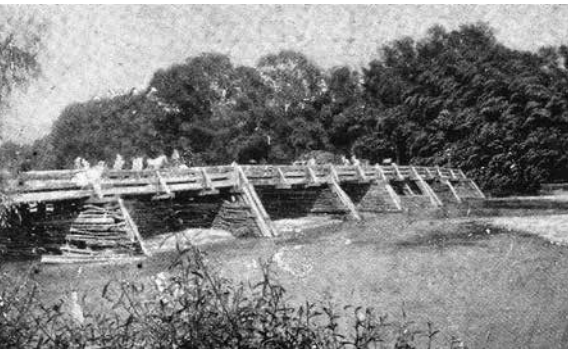
KRAJINSKÝ BRIDGE

GPS +48° 35′ 08.35″S
+17° 50′ 13.10″V

In my opinion this bridge is one of the most beautiful bridges in Slovakia. It perfectly suits its surroundings and it is also very elegant from the structural point of view.

The reinforced concrete bridge was built in 1931 with a span arrangement 2 x 29 + 52 + 4 x 29 m. The bridge was designed by a then highly regarded specialist in bridge construction Dr. Josef Činčera in cooperation with MSc. Ivan Grebeník. After its completion it was dedicated to the first president of Czechoslovakia T. G. Masaryk on the occasion of his 80th birthday.

On the bridge there are commemorative plaques dedicated to the designers and the constructors as well as stating the load which was taken into consideration during its design. Such a plaque with information about the allowable load is very rare. Nowadays, its width is insufficient and traffic accidents are quite frequent there.



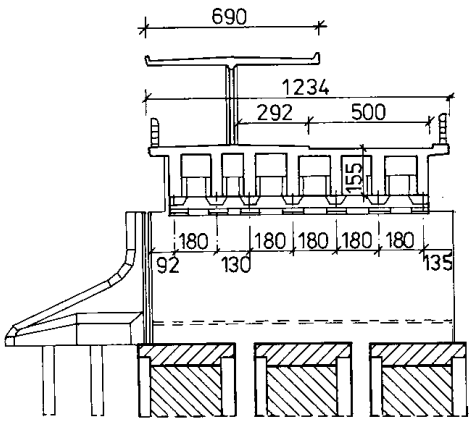
PIEŠŤANY

COLONNADE BRIDGE

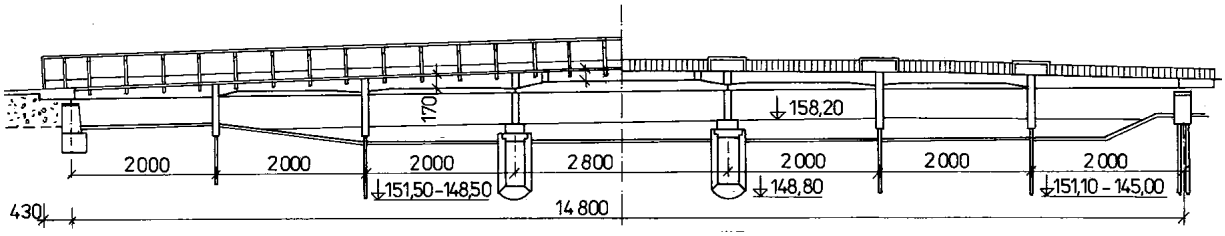
GPS +48° 35' 16.96"S
+17° 50' 23.98"V

The town of Piešťany became famous mainly thanks to its world famous spa, the first mention of which appears in 1545. The centre of the spa is the so called Kúpeľný ostrov (Spa Island) which was connected with the rest of the town by a timber bridge built by the Erdödy family back in the 19th century.

Later, it was rebuilt as a steel bridge with timber piers. This served until 1933, when the new concrete bridge was built. The new bridge project was ordered by the renter of the spa Ľudovít Winter. The design of the bridge was done by Emil Belluš, then only a 30-year-old architect, who later became a professor as well as a national artist and he also contributed to the founding of the Slovak University of Technology in Bratislava. In honour of his life work, Emil Belluš awards are granted every year for outstanding architectural projects in Slovakia. The structural design of the bridge was worked out by MSc Ivan Grebeník, who also worked on the Krajinský Bridge design. The substructure was designed by MSc Schwarz. The bridge itself was designed in such a manner that walking patients were separated from the rest of the pedestrians. The dividing wall was glazed. On the demand of the Ľudovít Winter, shops were built on both ends of the bridge and the dividing glass was artistically decorated by Martin Benka (Slovak national artist), using the motive of Detvianska pieseň (Detva's Song) and Na salaši (In the Shepherd's Hut). Nowadays the originals are placed in



the Balneological Museum, while copies were placed on the bridge. Another artistic item on the bridge is a statue of a man breaking his crutch. It is placed on the right end of the bridge and it was made by Robert Kühlmayer in 1934. While the man on the bridge is breaking his crutch, the piers of the bridge are designed so that they are able to break the potential ice floating on the river. In the case of concrete piers such complicated shapes were gradually abandoned and thus they are very unique nowadays. The writing above the entrance on the bridge Saluberrimae pistiniensen thermae means healing spa of Piešťany, which is also the title of Adam Traján's poem from 1642. The other side of the bridge bears the writing Surge et ambula; Stand up and go. The overall plan of the bridge, as well as its name colonnade (of Latin origins), were bound to capture the social purpose; as a place of meetings and resting. The bridge with its seven spans, with the maximum span in the middle being 28 m, was constructed by the building company Pittel-Brausewetter. The middle two piers were founded on drilled shafts and the four others on driven reinforced concrete piles. The bridge was completely destroyed during World War II. The plan for reconstruction was made by the Dopravoprojekt Company and the construction was carried out by the Doprastav Company.



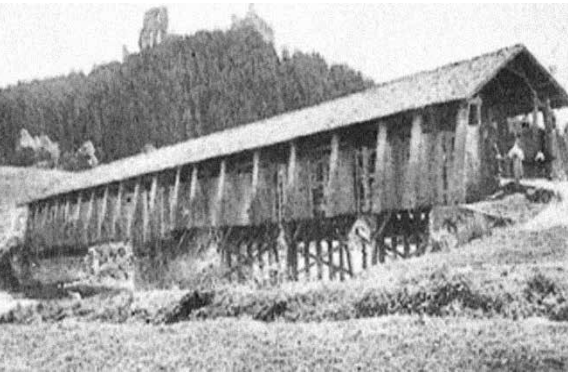
GPS +48° 35' 33.43"S
+17° 50' 27.18"V

PIEŠŤANY

FOOTBRIDGE ACROSS THE BISKUPSKÝ CANAL

The structural system of this footbridge is very interesting, since it is a combination of a suspension and a cable-stayed system. This kind of hybrid system is very rare in Slovakia.

Another interesting solution is the support of the pylons, which was done by a short concrete cantilever arm. The hybrid structural system, as well as the modification of the supporting cantilever arm, is the outcome of the reconstruction, which was carried out in 2007 according to the design prepared by the Faculty of Civil Engineering STU in Bratislava in cooperation with the Building Testing and Research Institute.



PLAVEČ

HISTORIC COVERED TIMBER BRIDGE

One of the longest covered timber bridges in Slovakia used to cross the river Poprad. It was preserved until the beginning of the 20th century and its length was 70 m.

It consisted of five spans, the biggest of which was 36 m long. It is interesting that, originally, it only had only two long spans, while the other small ones were created during the reconstruction after the fire which had damaged half of the bridge. The reason for making more small spans instead of one was the fact that at that time there was a lack of skilled carpenters who would be able to build a 36 m long span again. That is why four smaller spans had been created to replace one large span.

PODBIEL

STEEL BRIDGE

GPS +49° 18′ 18.80″S
+19° 28′ 48.81″V

The bridge across the river Orava, crossed by many heavy vehicles every day, was reconstructed in 2011.

Local entrepreneurs contributed to the reconstruction, since it is mostly used for their business. The bridge was built in 1945 and its main span has 26 m, while its overall length is 79 m.

PODLIPOVEC

LIPOVECKÝ VIADUCT

GPS +48° 47′ 12.56″S
+17° 38′ 05.64″V

The 114-m-long viaduct has been crossing the valley near the village of Podlipovec since back in 1929 when the railway line Nové Mesto nad Váhom – Myjava was put into operation.

PODTUREŇ

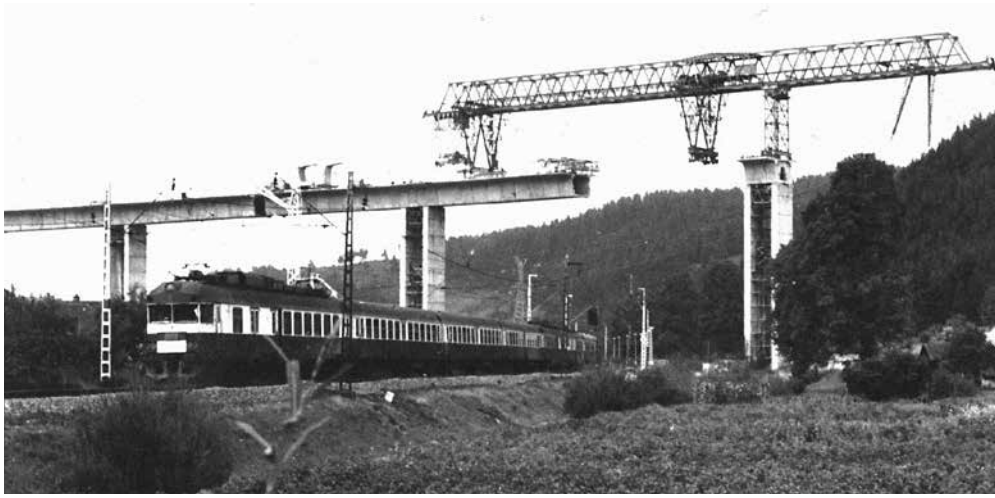
PODTUREŇ VIADUCT

GPS +49° 03' 26.12"S
+19° 41' 29.50"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The 1,038-m-long viaduct was built in 1983 and for more than 20 years it was the longest concrete bridge in Slovakia and at the time of its construction it was also one of the longest concrete bridges of its kind in central Europe.

During its construction, segmental bridge technology was innovated and enabled construction to proceed approximately five times faster than it had been possible on previous bridges. It was mostly enabled by the ability to produce 80-ton-heavy



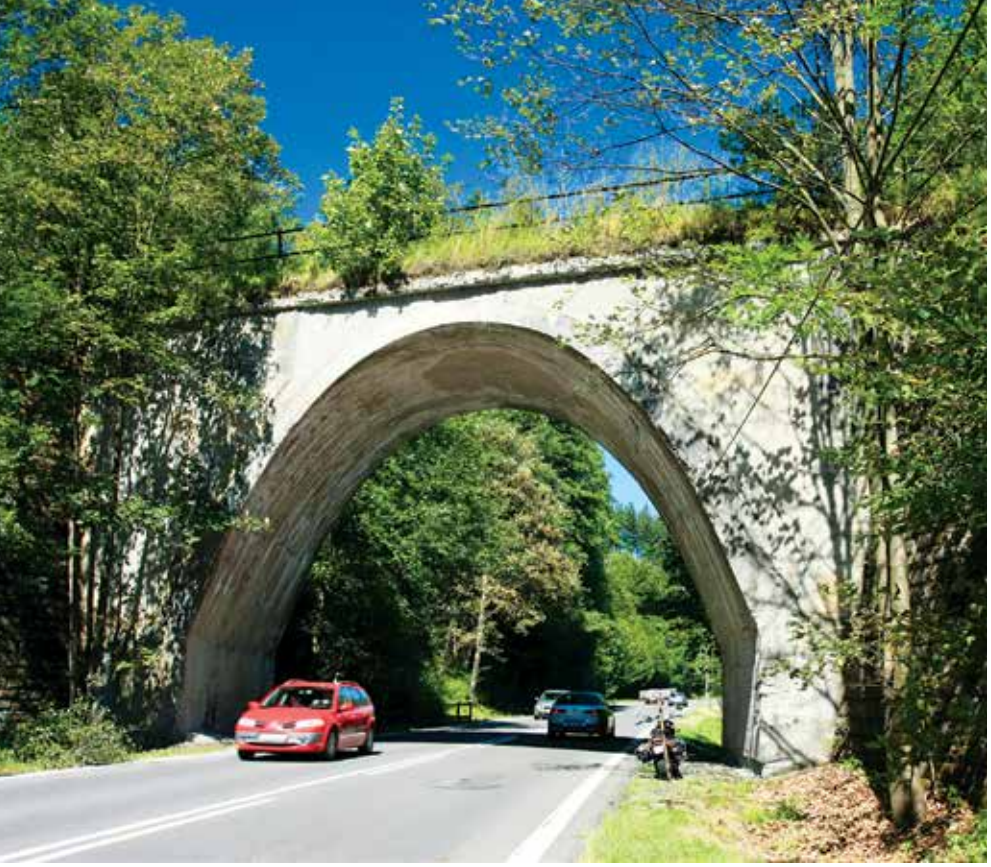
segments by the long line segment casting, where the segments were produced in such a way that the joints perfectly interlocked. This was achieved in a way that one segment basically served as a facing formwork for the other one and the whole span was prepared at once, thus the necessity of corrections of the shape during the erection was not needed. Subsequently, the individual segments were assembled with a special crane, the so called overhead launching gantry crane, which could bridge even the biggest spans of the bridge, these being 70 m. Construction of the bridge could be performed practically regardless of the traffic under the bridge as well as of the height above the terrain, which in some places reached 35 m. The bridge is divided into three expansion sections. The project was prepared by the company Dopravoprojekt, but also the members of the Department of Concrete Structures and Bridges of the Faculty of Civil Engineering STU in Bratislava were involved. The bridge was constructed by the company Inžinierske Stavby Košice, which at that time already had several examples of experience with this technology.

SUSPENSION FOOTBRIDGE

GPS +49° 03' 13.43"S
+19° 41' 23.82"V

Nearby the Podtureň Viaduct, the river Váh is crossed also by a footbridge built in the year 1959.

It replaced the original timber footbridge destroyed by a flood in 1958. The deck is approximately 58 m long.



POLKANOVÁ

RAILWAY BRIDGE

GPS +48° 48' 36.85"S
+19° 05' 46.11"V

The bridge is one of the 122 bridges on the 41-km-long railway line linking Banská Bystrica and Dolná Štubňa.

Its construction was begun in 1936 and it was finished in 1940. There are also 22 tunnels on the track with an overall length of 12.2 km. In 1938, more than 12,300 workers were working on various structures within this railway line, 35 of which were killed in accidents. The reinforced concrete arch has a parabolically shaped vault with a clear span of approximately 12 m.

POLTÁR

TURKISH BRIDGE

GPS +48° 25' 48.48"S
+19° 46' 43.09"V

The stone arch bridge built during the Turkish supremacy in the 17th century crosses the Ipeľ River with three arches each having a clear span of approximately 5 m.

However, the bridge does not retain its original shape, since it was rebuilt in 1886 (during the reconstruction the original stones were used). The piers are strengthened by concrete skirts. There is also a miniature sign on the bridge, probably placed there after a flood, but it had been evidently made for another bridge, since it states: Big water, 22. 10. 1974, the Hron river basin BB. The five-metre-wide deck is drained by six openings. The bridge is approximately 35 m long.

POPRAD

TRACKAGE BRIDGING

GPS +49° 03′ 36.46″S
+20° 17′ 43.58″V

The interchange hall of the High Tatras' electric railroad was put into service in 1991.

Its main structural part is an approximately 70-m-long steel truss structure the building of which took place in the 80s of the 20th century. The hall is hanging from this "backbone" which gives it a unique appearance. The hall may be considered as a hybrid between a bridge and a building.

PORIADIE

ARCH BRIDGE

GPS +48° 46′ 40.68″S
+17° 36′ 52.66″V

This road bridge built in the year 1928 crosses the railway with an arch, which has a 30 m long clear span.

It was heavily damaged in World War II, but it was eventually reconstructed to its original form.

POVAŽSKÁ BYSTRICA

ORLOVSKÝ BRIDGES

GPS +49° 07′ 26.59″S
+18° 26′ 08.80″V

The first of the two parallel bridges across the river Váh was built in 1949. It is composed of five arches with a clear span arrangement of 45 + 50 + 50 + 45 m.

This elegant, 245 m long bridge, as well as its twin built in 1997, is well visible from the new highway bridge offering bird's eye view of them both.

FOOTBRIDGE

The unusual footbridge across the Domanižanka Stream ranks among the most interesting footbridges in Slovakia.

The footbridge is decorated by a spherical object placed on the top of the pylon just above the saddle through which the suspension cables run. Also Interesting is the solution for the suspension of the main span. The cables run not just above the bridge deck as is the common solution, but near the abutment they run under the deck, which is supported there from underneath by rods instead of being hung. Unfortunately, I have not succeeded in finding out the year of its construction, neither its dimensions so I measured at least the length of the span, which is approximately 36.5 m

THE LONGEST HIGHWAY BRIDGE IN SLOVAKIA

GPS +49° 08′ 42.00″S
+18° 27′ 46.00″V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The category of the longest highway bridge in Slovakia was for a long time dominated by the Podtureň viaduct, but through extensive highway building it has been overcome by several other elevated highways.

Presently, the longest viaduct is the elevated highway near Považská Bystrica crossing the flood plain area of the river Váh with three types of bridge structures, each being an individual expansion section. The overall length of the viaduct measured between its abutments is 2,081 m. The individual expansion sections (hereinafter referred to as ES) have these parameters: 1st ES: steel girders with composite concrete deck (maximum span: 40 m, length: 986 m), 2nd ES: precast concrete girders (maximum span: 38.6 m, length: 788.2 m), 3rd ES: bridge built by the free cantilever cast in place technology (maximum span: 96 m, length: 307.3 m.). The design of the bridges was by the company Dopravoprojekt Bratislava.

POVAŽSKÁ BYSTRICA

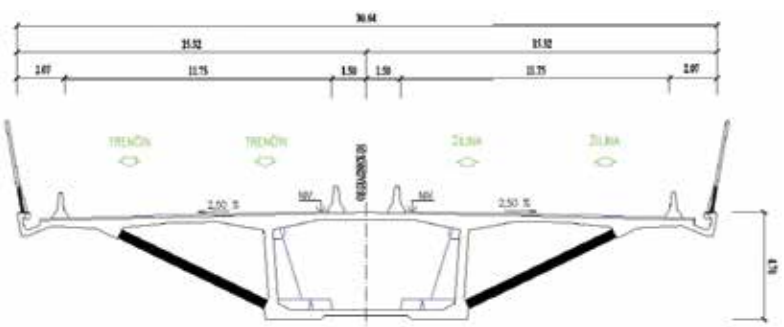
URBAN ELEVATED HIGHWAY

GPS +49° 07′ 05.02″S
+18° 26′ 19.65″V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

Hardly any other design project of a bridge in Slovakia has been influenced by such a number of parties involved as this one. For this reason, the engineering solution had to consider numerous factors so that the result would be acceptable to all of them. It was necessary to keep the price as low as possible, while the construction was to be finished as soon as possible with the least interventions on the built-up areas of the town.

Naturally, the precondition was to maintain the aesthetic elegancy of the structure, which was to become the dominant feature of the town. The final bridge design was made by the company ALFA 04 (Ing. Miroslav Maťaščík) and SHP. The elevated highway crossing the town of Považská Bystrica follows the highway profile. The superstructure is supported by piers having an unusual shape, which resulted from the demand to intervene



Inner view of the chamber

Experimental segment during the loading test

to the town's area as little as possible as well as from the demands of the building technology (balanced cantilever cast-in-place method). Being 969 m long, it is the longest expansion section in Slovakia. The construction itself was from the very beginning constrained by the demands to minimize the impact of construction on people in the urban districts and on the other hand to maximize the construction speed. For this reason, incremental launching technology was chosen in the preliminary design. The overall concept of the bridge was then adapted to this construction method. The final design was mastered excellently and if we consider the architectural point of view, it is probable that not even trained architects could have designed the bridge better. The positions of the piers were limited by the existing buildings, by the railway line, by the river Váh and also by the newly built junctions. These requirements resulted in the spans reaching up to 122 m. Despite the preliminary design, in which incremental launching technology was considered as the best solution, in the final phase the most suitable method which would meet all new requirements turned out to be the balanced cantilever method. To speed up the construction, 14 form travellers were used at the same time, with each of them able to build approximately five metres of the bridge in roughly 10 days. The shape of the piers, which were securing the stability of the cantilevers during their construction, also had to be adjusted. The casting of the cross section was first experimentally verified on a segment with a scale of 1:1 and at the same time the heat development due to cement hydration was monitored (in massive elements, the temperature is not allowed to exceed the critical value). On the experimental segment, its bearing capacity was also tested and was compared to the calculated values, which were finally surpassed by approx. 1.5 times. The experimental verification was provided by the company Projstar in cooperation with VÚIS Mosty (research institute of engineering structures), STU Bratislava and VUT Brno. When all the technological problems were solved and the builders

established a routine, the construction of the superstructure began to proceed in dizzying speed. The construction of the whole elevated highway, including the piers, lasted less than 22 months. In some phases, there were more than 270 workers and technicians working at the same time on the bridge. To design the bridge, many hours of drawing and structural analyses had to be done, considering different building stages and different loads acting on the structure. Building such a great structure is always a big engineering success in which many technicians, officials and politicians are involved. Particularly looking at this bridge, I take the liberty to mention some reflections upon the political influence on bridge building, since this elevated highway was strongly influenced by them and for some time the bridge became the subject of political games.

Since distant past, bridges have been the symbols of technological advance of the given region or country and they mirrored the success of the economy and growth. Their building was affected by the achievements of the regions and the further growth of the economy was possible only thanks to having advanced infrastructure, which is unimaginable without bridge structures. For this reason, bridges have always also been celebrated by the political elite and after all, it is them who has always cut the ribbon and ceremonially opened bridges to public use. So it has been since the epoch of the Roman Empire up to now. Certainly, politicians have a considerable influence on bridge building, because they decide about its financing and by this means they have some kind of privilege to cut the ribbon. However, it is still questionable to what extent politics can intervene in the construction itself and where lies the acceptable boundary of political goals. The building of this elevated highway was also strongly influenced by political intentions regarding the construction time, since the bridge had to be finished before the parliamentary elections in 2010 at all costs. Perhaps it would be interesting to analyse to what extent this political involvement influenced the final price of this magnificent structure, or in other words, to what extent did the benefits derived from earlier opening to traffic outweigh the extra cost of the very fast construction. Bridge constructors have always been in the hands of political games and it relies on their professional engineering ethics how much they will let themselves be influenced by the political scene. After all, a bridge is not a pre-election billboard which disappears some days after the elections. It is a masterpiece which remains for future generations. It gradually becomes the symbol of the era and I am a bit sad that particularly this unique bridge will have, besides the representative label of the progress made by our small country, also the label of political propaganda. But this is also what bridges are about.

PREŠOV

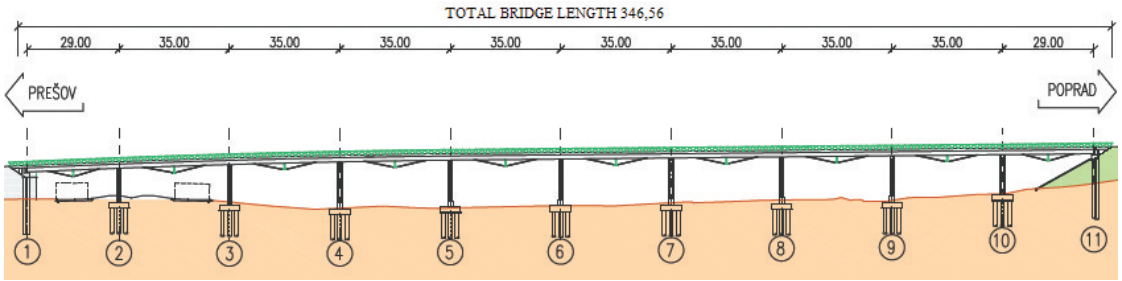
CONCRETE HIGHWAY BRIDGE

GPS + 48°59′ 52.16″S
+ 21°12′ 09.02″V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The highway bridge in Prešov was finished in 2009. It is 346-m-long and has 10 spans. External prestressing tendons were guided through steel deviators situated under the main girders in the middle of the spans. This solution increased their lifting efficiency and reduced the required depth of the cross section.

This solution is quite unconventional and besides its structural efficiency it also serves as an interesting architectural element. A triangular motive is thus created by the external cables and the deviator, which complements the V-shaped piers. The bridge was built by the company Inžinierske stavby Košice following the design made by the Dopravoprojekt Company. To verify the functionality of the external prestressing tendons and to monitor the real stresses in the cables, experimental measures were carried out during the construction as well as on its scaled down experimental model. The measurements were carried out by the company Projstar and VÚIS Mosty. The experimental model was prepared and tested in the Central Laboratories of the Faculty of Civil Engineering STU in Bratislava.



PÚCHOV
RAILWAY BRIDGE

GPS +49° 06' 35.51"S
+18° 18' 41.08"V

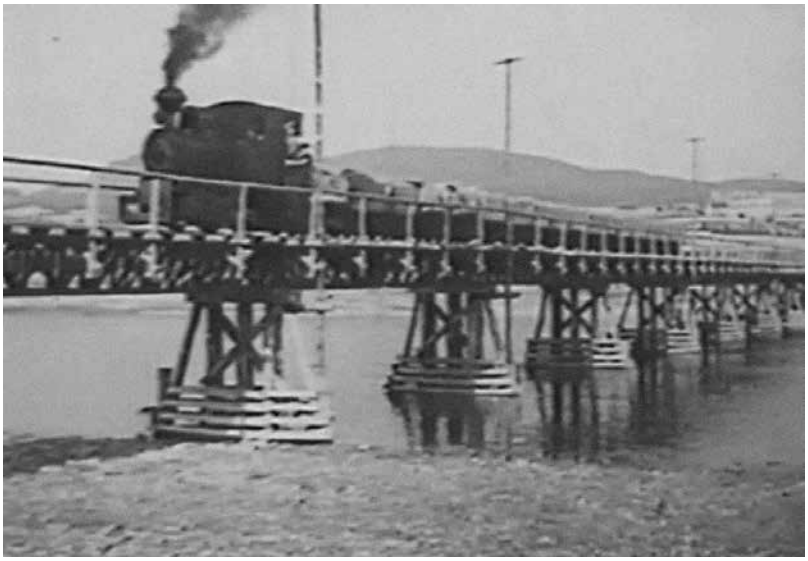
The bridge with a main span of 73 m was built across the river Váh in 1936 as a part of the railway line connecting Púchov and Horní Lídec (The Czech Republic).

In order to meet the deadlines set for the construction, six Czech companies participated on the fabrication and assembly of the steel superstructure having six spans. The overall length of the structure is 265 m. The bridge was heavily damaged during World War II; one of the piers supporting the steel structure was blown up.

PÚCHOV

CATWALK ON THE DAM NEAR DOLNÉ KOČKOVCE AND THE FORMER TEMPORARY BRIDGE

GPS +49° 05' 57.47"S
+18° 18' 42.09"V



Near Púchov, in the village of Dolné Kočkovce, the oldest cascade of the river Váh was built in the years 1932 – 1936 which serves for the exploitation of the hydropower potential of the river.

On the dam, small towers were built, in which lifting devices are installed as well as 25 m long steel catwalks above four spans of the dam. An interesting aspect of the dam is the special lock chamber enabling the crossing of the rafts which used to transport wood in those days. From the bridge building point of view, the temporary steel bridge placed on wooden piers is also remarkable. It was built during the construction of the dam for the purpose of transporting the building materials by train.

PÚCHOV

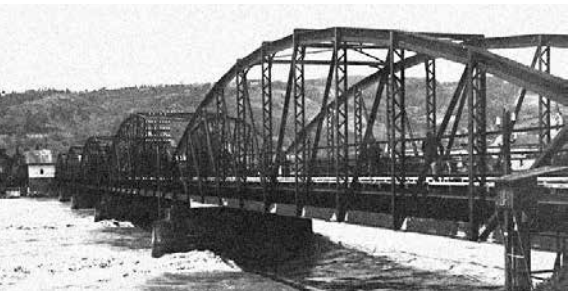
ROAD BRIDGE

GPS +49° 07' 09.89"S
+18° 19' 41.94"V

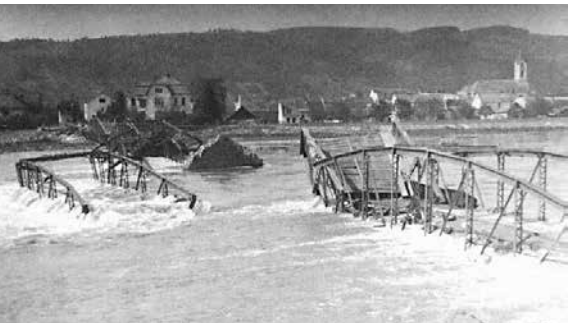
Besides railway bridges, there was also a steel truss road bridge in Púchov with five spans built in 1891.

Its history is well documented by the photographs capturing all the important events concerning it, among which are mainly its building and service, floods in 1944 and finally its destruction by German troops in 1945. The Red Army built a pontoon bridge in its place, which was destroyed by a flood in 1946. It must be added, that hardly any other bridge has its history so well documented in photographs. Since 1949 there has been a 186m long steel plate girder bridge with five spans in its place.

The building of the bridge, 1891

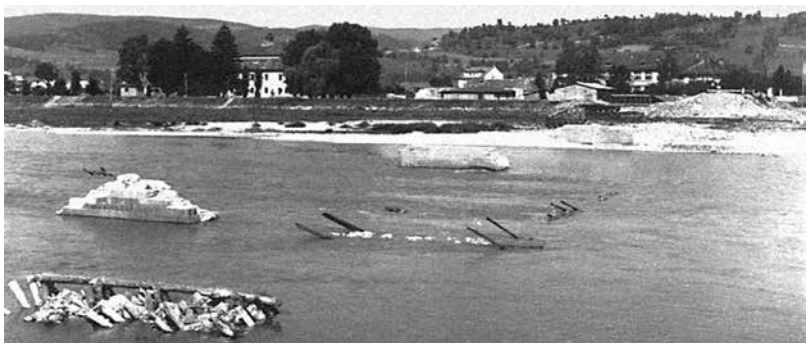


View of the bridge, 1944

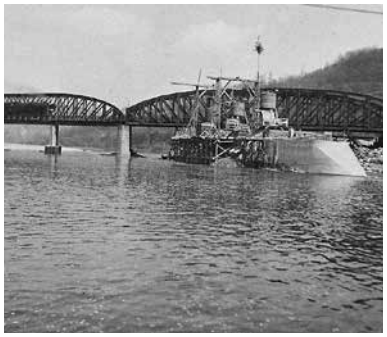


Destroyed bridge, 1945
www.puchovodedicstvo.sk

Timber temporary bridge, 1945



Remains of the steel bridge and the timber temporary bridge, 1946



PÚCHOV

FORMER BRIDGES IN THE AREA OF THE NOSICKÁ DAM

GPS +49° 07' 41.21"S +18° 21' 57.77"V

The dam was built in the years 1950 – 1957 and its original name was Priehrada mládeže (Youth's Dam). It really deserved its name, because for example in 1950, almost 13,000 young volunteers worked in turns on its construction, building their socialist motherland.

Small towns, where rich social life flourished after the working day, needed temporary bridges leading to the working site to be built for them. The construction was significantly complicated in 1952 with the discovery of a mineral spring, which has been ever since used in the nearby Spa Nimnica. As a matter of fact, the effect of a mineral spring on concrete is opposite to the effect on a human body, so first it was necessary to solve the unexpected situation endangering the further construction of the dam. The building of the dam itself strongly influenced the transport on a busy double track railway line between Bratislava and Žilina, which was crossing the river Váh in this place with two truss bridges called Milochovský Bridges. Both of them had to be taken down and the railway line was moved farther so that it did not cross the site of the future dam. The present day's reinforced concrete wall of the dam was built right in the place where once used to stand the so called Lower Milochovský Bridge. It was composed of three parabolically shaped truss arch spans. It was built within the Považská railway line, which was put into service in 1883.

photo: courtesy of www.puchovodedicstvo.sk

FORMER FOOTBRIDGES

Besides the big steel bridges, there were also several quite long timber footbridges.

Similar small timber bridges were once quite usual in Slovakia.

RÁKOŠSKÁ BAŇA

FORMER BRIDGE OF THE NARROW GAUGE RAILWAY

The villages around Železník, the peak of the Gemer region, used to be important for the mining industry. Inhabitants made their living mainly by mining iron ore, which was first mined there already in the 2nd century B.C, but the biggest boom did not come before the middle of the 19th century, when a 14-m blast-furnace was built in Červeňany.

Later after a geological survey near Rákoš in 1891 including a 217-m-deep bore hole, it was decided to build a narrow gauge railway, a part of which was also a timber bridge standing on 11 supports made of bricks. It was finished in 1892 and it was 62 m long. Iron ore was transported on it by horse drawn carts, later replaced by steam locomotives. It is interesting that it was probably the first curved timber railway bridge built within the whole former Hungarian Empire.

RUŽÍN

RUŽÍN VIADUCT

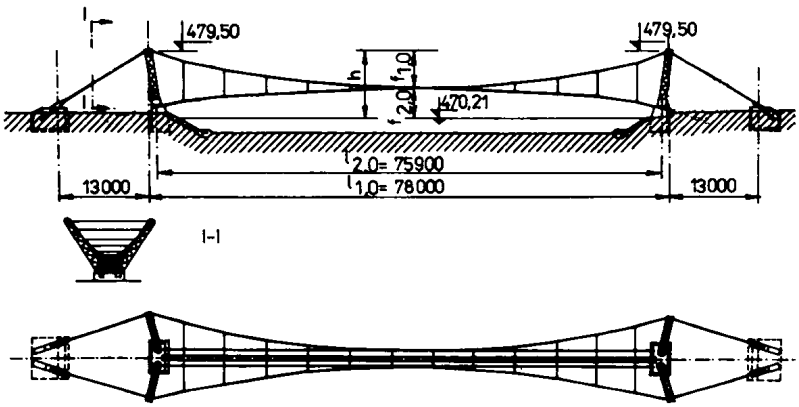
GPS +48° 52′ 33.99″S
+21° 06′ 43.30″V

General Designer of Reconstruction:
REMING CONSULT, a.s., Bratislava, Slovakia

One of the highest railway bridges in Slovakia has crossed the water reservoir Ružín at a height of approximately 40 m since 1955.

The truss superstructure is composed of four spans of 64 m, while its overall length is 280 m. The construction of the side spans was done on falsework, on which the whole steel structure was assembled. However, more interesting was the solution used for the building of the inner spans, the parts of which were assembled under the bridge and afterwards lifted to their final position. This solution saved approximately 1,100 m^3 of timber, which would be otherwise used for the construction of the falsework. When finished, the massive piers made of reinforced concrete were manually faced with andesitic stone.

RUŽOMBEROK



SUSPENSION PIPELINE BRIDGE

GPS +49° 05' 03.57"S
+19° 16' 50.53"V

The suspension pipeline bridge connecting Ružomberok with the local part Rybárpole was built in 1965 as a prestressed cable structure.

Two water pipes run across the bridge and it serves also as a footbridge.

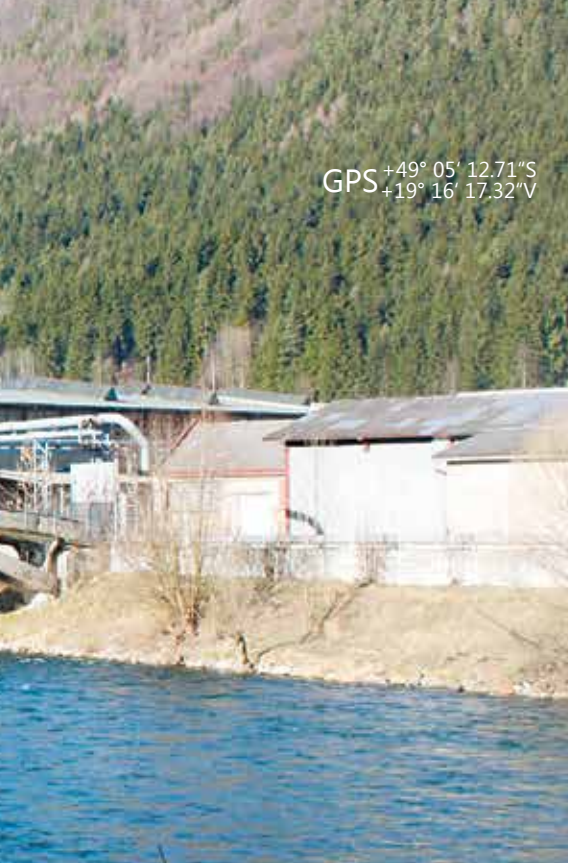
RUŽOMBEROK

HISTORIC STEEL BRIDGE

GPS +49° 05' 02.38"S
+19° 18' 20.96"V

At the turn of the 19th and the 20th century, a steel truss bridge was built across the river Váh in Ružomberok, connecting the town with the railway station and with the region of Orava.

Only the pier supporting today's steel truss footbridge is preserved. The span of the new bridge is approximately 25 m.



GPS +49° 05′ 12.71″S
+19° 16′ 17.32″V

CONCRETE BRIDGE NEAR THE FACTORY

Towards the end of the 19th century the building of a textile factory was begun. This later became the biggest in the former Hungarian Empire.

The factory was named after the industrialist Izák Mautner, but after World War II it was renamed as Vladimir Ilich Lenin's Cotton Industry. Although it employed as many as 5,000 people in its best times, nowadays it is nothing more than an abandoned dilapidated complex. The footbridge over the river Váh, composed of three arches with an overall length of almost 70 m is also only a dilapidated memorial to the former fame of the factory. It was built in 1912 and being more than 100 years old, it is among the longest preserved reinforced concrete bridges in Slovakia.

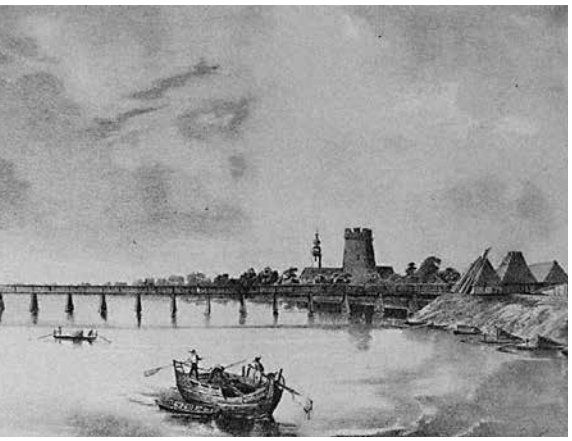
SALKA

TRUSS BRIDGE

GPS +47° 53′ 10.60″S
+18° 45′ 47.19″V

The original cross-border bridge between Slovakia and Hungary was destroyed on the 20th of December 1944 by German troops after heavy fights in which the major part of the village was flattened. It was reconstructed between the years 1952 and 1954, but it was not opened until 1990 when it served as the border crossing to Hungary.

The bridge crosses the river Ipeľ with two spans of 46 m.



SEREĎ

HISTORIC BRIDGES

Since long time ago Sereď lay on the important crossroads of a commerce route connecting the mining towns with Bratislava and Vienna and of the "Czech road" leading to Morava. Therefore, it belonged to places where many merchants and raftsmen transporting goods used to stop on their ways.

Since the Middle Ages, a water castle protecting this area stood there. There was also a timber bridge for several centuries and, although it was often destroyed by floating ice or floods, it was always quickly repaired due to its importance. The toll collected on the bridge provided decent income. However, towards the end of the 18th century the situation turned against its owners and because of more and more frequent damage to the bridge, the toll could not cover the costs of the maintenance. It became loss making and its owners attempted to sell it to the state, in which they finally succeeded on the 8th of May 1905. They sold the bridge for 100,000 crowns. But because of persisting problems with the maintenance, in the years 1911 and 1912 the bridge was replaced (with the state's money) by a steel truss bridge built by the company of Béla Zsigmondy. Its position was moved 350 m downstream, closer to the town. Near the former timber bridge, there was also a statue of St. John of Nepomuk, which was mentioned back in the 18th century. Today, the statue is positioned on the ramp of the former steel arch bridge near the entrance gate to the Raketa restaurant. J. Godály had it placed there in 1923. The new steel truss bridge was the first from a series of steel truss bridges with parabolic top chord designed in Hungary. It was blown up on the 1st of April in 1945 by the withdrawing German troops.

Floating water mills near Sereď, in the background: former steel truss bridge across the river Vah

SEREĎ

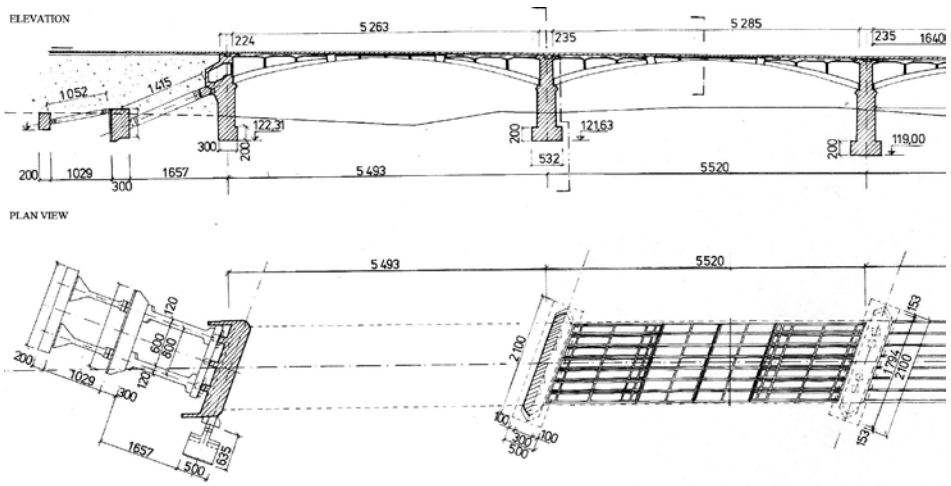
CONCRETE ARCH BRIDGE

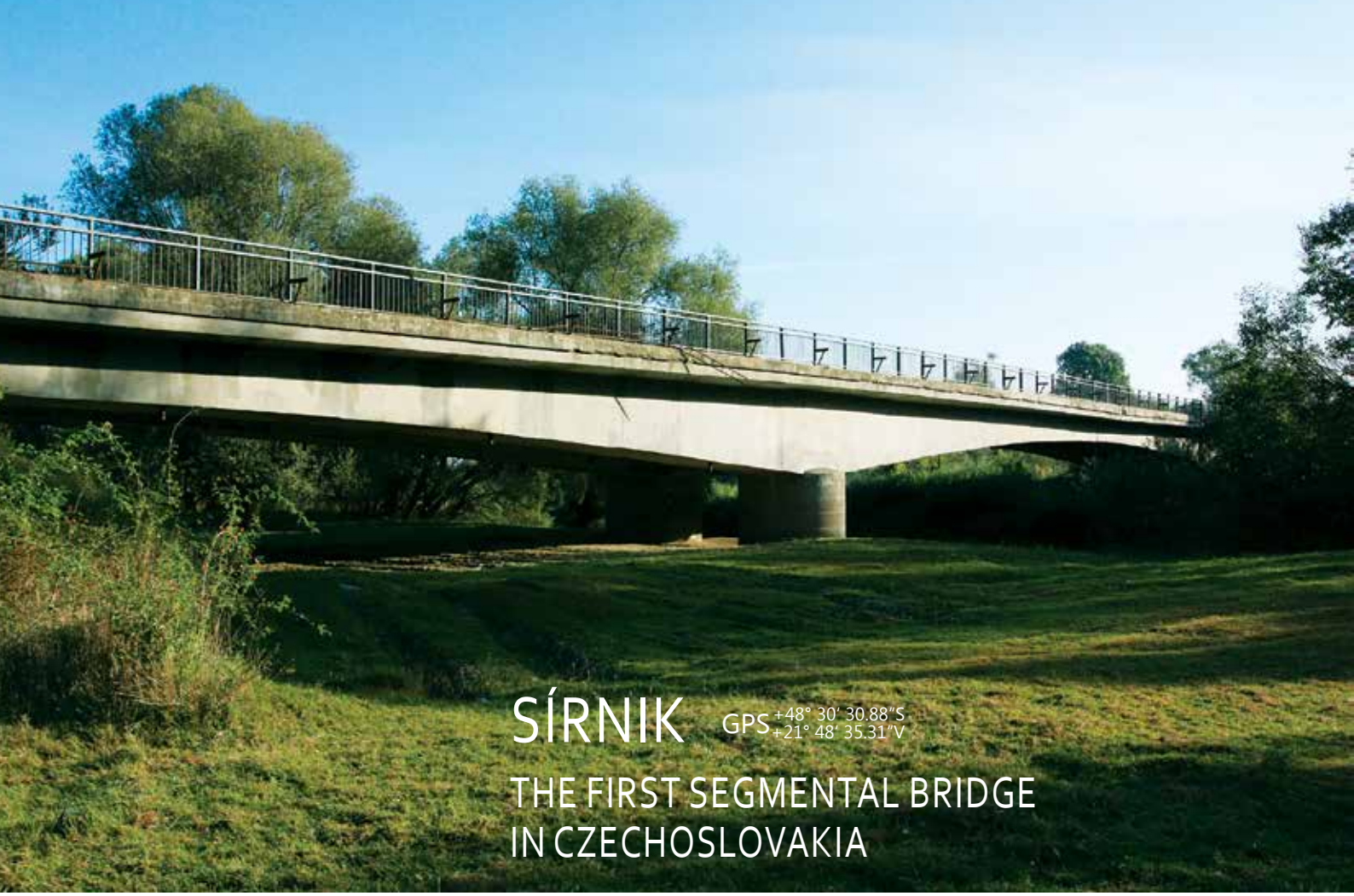
GPS +48° 17' 09.62"S
+17° 44' 50.61"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The steel bridge was partially reconstructed after the war and in the years 1955 and 1961 it was replaced by a new prestressed concrete arch bridge with six spans. The length of the superstructure, measured between the abutments, is 331 m and the span of the arches is about 55 m.

Even from the present point of view, the bridge connecting Sereď with Šintava had a statically very complicated precast structure. Besides the complications caused by the precasting and connections of the parts, the skewness of the bridge regarding to the river flow, being 70°, also caused many problems. The arch thrust force of the side spans was compensated by the activation of special wedges situated behind the abutments. . As well as the company Dopravoprojekt, which was mainly responsible for the drawings, also STU Bratislava (Professor J. Wünsch) and CVUT Prague and VUT Brno cooperated on the structural design. Construction was by the company Doprastav in cooperation with the company Priemstav. The bridge is decorated by the emblems of the towns through which the river Váh flows, these being the towns of Liptovský Hrádok, Žilina, Trenčín, Sereď and Komárno.





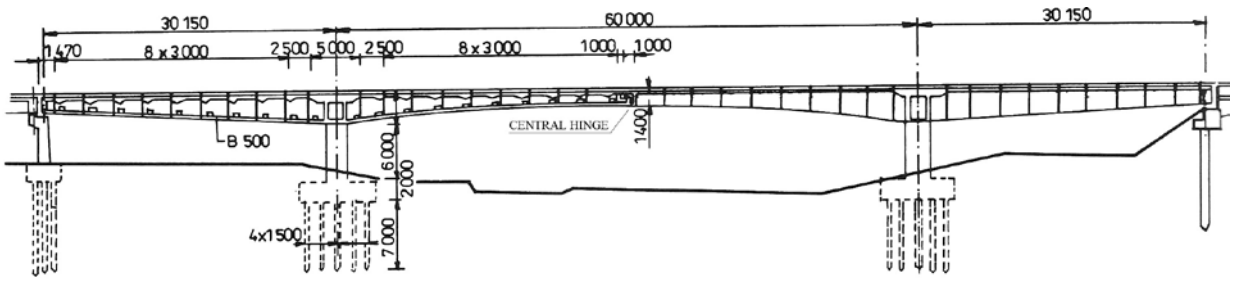
SÍRNIK

GPS +48° 30' 30.88"S
+21° 48' 35.31"V

THE FIRST SEGMENTAL BRIDGE IN CZECHOSLOVAKIA

The free cantilevering method is presently used to construct segmental bridges with medium spans between 50 and 80 m.

As its name indicates, the bridge is gradually assembled from precast segments, which are attached to the previously finished superstructure without the need for falsework (support from the ground). Czechoslovakia was among the first countries of the world to build bridges with this method. The bridges near Margecany from the year 1966 were the first segmental railway bridges built with this technology in Europe. In Czechoslovakia, the first experimental bridge using this technology was the bridge near Sírnik on the east end of Slovakia. It was built across the river Ondava in the years 1963 – 1964 by the company Inžinierske stavby Košice in close cooperation with the Research Institute of Engineering Structures in Bratislava.



SKALITÉ

ARCH BRIDGES ACROSS THE EXPRESSWAY

GPS +49° 30′ 29.44″S +18° 57′ 46.46″V

The bridges with a length of approximately 60 m were built in the years 2004 and 2005 across the D3 highway near the border crossing with Poland.

The border is between the bridges and thus the concrete bridge is still in Slovakia, while the steel one is in Poland. They bridge the highway at a height of approximately 20 m.

SKALITÉ

COMPOSITE STEEL-CONCRETE BRIDGES OF THE D3 HIGHWAY

GPS +49° 30' 15.63"S
+18° 57' 12.69"V

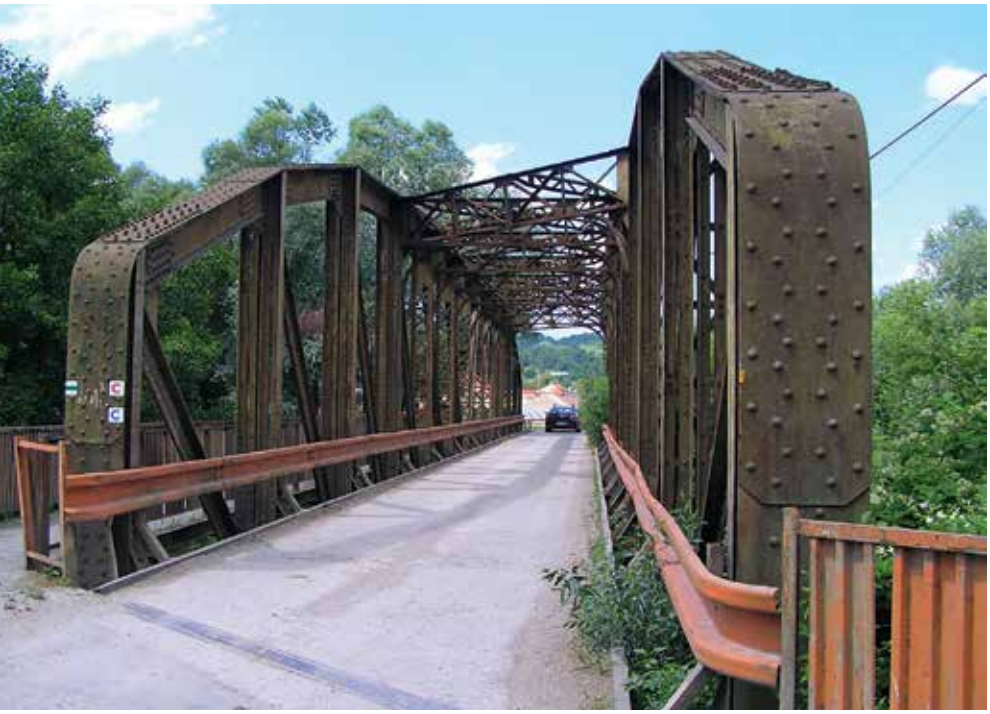
On the D3 highway between Žilina and the border crossing Skalité, four composite steel-concrete bridges were built; the longest of them being 492 m long.

The other three are 440, 150 and 270 m long, while the maximum span is 60 m. The last of the four was finished in 2007 using incremental launching technology. Steel girders were launched above the valley and subsequently the composite concrete bridge deck was cast using special movable formwork. The concrete casting could be carried out only in favourable conditions, mainly temperature changes, which could have caused cracking in the fresh concrete. A number of concrete pours could be thus only be done during the night hours.

SLOVENSKÁ ĽUPČA

STEEL BRIDGE

GPS +48° 45' 46.53"S
+19° 16' 51.76"V



The road bridge across the river Hron with a span of 57 m was originally a railway bridge and it was transported to its contemporary place when the railway administration put it out of service.

The bridge is unique mainly because its 6.9 m high truss girders are mutually shifted; the bridge is skewed.

THE SLOVAK PARADISE (SLOVENSKÝ RAJ)

CHAIN FOOTBRIDGE

GPS +48° 57′ 09.98″S +20° 25′ 06.64″V

The Slovak Paradise is considered to be one of the most beautiful natural areas in Slovakia with numerous chasms, waterfalls and karst forms.

To make the hardly accessible places approachable, several footbridges spanning the chasms and valleys were built. The chain footbridge crossing the chasm of the Hornád is one of them. The year 1972 is engraved on the concrete foundation, but it is not clear whether it is the year in which the footbridge was built or reconstructed.

SUSPENSION FOOTBRIDGE AT THE RIVER MOUTH OF THE VALLEY KLÁŠTORSKÁ DOLINA

GPS +48° 57′ 10.87″S +20° 25′ 22.51″V

On the tourist route by the gorge of the river Hron, there are altogether seven steel footbridges, some of which have a suspension structure.

The bridge deck of the footbridge is connected to the suspension cables by chain hangers. It was reconstructed in 2004, which is testified by a steel commemorative plaque stating also information about the designers and constructors.

Picture taken before 1945

SLOVENSKÝ RAJ

CARTHUSIAN BRIDGE

GPS +48° 57′ 16.67″S +20° 26′ 30.64″V

This historic bridge of the Slovak Paradise is situated in the area of Letanovský mlyn on the access road to Kláštorisko (Monastery). It was built by the monastic order of the Carthusians from the former abbey.

The monastery, to which the bridge led, is to be found on a high plain also called Lapis Refugii (the rock of refuge) named because the inhabitants of the region Spiš hid there during the Tartar raids in 1241. The monastery itself was begun to be built by the inhabitants thankful for their rescue when the danger was gone in 1305. The first colony of monks came there in 1307. The monastery had been gradually growing throughout the 14th and the beginning of the 15th century, until it was plundered by the Hussite troops in 1433. At the turn of the 15th and the 16th century, it was radically rebuilt by skilful masters, who had previously worked on majestic buildings of the Zápolský family in Poland. However, it was attacked by robbers shortly after its completion in 1543 and to prevent them from hiding there, the nobility had it pulled down in the same year. Probably towards the end of the 15th century, the bridge across the river Hornád was also built within the access road. It served until the end of World War II when it was destroyed by a German squad. The bridge was not rebuilt until 1995. There are two commemorative plaques on this approximately 40 m long bridge. One of them states the information about its reconstruction and the second is dedicated to the memory of two men who died in an accident during the reconstruction works. The original clear span of the bridge was 12 m and it was made 2 m longer after the reconstruction, which except for stone, also used reinforced concrete as a structural material.

SLOVENSKÝ RAJ

STEEL FOOTBRIDGE NEAR THE NECK OF THE HORNÁD RIVER

GPS +48° 57′ 44.13″S
+20° 24′ 09.90″V

The river Hornád, over which the before mentioned bridges are spanning, leaves the Slovak Paradise in the so called Neck of the Hornád.

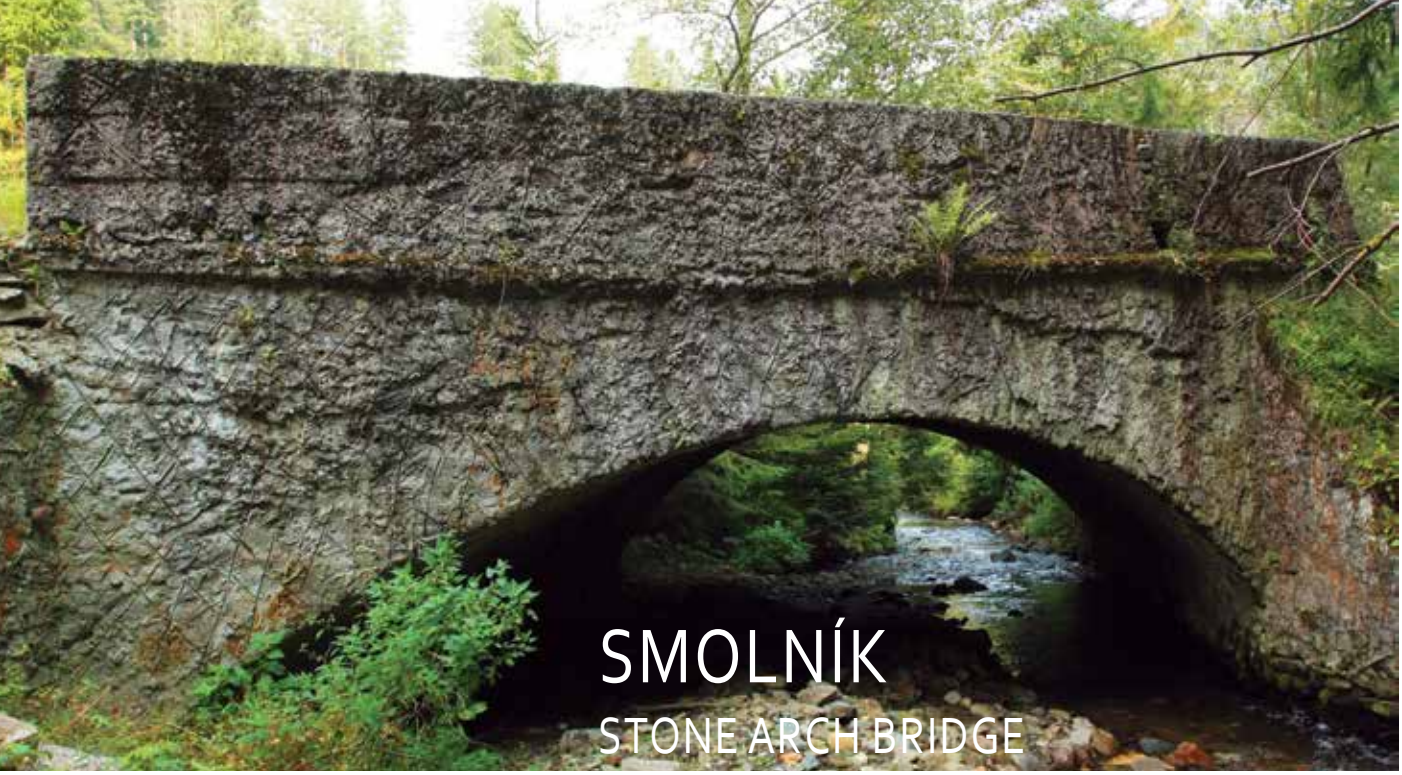
Here, a simple steel footbridge was built and it represents a kind of entrance to the tourist route leading through the chasm of the Hornád.

THE RECHLE BRIDGE

GPS +48° 54′ 49.72″S
+20° 25′ 07.48″V

Once, water streams were mainly used for transporting wood in the area of the Slovak Paradise.

To release the wood logs which piled up in front of the sluice, small, usually timber footbridges, also called "rechle", of this kind were used. With the help of so called spars it was possible to manipulate the trunks so that they were released and through a ramp they were launched to the river. In the part of the Slovak Paradise called Klauzy, one such footbridge has been preserved. Its span is five metres and it is also registered as a national cultural heritage. Unfortunately, a few years ago the wooden ramp, through which the trunks used to be released to the river, collapsed.



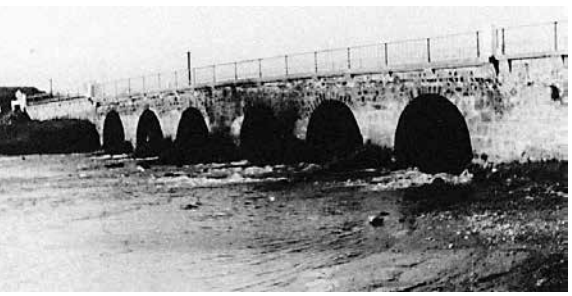
SMOLNÍK

STONE ARCH BRIDGE

GPS +48° 42′ 59.27″S
+20° 42′ 38.82″V

Smolník became famous mainly as a mining town. There is a legend about its establishment that there was a secret corridor leading from the local stream to the place of the contemporary tobacco factory, where the inhabitants escaped during the Tartar invasion.

In 1327, the town was granted mining privilege to extract metallic ore. In the following years the town suffered from robberies, illnesses, famine, fires and oppression. Despite the cruel fate, the inhabitants always pulled round and continued to work mainly in the mining industry. During the most favourable times, there was a mint, a theatre and also a mining school in the town. At the end of the 19th century, when the mining industry began to decline, the town began to transform into a town of weekenders. Besides the memories, a quite unusual skewed stone arch bridge has also been preserved. It is situated on the road to Úhorná and its unusually shaped arch built in the year 1890 has a clear span of approximately 6.2 m.

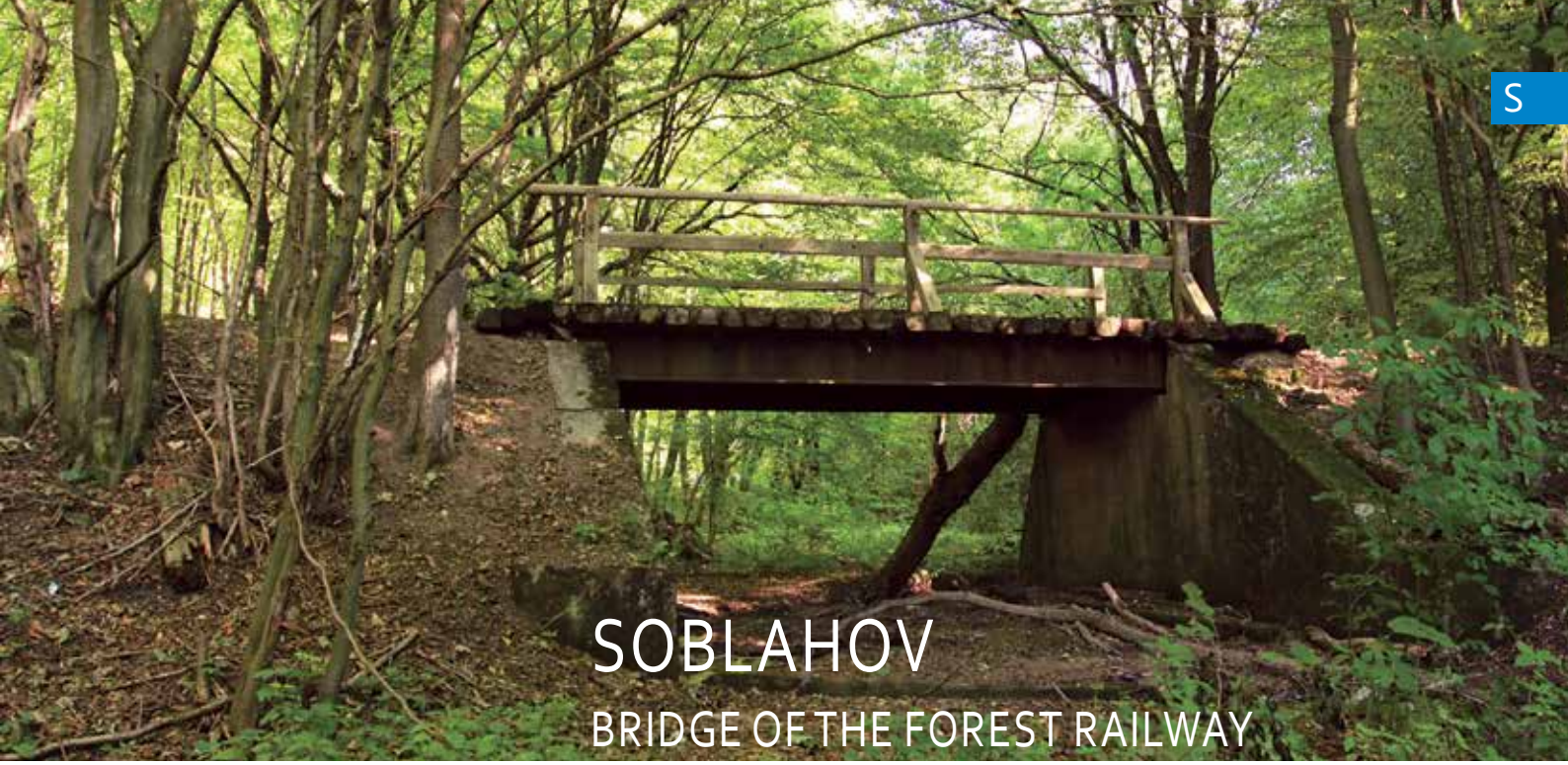


SOBÔTKA

HISTORIC STONE ARCH BRIDGE

In today's urban district in Rimavská Sobota, a castle was built on the initiative of John Giskra. However, shortly after its completion it was seized by the king Matthew and was immediately destroyed.

In 1555, there was a Turkish fortress standing on its ruins, from which the Turkish troops set on their campaigns. For the first time, the fortress was recaptured by Christian troops in 1566, but one year later it was in the hands of the Turks again. It was definitively conquered in 1593, when its destruction was completed and it has not been reconstructed since. However, up until the middle of the 20th century, a bridge built by the Turks across the river Rimava was preserved. A legend says that it was built so that girls could easily be transported to the harem near Nižná Pokoradz. Anyway, the real reason was to gain greater control over Rimavská Sobota, which was before its completion quite a difficult task because of the insecure fords. The bridge was destroyed by a flood in the 60s of the 20th century.



SOBLAHOV

BRIDGE OF THE FOREST RAILWAY

GPS +48° 51' 38.61"S
+18° 06' 35.00"V

Wood was transported on the forest railway line connecting Trenčín with Selce between the years 1912 and 1930. Today only one small reconstructed bridge with a wooden deck remains preserved.

The reconstruction of the bridge with a span of approximately 5.5 m took place in 1996 and today a tourist route crosses it. There is an information board nearby, where besides the basic data, there is also the poem called "Posledný Mohykán" (The Last of the Mohycans) dedicated to the bridge. Its author is Ondrej Mrázik and he composed it to pay respects to the constructors of the bridge. The text of the poem is transcribed at the end of this book.

SPIŠSKÁ SOBOTA

HISTORIC STONE ARCH BRIDGE

This once independent settlement has been a part of Poprad since 1950. Its history has been closely connected to the town since its establishment.

In the past, Spišská Sobota was, thanks to its excellent international relations, an important cultural and economic centre of the upper region of Spiš. Meetings of merchants, intellectuals and significant constructors from all over the Europe took place there. Furthermore, it was the hometown of famous sculptors Ján and Fridrich Brokoffka, the statues of who decorate the Charles Bridge in Prague. In 1954, a well-preserved part of Spišská Sobota was declared a conservation area. The image of the stone bridge on the road to Poprad was preserved only on the postcards from the beginning of the 20th century.

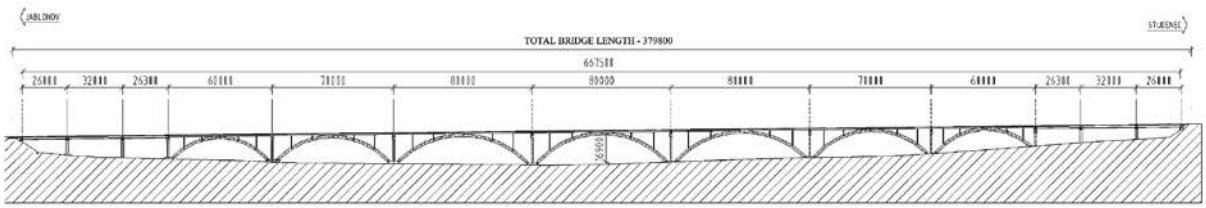
SPIŠSKÉ PODHRADIE

STEEL ARCH BRIDGE

GPS +49° 00′ 29.33″S
+20° 42′ 59.72″V

The highway bridge is situated nearby a historic village just under the Spiš Castle ruins. The castle was built on strategic high ground on a limestone rock.

This site was probably inhabited already in the Neolithic age, but the first stone walls date back to the 11th century. An interesting aspect of the site is also a large several hundred metres pattern formed from stones by the sculptor A. Rogers in 2008. It is one of the series of twelve geoglyphs, the other parts of which are for example in Chile, Israel, Sri Lanka or Iceland. In order to retain the historic character of this locality, it was decided that the shape of the bridge should reflect the region's history. Thus a 13-span bridge was designed with an overall length of 680 m. Seven of its middle spans are composed of steel arches. It must be emphasized that the geology of the place is quite unsuitable for the construction of an arch bridge and therefore complicated foundations had to be built, which was a penalty to be paid for the architecture of the bridge. The bridge was built in the years 2007 – 2012 by the company Doprastav. The maximum span of the steel arch is 80 m and as well as the foundations, the deck and six side spans are also made of concrete. Construction supervision was carried out by the company Amberg Engineering Slovakia.



SPIŠSKÝ HRHOV

HISTORIC STONE ARCH BRIDGE

GPS +49°00' 08.76"S +20° 38' 30.09"V

From the former roads point of view, the town of Spišský Hrhov had a geographically very suitable position.

It was situated on a crossroads of important routes within which a 40 m long stone arch bridge was built in the years 1803 – 1808 under the supervision of the road inspector Andrej Probstner. It crosses the Lodzina stream with four arches the clear spans of which vary between 5.5 and 5.8 m. There are 2 m wide piers with cutwaters, which in fact probably have only a decorative purpose. The deck is drained by openings above the top of the arches. Just next to the bridge, there is a small timber footbridge with nice carved statues. This stone arch bridge is one of the nicest preserved stone bridges in Slovakia.

STANKOVANY

CABLE-STAYED BRIDGE

GPS +49° 08′ 43.39″S
+19° 10′ 10.88″V

This rare type of structure crosses the river Váh in Stankovany and was built in 1992 replacing the original timber footbridge from the year 1954.

Stay configuration is created by solid bars divided into several branches; thus the deck is supported in multiple points. The main span is 60.4 m.

STARÁ ĽUBOVŇA

SUSPENSION FOOTBRIDGE

GPS +49° 18′ 12.60″S
+20° 40′ 51.98″V

The footbridge was built across the river Poprad in 1989 nearby a screw factory. It significantly shortened the way to work for more than a thousand employees.

Although the footbridge is stiffened additionally by tensioned lower cables, it has been labelled as a swinging bridge by the locals. The suspension footbridge with inclined pylons being 24.5 m high has an overall length of 82.6 m including the anchorage blocks.

STARÁ VODA
FOUR-ARCH RAILWAY BRIDGE

GPS +48° 48' 29.30"S
+20° 40' 40.15"V

The bridge is on the railway line Červená skala – Margecany, which was put into service in 1936.

The bridge is composed of four concrete arches faced with stone. Three of them have a clear span of 8 m and one of the middle arches has a clear span of 12 m. Similar to many other bridges, this one was also destroyed at the end of World War II and was for some time substituted by a temporary timber bridge.

STRATENÁ
RAILWAY BRIDGE

GPS +48° 52'04.88"S
+20° 20' 51.13"V

This bridge was also built within the railway line Červená Skala – Margecany, between Dobšinská Ľadová Jaskyňa and Mlynky. This section of the railway line was put into service in 1935.

The bridge has two side spans of seven metres and a main span consisting of 18.5 m long steel girders. The bridge in Stratená is a nice example of a simple, small and at the same time a very elegant structure.

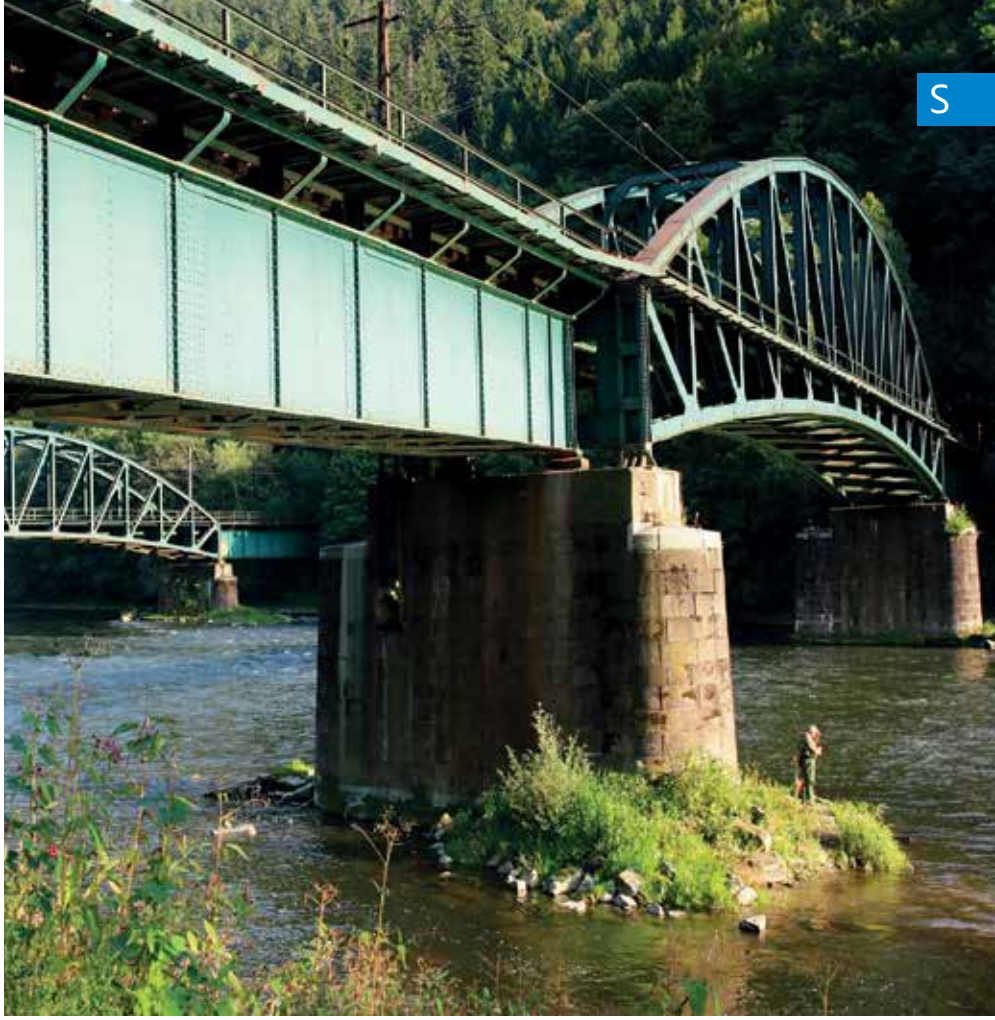
STREČNO

FOOTBRIDGE UNDER THE CASTLE

GPS +49° 10′ 46.31″S
+18° 51′ 53.59″V

The castle, the landmark of the village Strečno, was built in the 13th century on a high rock, probably on the remains of a Slavic castle. The body of Zofia Bosniak was found in its ruins in 1689 and this fact together with the history of the castle makes this place quite interesting.

In the days of the discovery, Zofia had already been dead for 45 years and even though her body was not embalmed, it remained preserved. Many people were convinced that she was a saint and they exhibited her body in a church in Teplička nad Váhom. Unfortunately, this more than 350-year-old mummy was set on fire by a mentally disturbed man in 2009. The reconstructed castle offers a great view of the bridges spanning over the river Váh. One of them is an approximately 150 m long steel footbridge connecting the Strečno village with the village of Nezábudská Lúčka.



Bridge from the year 1909

Temporary bridge in 1945

Temporary bridge next to the destroyed structure, 1945, *photo: ŽSR MDC*

PAIR OF RAILWAY BRIDGES

GPS +49° 10′ 14.15″S
+18° 52′ 30.48″V

The first railway truss bridge was built here back in 1871. The truss structure was originally also applied to the side spans of the single track railway bridge, which could be seen on historical photographs.

When the railway line was rebuilt in 1939 to a double track, a new bridge was built next to the old one and the steel structure of the old bridge was changed. The bridge was at that time already 70 years old. Both of these bridges were damaged through World War II several times. It was the Partisans who temporarily repaired it in late august of 1944 and so put it back into service. However, the bridges were completely destroyed towards the end of the war; one of them was blown up with five locomotives placed on it. Therefore it was necessary to quickly build a new temporary steel bridge on wooden piers, which served till the end of 1946, when both of the bridges were put back into service. To make quick reconstruction possible, up to 500 people in three shifts were working on the construction site. The reconstruction on the left track was complicated by the locomotives stuck between the ruins, which had to be removed. The bridges were reconstructed following the original drawings with plate girders in the side spans being 29.4 m long and with truss structures of the middle span being 57.4 m long.

STUPAVA

BRICK BRIDGE

GPS +48° 16' 26.31"S
+17° 01' 57.26"V

The history of Stupava is connected to a Roman military camp built on a small hill, from which the area of Bratislava and the strategic, so called amber route could be controlled.

After the Roman withdrawal, Slavic tribes settled here until the birth of the Hungarian Empire at the turn of the 11th century. To secure this strategic place, a stone castle was built here in the second half of the 13th century, today known as Pajštún. Only its ruins had been preserved. Another castle from this period is the so called water castle, which was begun to be rebuilt in the middle of the 17th century to a fortified early baroque castle with four corner towers. However, its contemporary shape dates back to the 19th century, when it was rebuilt in Roman style. The original moat is bridged by a 20 m long bridge with five arches having a clear span of 2.7 m. The last arch is nowadays walled up. The most valuable part of the bridge is the two sculptures of lions placed on its beginning. Once they were the end parts of the brick parapet which was later replaced by a temporary steel handrail. Presently, the bridge is in a very poor state and a part of the arches has already collapsed.

SUCHÁ NAD PARNOU

BRICK BRIDGE

GPS +48° 24' 36.63"S
+17° 29' 47.07"V

In the village situated near Trnava, there were several brick factories and in consequence there are various brick bridges in this area. One of them is a 30 m long bridge composed of four arches with clear spans of 3.6 m.

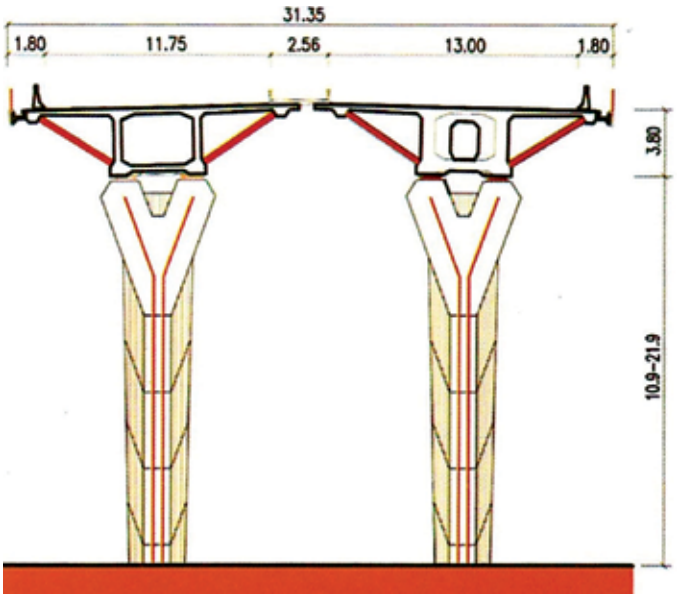
The bridge was built in 1870 and although it is was nicely reconstructed; it has been spray-painted all over by some vandals.

SVEREPEC
HIGHWAY BRIDGE

GPS +49° 04′ 16.89″S
+18° 24′ 03.82″V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The 443 m long highway bridge was finished in 2005 within the D1 highway.



The superstructure is composed of a box section with the upper deck slab supported by inclined struts. The colours of the bridge were used to emphasize particularly these struts and the line of the piers. The reason for this design, quite unconventional for highway bridges outside towns, is the presence of a sporting site where international motocross races are regularly organized. There is also a parking lot under it. Thus, the bridge was designed not only as a functional structure, but also as an architectural element completing the area. The design of the highway bridge was done by the company Dopravoprojekt and it was constructed by the company Doprastav.

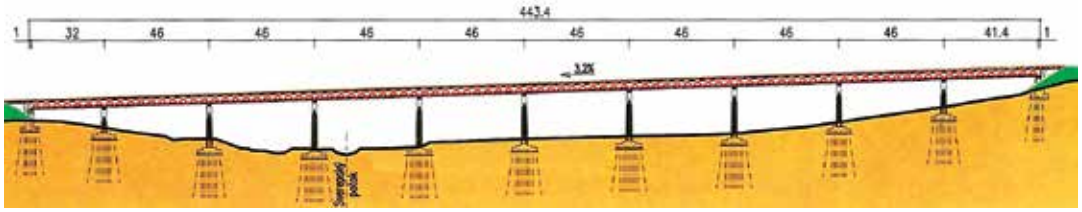


photo: Ing. Miroslav Maťaščík

SVIDNÍK

PIPELINE BRIDGE

GPS +49° 18' 17.34"S
+21° 34' 21.90"V

Nearby Svidník, in the so called Death Valley (originally Dukliansky priesmyk), one of the harshest fights took place during the passage of the Russian front across the Carpathian Mountains.

In memory of the fallen soldiers a memorial was built, which together with the wooden open-air museum, belong to the most visited parts of eastern Slovakia. In the shadow of these interesting buildings, there are also some simple bridges across the Ladomírka River. However, one of them is quite special. It is a 50 m long pipeline bridge composed of plate girders shaped by cutting hexagonal openings into the webs. Also the piers designed as concrete cantilevers are very unconventional.

SVRČINOVEC

CONCRETE BRIDGE

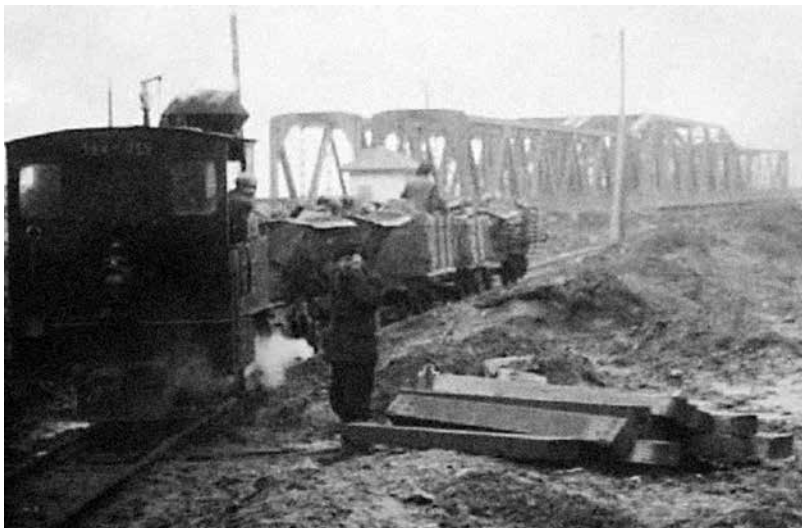
GPS +49° 28' 47.76"S
+18° 47' 38.41"V

Nearby the border crossing with the Czech Republic, a concrete bowstring arch bridge with a span of 32 m crosses the river Čierňanka. The reinforced concrete bridge was built in 1931, but due to its poor technical state, it had to be strengthened in 2002 by massive steel profiles anchored to the arch of the bridge.

Nevertheless, this strengthening is scarcely visible when crossing the bridge and from the underside view it creates an aesthetically interesting structure. Another example of a similar, but much more sensitive reconstruction is the reconstructed bridge in Dolné Plachtince.

SZOB (HUNGARY)

CROSS-BORDER RAILWAY BRIDGE



Bridge from the year 1859

Bridge during its reconstruction carried out in 1900

Czechoslovak and Hungarian soldiers on the bridge in 1919 (before the Treaty of Trianon)

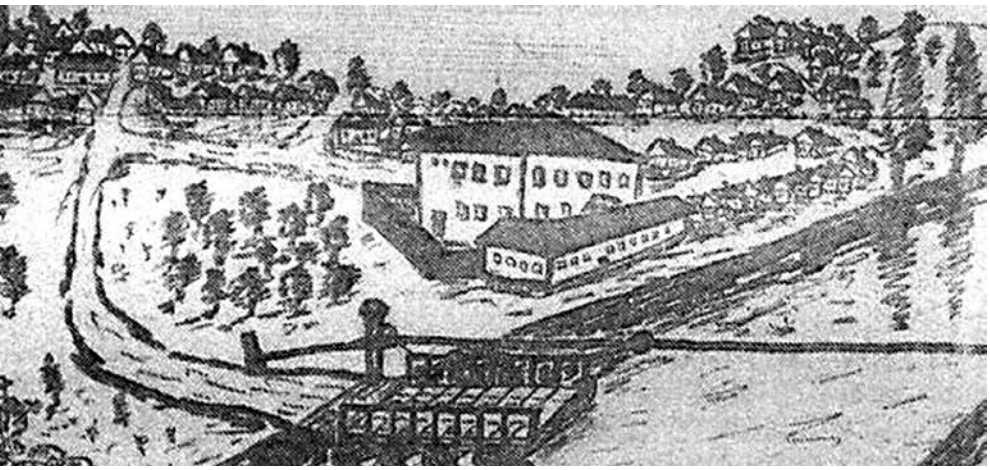
GPS +47° 49' 25.00"S
+18° 51' 10.30"V

The railway between Štúrovo and the Hungarian town Szob was put into service in 1850. Numerous bridges were built within it crossing the river Hron and Ipeľ. At first they were made of timber and later they were replaced by new steel bridges in 1859. These were the first riveted truss bridges on the former Hungarian railways.

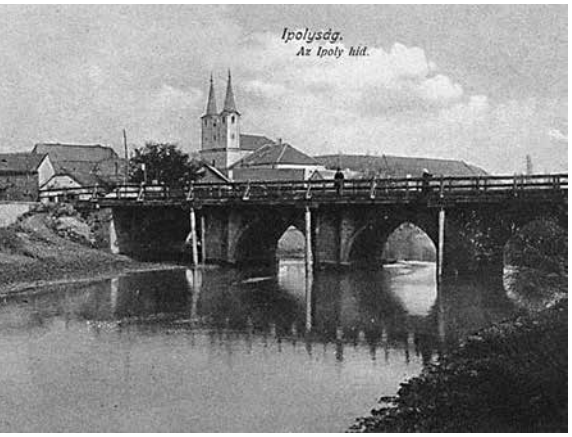
The author of the design was the engineer Ruppert. The middle span of the bridge near Szob had a clear span of 56.8 m and until the year 1867 it was the longest railway bridge span in the Hungarian Empire. The continuous three-span structure was made for two tracks, but the railway itself was single track up until 1893. Half of the bridge was thus unused for more than 30 years. Towards the end of the 19th century, shortly after the first trains crossed it, the bridge did not meet the requirements of the subsequently increasing weights of trains anymore. In 1900 it was rebuilt to a Pratt truss with curved top chord maintaining the original spans. After the Treaty of Trianon it became a border bridge and it was standing there till the end of World War II, when its whole structure including the piers was destroyed by German troops. After the war, reconstruction was carried out by the engineer Pál Savoy (the bridge in Hungary still bears his name). The foundations of the original piers were used and the spans remained unchanged. The main span of 59.4 m has an unchanged clear span of 56.8 m. The new bridge also resembles the original bridge from 1859 in shape.

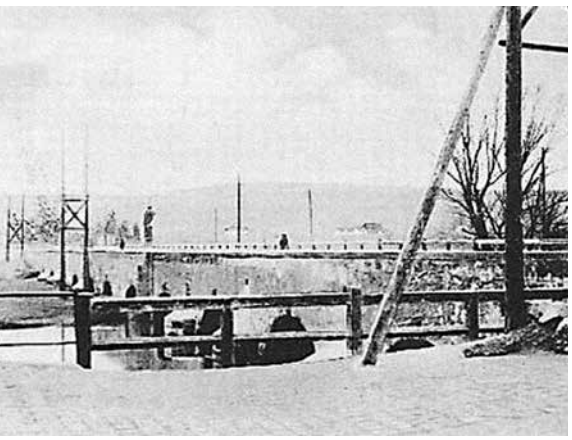
ŠAHY

HISTORIC STONE ARCH BRIDGE



The ferryboat at the place of the later stone arch bridge





The first written record about the settlement originally called Saag dates back to 1237 when it appears in the document of Belo IV. An important event directly connected to bridge building in this region was the establishment of a monastery, the place of which was strategically decided by the town to be near the main road (leading to the mining towns), where it crosses the river Ipeľ.

Although shortly after its founding the monastery was burnt down by Tartar hordes, it quickly began to recover. It gradually gained the confidence of the inhabitants and in 30 years of its existence the traffic across the river Ipeľ raised to a degree such that the existing ferryboat was not sufficient anymore. For this reason, in 1266 king Belo IV ordered the building of a bridge and granted the right to collect the toll to the Premonstratensians. During the Turkish wars, after the fall of Budín, Vácov and Esztergom, in 1546 the Viennese government decided to reinforce the monastery to make a castle. In its neighbourhood, at the Dregely Castle, in 1552, an uneven battle took place, in which the defenders of the castle were outnumbered by the Turkish troops. Almost all the fighters protecting the castle died in this heroic battle, but at least they succeeded to delay the enemy, so that the valuable archives of documents stored in the nearby monastery could be saved. The Turks built a new timber bridge across the river in the east of Šahy from where they guided their raids. They left this area in 1685, when the Christian troops were approaching. In 1688, king Leopold I gave the local dominion to the Jesuits who took good care of it. They also built a new stone arch bridge finished in 1769 which served up until the end of World War II. It played an important role also during the Hungarian revolution in 1849 when it formed a defensive line of the Hungarian army. The Hussars were defending the bridge against the imperial army up until the rear-guard left the town. However, the rebel army together with the militia did not rejoice in the success for a long time, since several months later they suffered a crushing defeat and they laid down their arms at Világos. Today, the river is spanned by concrete bridges. In memory of the old route and the historic bridges, a statue of St. John of Nepomuk was built here in 2010. It is similar to the one which used to stand in the middle of the stone arch bridge.

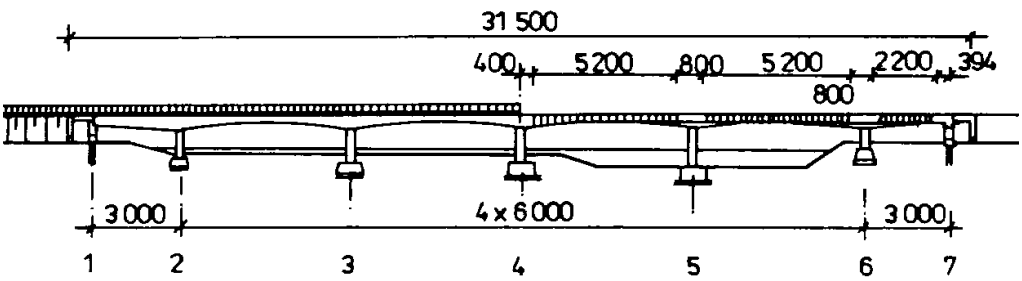
ŠAĽA
CONCRETE BRIDGE

GPS +48° 09' 37.35"S
+17° 52' 49.00"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

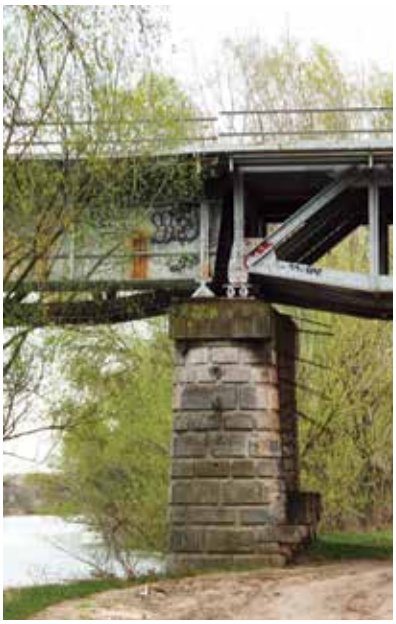
Besides a railway bridge, there is also a road bridge across the river Váh. It was built in the years 1973 – 1978.

In its immediate proximity, there used to stand one of the few bridges which survived World War II without any major damage. It was built in1913 and it was 300 m long. The structure was composed of five truss spans with a 4.8 m wide deck. Later, it was found that the width of the deck did not meet the requirements of the increasing traffic anymore and therefore a new bridge had to be built.
For the building of the new bridge, the balanced cantilever method was used. With the maximum span of 60 m and with benefit of previous experience, a quite slender superstructure was designed, with an average depth ranging between 2.23 m in the middle of the spans and 2.77 m above the supports. When the bridge was finished and loading tests were done by the Department of Concrete Structures and Bridges STU in Bratislava, it was discovered that the behaviour of the bridge was not in agreement with the calculations; the cause was higher friction of the bearings. Nevertheless, after further calculations and after taking into consideration the real behaviour of the bearings and its effect on prestressing, the bridge eventually met the prescribed requirements.



ŠAĽA
RAILWAY BRIDGE

GPS +48° 08′ 56.32″S
+17° 54′ 14.72″V



The 445.8 m long bridge crosses the river Váh between the railway stations of Šala and Trnovec nad Váhom.

Until 2005 it was the longest railway bridge in Slovakia (the cross-border bridges are not taken into account, since half of them are in different states). The original bridge stood here already in 1847 and since then it has been reconstructed and rebuilt several times. The present structure is composed of 14 spans being approximately 31 m long, while parts are made of truss girders and others are steel plate girders.

ŠAMORÍN

CABLE-STAYED FOOTBRIDGE

GPS +48° 00′ 33.20″S
+17° 18′ 23.67″V

The footbridge was built within the local recreation area Čilistov in 2006.

Its purpose is to connect the local hotel with the riverbank of the Danube. It is 52 m long and its main span is supported by rod stays anchored on the top of the pylons (fan arrangement). This footbridge crossing the lake is a good example of a nice and at the same time structurally simple and effective bridge. Its span is approximately 23 m long.

ŠENKVICE

THE LONGEST RAILWAY BRIDGE IN SLOVAKIA

GPS +48° 18′ 25.00″S
+17° 19′ 05.30″V

Modernisation of the railway between the railway station Bratislava-Rača and Trnava as well as the increasing of the line speed to 160 km/h necessitated the construction of a railway flyover.

Designers proposed a bridge instead of high embankments concerning its possible excessive settlements caused by weak subsoil conditions. After several proposals of different types of steel bridge in the final stage prestressed concrete bridge was chosen as a best alternative. It consists of 20 simply supported spans of 35 m and its overall length reaches 740 m. First train crossed the bridge on june12, 2005.

ŠELPICE

GPS +48° 26' 04.21"S
+17° 31' 53.98"V

ST. JOHN'S BRICK ARCH BRIDGE

The bridge between the villages of Šelpice and Bohdanovce nad Trnavou was built back in the 19th century and served the local inhabitants until the beginning of the 21st century, when it was classified as structurally deficient.

MSc. Frantisek Brlit's structural report declared only an uncertain residual load bearing capacity, while the bridge itself probably remained standing only with the help of St. John of Nepomuk, the statue of whose was placed on the bridge in 1907. It was the mayor of Bohdanovce village who appealed for its reconstruction the most and he finally succeeded in obtaining sufficient funds. On the 29th of August 2010 the bridge was put into service again. The statue was also restored and thus St. John of Nepomuk can keep protecting it. After the reconstruction, this bridge is one of the most beautiful brick arch bridges in Slovakia.

Bridge before the reconstruction

ŠTEFANOV NAD ORAVOU

ARCH BRIDGE

GPS+ 49° 21' 37.22"S
+19° 32' 56.20"V

Another bridge from our series of concrete arch bridges was built in 1950 and the span of its arch is 60 m. In the later years of the 20th century, it seems as if concrete arch bridges have (with a few exceptions) sunk into oblivion.

One of the reasons why it happened was the boom of prestressed concrete. Using it, the construction of bridges became more efficient and faster and it completely drove arch concrete bridges out of competition, although in some surroundings they look very impressive. This bridge is also noticeable thanks to its bridge deck covered by cobblestones, which immediately wake up the vehicle drivers from a monotonous drive.

ŠTRBA

BRIDGES OF HIGH TATRA'S ELECTRIC RAILROAD

GPS +49° 07' 06.54"S
+20° 04' 03.34"V

The first part of the railway line connecting Štrbské Pleso to Štrba was put into service in 1896. There was also the station of the train operating between Košice and Bohunín.

On the 5 km long track, it surmounted an altitude difference of 430 m, which was quite a difficult task for the locomotives of that period. The train station in Tatranská Štrba was then on the other side of the track and a simple footbridge spanning over the track was built there in order to reach it. After getting off the train, the passengers crossed the footbridge to reach the rack railway leading to Štrbské Pleso. This original track served for 37 years. Its operation was stopped in 1933 and the track was dismounted. Its reconstruction did not begin until the oncoming World Ski Championship held in Czechoslovakia in 1970. Some new concrete bridges across the road leading to Štrba were also built and the bridges of the electric railroad between Štrbské Pleso, Poprad and Tatranská Lomnica were reconstructed. Despite their simple structure, they are the highest elevated bridges serving railway transport in Slovakia. The one situated the highest is at an altitude of 1,300 m on the track leading to Smokovec.

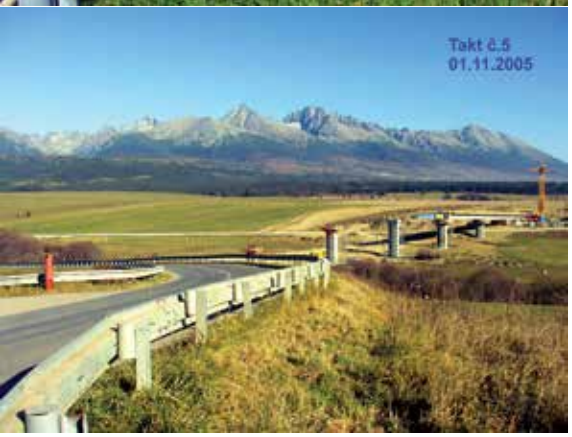


photo: Ing. Matúš Búci

CONCRETE HIGHWAY BRIDGE

GPS +49° 03' 50.73"S
+20° 04' 59.62"V

The bridge outside Štrba is the first Slovak concrete bridge built using incremental launching technology.

With this method, the bridge is first constructed behind one of the abutments from where it is gradually launched above the valley on sliding bearings with the help of hydraulic jacks. The method proved to be very effective and since those days at least one bridge on every major highway section has been built with this technology. I had the opportunity to work on construction of this project crossing the valley under the High Tatra Mountains as an employee of the Doprastav Company, which constructed the bridge in cooperation with a German company Max Bögl. The main construction manager was MSc Matúš Búci, who had previous experience with the construction of similar bridges in Germany. The overall length of the bridge is 609 m and the maximum span is 41 m. Except for the periods of extreme cold when the temperature was below minus 30 °C, the building advanced at a speed of 80 m (of the bridge) per month. The bridge was completed in 2007.
Many local inhabitants helped with the construction. They mainly worked during the days of launching and their task was to place the sliding plates between the bridge and the special sliding bearing. During the last launch, more than 30 ancillary workers were present on the piers.

ŠTRBSKÉ PLESO

CROSS COUNTRY SKI BRIDGE

GPS +49° 07′ 21.90″S
+20° 03′ 50.52″V

Since the area of Štrbské Pleso is a winter sports region, a concrete arch bridge was built across the road within the cross country ski track to serve the sportsmen.

It gives an impression of an entrance gate to the sporting site.

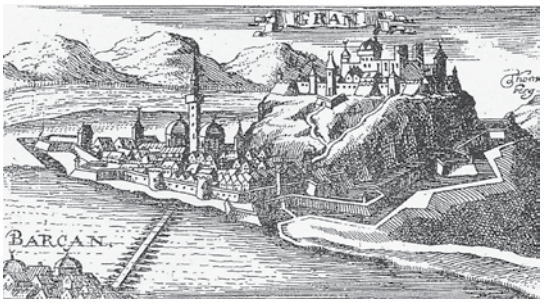
ŠTURECKÁ CESTA

HISTORIC STONE ARCH BRIDGE

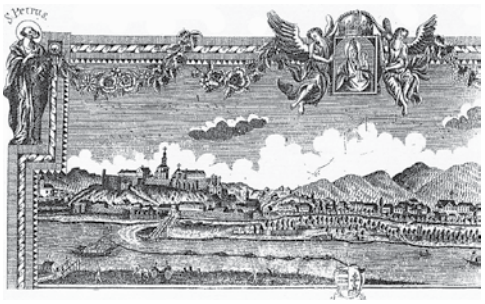
GPS +48° 52′ 17.00″S
+19° 09′ 51.00″V

Nearby Banská Bystrica in the direction to the Šturec hill, there used to be a stone arch bridge up until the beginning of the 20th century, which was probably built within the reconstruction of the local road in the 50s of the 19th century.

The picture of the bridge has been preserved on a postcard from the turn of the 19th and the 20th century. I have not succeeded in finding its definite position, but I found remains of a structure which could have been this bridge.



Turkish pontoon bridges in the years 1664 (upper image) and 1585



So called "flying bridge" in 1762

ŠTÚROVO

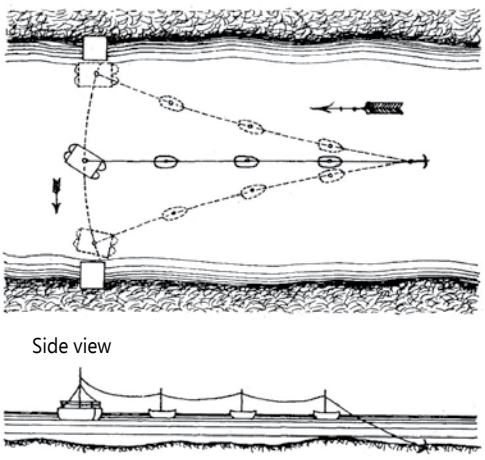
MARIA VALERIA BRIDGE

GPS +47° 47' 43.15"S
+18° 43' 45.97"V

General Designer of Reconstruction:
DOPRAVOPROJEKT a.s., Bratislava, Slovakia,
Pont-TERV, Budapest, Hungary

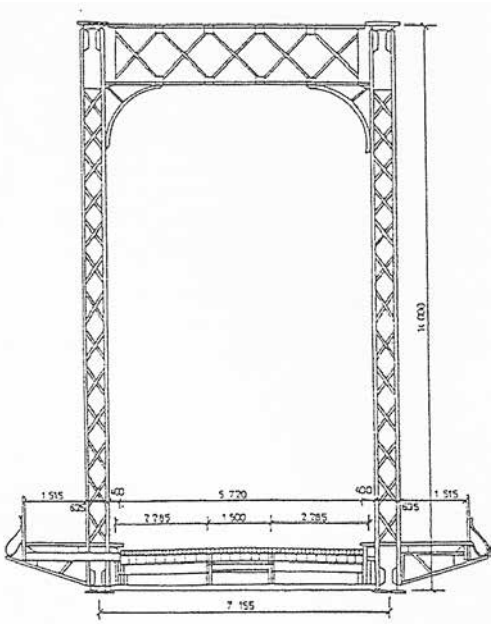
Hardly any bridge has such a rich and quite well recorded history as this bridge connecting the Štúrovo town with the Hungarian town of Esztergom.

According to archaeological research it can be assumed that the ford across the Danube existed here back in the Bronze Age. The first written record dates back to the Roman period, more precisely to the second half of the 2nd century. When this area was later occupied by the Magyars, a permanent ferry already existed, on which a toll was collected for the Esztergom abbey. In 1543, Esztergom was conquered by the Turks, who immediately took over the ferry. However, it was not sufficient for quick movement of troops and thus in 1585 Sinan, the pasha of Buda, ordered the building of a pontoon bridge which served for more than 100 years. The bridge, which consisted of 54 bladder pontoons, could be quickly opened, which enabled free passage of the navigation on the Danube. Although the bridge was partly damaged by imperial troops in 1663, it was completely destroyed only later, by the overload caused by the withdrawing Turkish army and the cannonade during the battle of Parkany in 1683. After the liberation of Esztergom it was not renewed and once again, only a ferry was in operation. The pontoon bridges could be seen on various period engravings, from which it is evident that it gradually changed its position and moreover, there were times when two pontoon bridges existed next to each other.
In 1762, the ferry was replaced by a so called flying bridge consisting of a ferryboat tied up to a fixed point by an approximately 400 m long rope. To make its movement easier, the rope was supported on a system of seven boats placed approximately 50 m from each other. Since the ferryboat was directed in an oblique position against the current, the stream made it move and the crossing itself took between from 6 to 8 minutes, which is quite a good performance when compared to the motorised ferries of the 20th century. The flying bridge between Parkany (Štúrovo) and Esztergom was operating till 1842 when a 6.2 m wide pontoon bridge was built on 40 boats. The cost of its construction was four times higher than the cost of the flying bridge, but since its capacity was much greater, higher income from the toll was expected. The bridge was partially damaged in the years of the Hungarian revolution in years 1848 – 1849, when it was set on fire. It was put back to service in 1851 and it served until a new steel bridge was built. Its appearance has been preserved on a period postcard from the end of the 19th century.

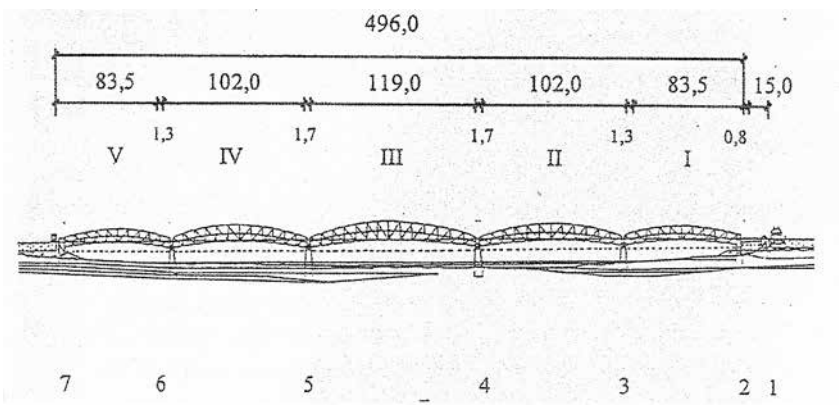


Principle of operation of the so called "flying bridge"

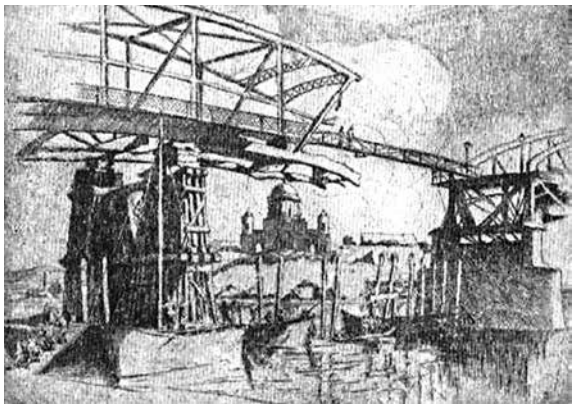
Boat bridge in 1895



When the Danube was already bridged between Vienna and Budapest by two other permanent bridges in Pressburg (1890) and Komárno (1891), demand arose for a permanent steel bridge in Esztergom. Geological research of the area was carried out in 1893 and the axis of the bridge was set 120 m upstream of the pontoon bridge, which enabled its continued usage during the construction. A five-span bridge with different spans was designed, while the biggest span reached 119 m. The steel truss structure of the bridge was designed as to also be able to carry the trains on a railway line which was planned to be built.
The shape of the bridge as well as its structural arrangement (simply supported girders: steel crescent type Pratt through truss) was designed by the engineer János Feketeházy, who was at that time specializing in bridge structures.
The substructure began to be built in February 1894 by means of the so called pneumatic caisson - in the air lock the work proceeded day and night. Despite the extraordinarily hard soil and the pressure of 2 atm., which prevented the

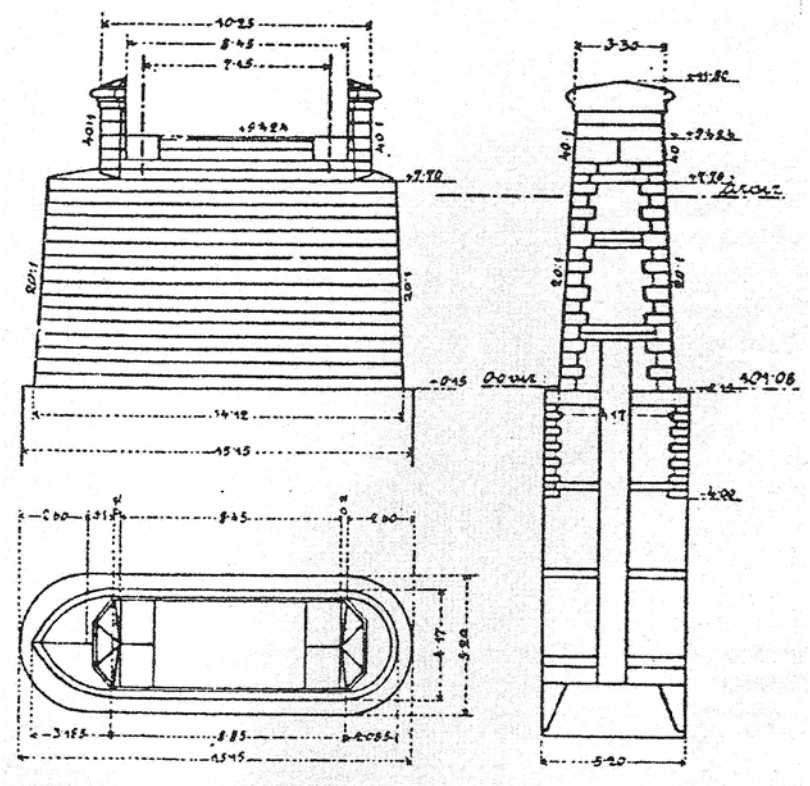


Destroyed first span in 1919

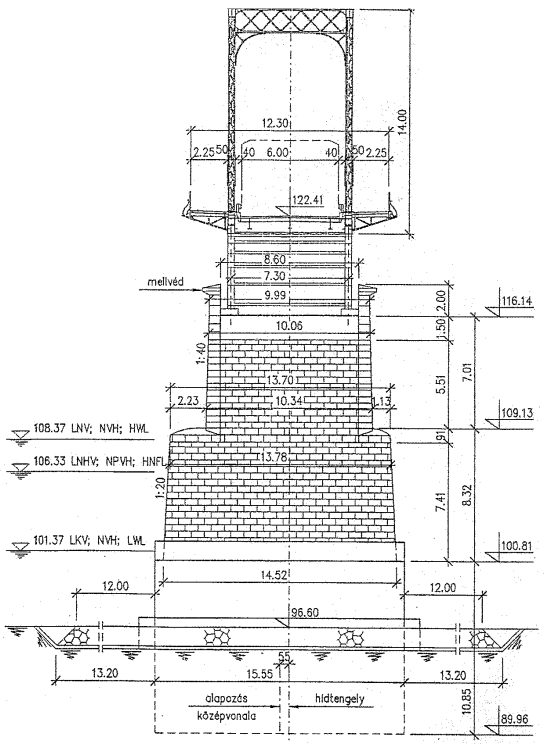


Bridge during the reconstruction in 1923

Temporary footbridge and the preparation works for the reconstruction, 1922



penetration of water into the caisson, approximately 10 to 40 m^3 of soil could be extracted every day. The foundations together with the piers near the river banks were completed already towards the end of the year 1894 when the steel superstructure began to be assembled. The construction of the bridge was led by the company Carthry Szaléz és fia, which kept detailed records about the process of the building; it states even the approximate composition of the concrete, which in those days was used very rarely. Other interesting information is the amount of steel used in the superstructure per one meter of the bridge – it was approximately four times less when compared to the Franz Joseph's bridge in Pressburg (Bratislava). The overall weight of the steel used for the bridge, including the amount used for another smaller 16 m long bridge on Esztergom's side, was 2.507 tons. The opening ceremony was held on the 18th of September 1895. Taking into consideration the techniques of the period, the speed of construction is quite unbelievable. From the moment when Carthry's company was entrusted with the task, it took less than 25 months to put the bridge into service. It served up until the end of World War I, when it was barricaded by the Czechoslovak army and on the 22nd of July 1919 a bomb exploded on it, damaging the first span on the Czechoslovak side (it is not clear whether it was a an accident or intentional). After this incident, a temporary footbridge was built and the matter of reconstruction was begun to be discussed.
The collapsed part had to be lifted to its original position and the damaged


12.30
14.00
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50
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122.41
8.60
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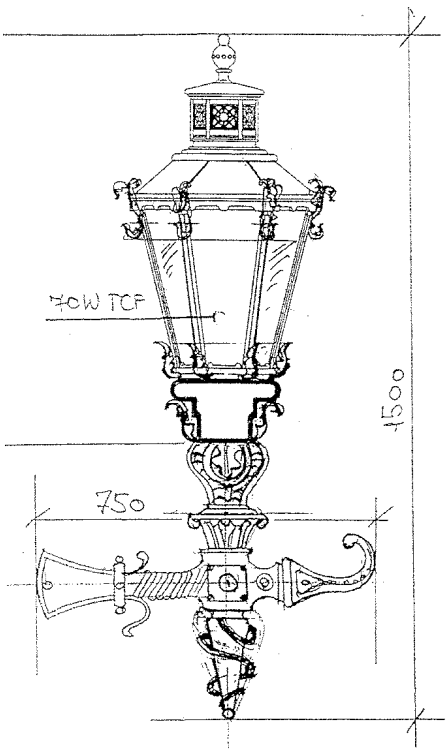
mellvéd
2.00
116.14
50
10.06
1:40
5.51
7.01
13.70
2.23
10.34
13
109.13
108.37 LNV; NVH; HWL
91
106.33 LNHV; NPVH; HNFL
13.78
1:20
7.41
8.32
101.37 LKV; NVH; LWL
100.81
14.52
12.00
12.00
96.60
55
13.20
15.55
13.20
alapozás
középvonala
hídtengely
10.85
89.96


70W TCP
1500
750

parts had to be replaced. It was not finished until 1927. The reconstruction of the steel structure was carried out by the Škoda company and the new reinforced concrete bridge deck was by the company of MSc Artúr Komlós. The next period of this bridge's life did not last more than 18 years, until the end of World War II. It seemed to be a miracle that it resisted several attacks and bomb runs without any damage. Nevertheless, its destruction was brought about by the technical squad of the withdrawing German army which destroyed the three middle spans in 1945. Afterwards, the Red Army built a temporary pontoon bridge which served only for several months. So that the navigation on the Danube was not endangered, the destroyed parts of the bridge had to be removed in the following years, but reconstruction took place only 50 years later and a motorised ferry was used instead. Different alternatives of reconstruction were discussed, but finally it was decided to preserve the original appearance and the reconstruction was finally finished in 2001. The only visible change is the higher piers resulting from the Danube river navigation requirements. Among others, the Department of Steel and Timber Structures STU in Bratislava headed by Prof MSc Zoltán Agócs, PhD also significantly contributed to the reconstruction.
Commemorative plaques were placed on the bridge, stating information about the building and the reconstruction. There is also the Slovak national emblem on the Slovak side, as well as the emblems of Esztergom and Hungary with the Hungarian saint crown on the Hungarian side of the bridge. Among those who contributed to the reconstruction are the companies: Ganz acélszerkezet, Inžinierske stavby Košice, Közgép and Dopravoprojekt Bratislava in cooperation with other minor subcontractors.

TELGÁRT

CHMAROŠSKÝ VIADUCT

GPS +48° 51′ 18.30″S
+20° 12′ 14.65″V

The bridge near Telgárt is a part of the railway between Červená skala and Margecany, which was built in the early 30s of the 20th century.

The technically most difficult part of the railway line was the crossing of the mountains near Telgárt village, where besides the tunnel, it was necessary also to build many bridges. One of the biggest ones is the 113.6 m long Chmarošský Viaduct, which crosses the valley at a height of 18 m. Reinforced concrete was used for the structure. The arches with a clear span of 10 m were faced with stone. This viaduct together with the Telgárt Bridge were the first railway bridges in Slovakia made of reinforced concrete

TELGÁRT
THE TELGÁRT BRIDGE

GPS +48° 51' 09.70"S +20° 11' 54.93"V

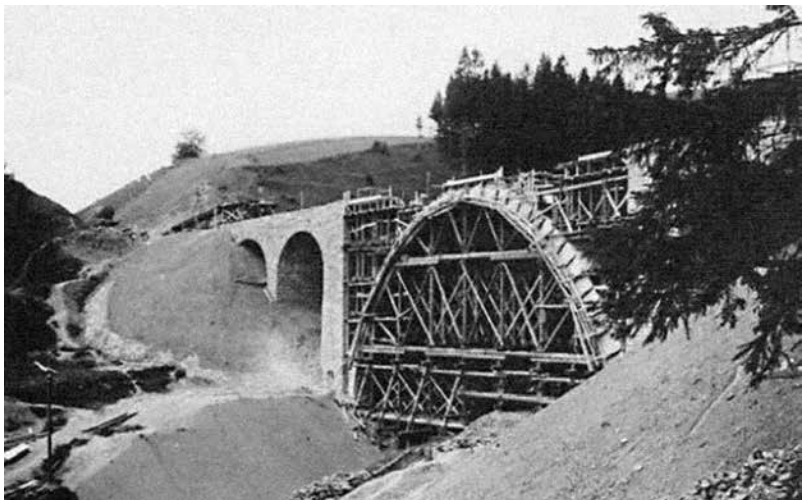
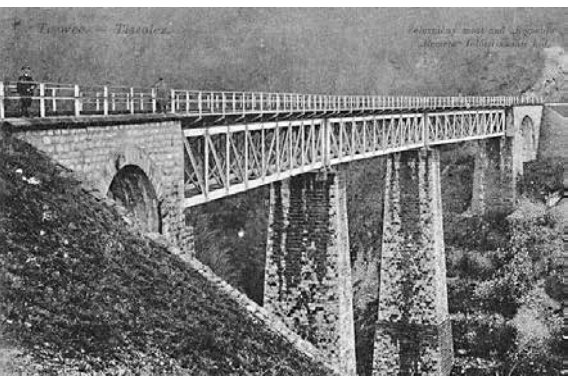


photo: ŽSR MDC

The second impressive bridge near the Telgárt village is the Telgárt Bridge.

It spans the valley at a height of 22 m and is more than 86 m long. Similar to the Chmarošský Viaduct, reinforced concrete was used in its construction and its main arch has a clear span of 32 m. There are smaller arches near the abutments with a clear span of 9 m. The bridge is located on the only spiral loop on the Slovak railways, the function of which is to overcome the altitude difference of approximately 31 m, while keeping the maximum gradient under 17‰. The railway crosses over itself some distance behind the bridge.



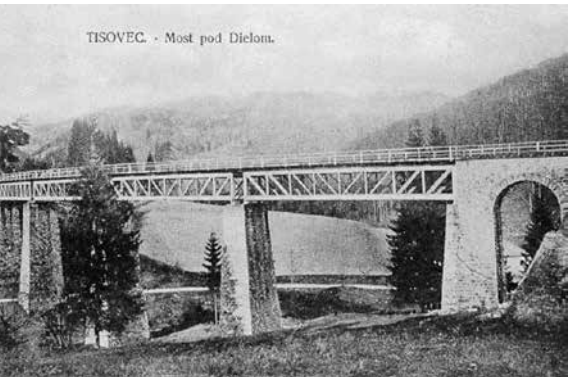
TISOVEC

GPS +48° 43' 54.98"S +19° 51' 24.63"V

ČERTOV VIADUCT (DEVIL'S VIADUCT)

Čertov Viaduct, meaning Devil's viaduct, is not an uncommon name for a bridge. Every country has its own Devil's Bridge and there is always a legend connected to its construction.

The story is more or less always the same: The builder of the bridge is unable to finish the construction in the assigned deadline despite all his effort and when he stands desperately in front of the unfinished work a devil appears and offers him help. In turn he wants to get the first soul who will pass through the bridge. The builder cannot do anything but agree. He succeeds in completing the bridge by the next morning. In the next day, the builder comes to the bridge and chooses a sheep to be the first creature to pass the bridge. Since the devil did not specify what kind of soul he desires, he has to take that of the sheep. Thus, the bridge is finished on time and no human loses its life or soul. The infuriated devil stomps angrily and leaves a print of his hoof on the bridge and returns to hell. This is the legend about the Devil's Bridge; however, I have not succeeded in finding the print of the hoof. Therefore I am inclined to think, that the name was derived from the Devil's valley (Čertova dolina), over which the bridge crosses. The bridge was built in 1896, it was 105 m long, but due to its destruction by German troops it had to be reconstructed after World War II. It is difficult to take pictures of this bridge because of the thick growth around it; I succeeded in photographing only its side span with a part of one abutment.



TISOVEC

VIADUCT POD DIELOM

GPS +48° 43' 32.21"S
+19° 51' 17.59"V

This viaduct is another example of an interesting bridge, the original structure of which was built in 1896.

The bridge is situated in a curve with a radius of 250 m and it was composed of five truss spans of 25 m and one arch span at each abutment. During World War II, partisan groups were the first to attempt to destroy the bridge to cut off the traffic on the railway. However, they did not succeed and the damage they caused was easily repairable. The bridge was opened for traffic as soon as one week after the attempt. Nevertheless, the bridge was later destroyed by the withdrawing German troops; the superstructure as well as the piers was blown up. Afterwards, a temporary, 156 m long, timber bridge was used instead of it for some time. This one was damaged several times by fires caused by live coals which fell out from the steam locomotives. Nevertheless, it served more than 10 years. In 1958 it had to be put out of service due its unsatisfactory technical condition which was caused by rotten supports. In the same year, it was begun to be demolished and a new bridge, which was to be the first fully welded railway bridge in Czechoslovakia, was begun to be built. The construction was designed by Prof MSc Arpád Tesár from STU in Bratislava. The spans of the renewed bridge are 28 m. It was put into service in 1959.

TRÁVNICA
BRICK ARCH BRIDGE

This arch bridge was built of bricks across the stream Lyska and it connects the villages of Trávnica and Beša.

From Trávnica, there is a paved road leading almost to the bridge and the nearby local pond. The bridge used to have a parapet on the sides, which, however, had to be removed to allow wide agricultural machinery to cross the bridge. The bridge, with a clear span of approximately three metres, is surrounded by thick growth and the top of the arch is not protected by any soil or pavement anymore, so vehicles drive directly on its structure. There is a very similar bridge also in the village of Mužla.

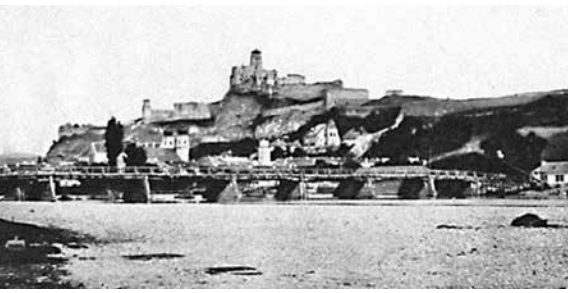
TRENČIANSKE TEPLICE
THE BRIDGE OF FAME (MOST SLÁVY)

The symbolic Bridge of Fame is associated to the international film festival Art Film Fest, which has been held in this town since the year 1993 under the auspices of UNESCO.

The original bridge across a stream lead to the nearby hotel and since 1995 commemorative plaques with the names of the awarded artists have been placed on its handrail. The first one was that of the Italian actor Franco Nero.

Besides its real function of connecting two banks of the stream, it also has a symbolic function of connecting spectators with artists. To improve the organization of the ceremony and to provide more space for the new plaques a new bridge was built in 2009 to which also the old plaques were fixed. Its function is exclusively symbolic, since it does not bridge any gap, but it is placed only a few centimetres above the ground.

Image of the town of Trenčín and the bridge across the river Váh, 1710



Photograph of the timber bridge from the end of the 19th century

TRENČÍN

GPS +48° 53' 43.20"S
+18° 02' 02.67"V

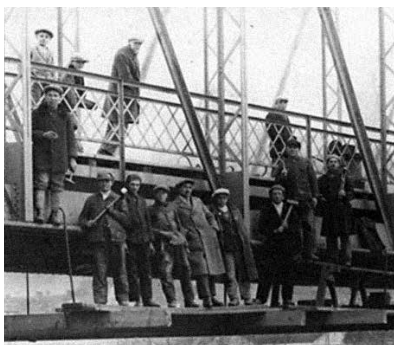
General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

ROAD BRIDGE ACROSS THE RIVER VÁH

Trenčín prides itself on its rich history dating back to prehistoric times.

However, it made its first significant mark in history at the turn of the year 179, when one of the most important battles between the Germanic tribes and the II Roman Legion took place here. The Romans won the battle and in their memory they carved an inscription into the castle rock saying "To the victory of the emperors - the army that lies at Laugaricio, 855 soldiers of the II Legion, made on the order of Marcus Valerius Maximianus, the legate of the II auxiliary legion". Whether the legions also built some temporary boat bridge over the river Váh is not known. The first documented reference to the existence of the bridge dates back to 1271 and the first bridge shown on the picture of Trenčín is on the engraving from the year 1710. The timber bridge could also be seen on a photograph from the end of the 19th century. In 1897 the timber bridge was replaced by a 4 span, 261 m long steel truss bridge, with piers founded on caissons. The truss with curved top chord was 8 m high. Two commemorative plaques were placed on the bridge; one stating the name of the bridge and the second one the order to "run the horses at a walk". There was also a small toll house on the bridge until the 30s of the 20th century. The collection of a toll was cancelled after a funny incident when the temporary substitute for the

The steel truss bridge, photograph from 1910



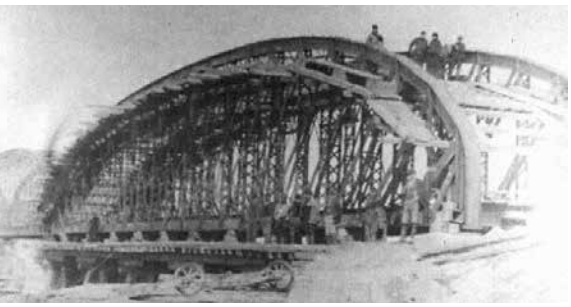
The crew performing maintenance

The temporary timber bridge after the destruction of the original bridge in 1945

The bridge shown on a period postcard of the town of Trenčín

toll collector Komorovský unconsciously stopped a government vehicle with the minister S. Mach and asked him for payment.
After the destruction of the bridge in World War II, it was temporarily replaced by a timber bridge which served until the construction of the new reinforced concrete bridge finished in 1956. Considering that prestressing tendons were not used, the new bridge has quite a large span of 57 m. The main span is composed of two 13.5 m long cantilevers and a 30 m long dropped-in section (this type of structure is often referred as a Gerber girder). The overall length of the bridge is 344 m and the depth of the deck varies between 2.4 and 3.6 m. The author of the project is the company Dopravoprojekt and the bridge was constructed by the company Doprastav.

TRENČÍN



Construction of the first bridge, 1833
photo: ŽSR MDC

The bridges in 1944
photo: ŽSR MDC

RAILWAY BRIDGE ACROSS THE RIVER VÁH

GPS +48° 53′ 51.32″S
+18° 02′ 17.08″V

General Designer of the new concrete bridge:
REMING CONSULT, a.s., Bratislava, Slovakia

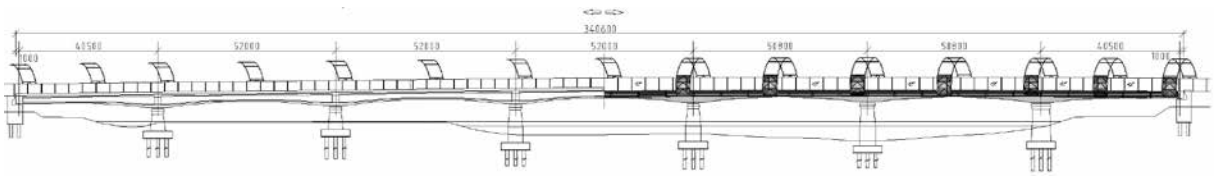
The first railway bridge in the town was built in 1883 by the company Hügel & Sager.

It was composed of four steel truss spans of 61.6 m having a semi-parabolic shape. When the double-track was finished in 1907, there were two similar parallel bridges across the Váh serving up until the end of World War II when they were destroyed by aerial bombs. Only the left bridge could be reconstructed and it had to be temporarily reinforced by timber beams. The superstructure of the right bridge had to be replaced by a new one, which has been in service since 1946. The repaired superstructure of the left railway bridge served till the 60s of the 20th century when due to its unsatisfactory condition and insufficient clearance the speed of the passing trains had to be reduced. Preparation of a new design began immediately, but the new bridge was not finished

Reconstruction of the bridge in 1945
photo: ŽSR MDC

Bridge building on the left track in 1946
photo: ŽSR MDC

View of the
bridges after 1948
photo: ŽSR MDC

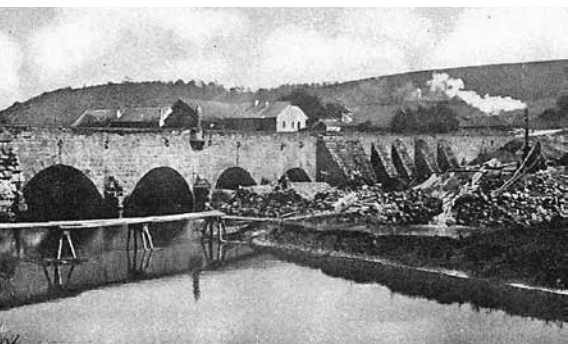


up until 1984 when a new through truss structure with parallel chords was built. Nowadays, plans for the new bridge are ready. It is to be next to the old one which afterwards will be used only by pedestrians and cyclists. The new superstructure will be made of prestressed concrete and will be 340.6 m long. The maximum span will be 52 m. The author of the project is the company Reming Consult in cooperation with the Betoning Company. The construction is already in progress.

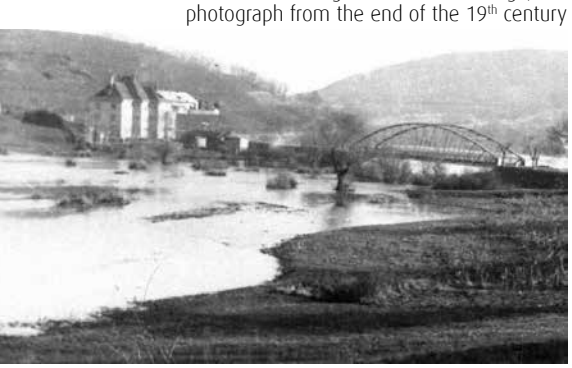
TRENČ-RÁROŠ

MADÁCH'S BRIDGE

GPS +48° 12' 27.41"S
+19° 32' 40.02"V



The original stone arch bridge, the photograph from the end of the 19th century



The steel truss bridge built in 1904

The bridge across the river Ipeľ near Ráros was mentioned for the first time in a document from the year 1792 which mentions its poor condition and the need for its reconstruction. However, no technical information has been preserved and we can only estimate them from the photographs. The approximately 60 m long bridge was composed of six arches, the spans of which were probably not more than 8 m. If we take into account also the elevated access roads made of stone, the overall length could have been approximately 200 m.

The river Ipeľ is known mainly for the dramatic seasonal variations in the flow rate; in the winter it is just a small knee-high stream which, however, can

Horthy's troops crossing the steel bridge in 1938

change to a wide deep river within a few days. In reference to this an anecdote of the Hungarian king Joseph II was preserved. When he was crossing this huge bridge when the water level was low, he said, "Gentlemen, either less bridge or more water". During the Hungarian revolution (1848) the bridge was barricaded by the armies of the militia, but it survived without any damage. On a photograph from the end of the 19th century, the statue of St. John of Nepomuk, placed in the middle of the bridge, is visible.

Poor technical condition and expensive reconstruction forced the engineers to replace the bridge by a new one and thus in 1904 it was demolished and a new bridge with steel truss structure was built in its place. In 1938 this decorated truss arch bridge served as an entrance gate to Czechoslovakia for the Hungarian Horthy's troops, who immediately occupied the nearby barracks. At the centre of the bridge the keys of the military facilities were symbolically handed over. Several years later the bridge was destroyed by the withdrawing fascist army to try to slow down the Red Army. The new bridge was not constructed until 2011, when a concrete arch bridge faced with stone was finished. Looking at the stone facing, the bridge was probably intended to resemble the historic stone arch bridge, but it surely cannot be considered a faithful reproduction. The only thing preserved from the historic bridge is the statue of St John of Nepomuk placed in its middle. Besides the statue, there are also commemorative plaques placed on the both sides of the bridge, stating information about the constructors and investors. The reconstruction of the bridge, which was named after the famous Hungarian writer Imre Madách, was in large part co-financed from the European Union funds. The 73.4 m long new bridge has three concrete arches with spans of 20 + 25 + 20 m.

GPS +48° 23' 00.90"S
+17° 34' 40.36"V

TRNAVA

BRICK BRIDGE LEADING TO THE CALVARY

The town of Trnava developed from a mercantile settlement founded on a crossroads of old commerce routes near the stream Trnávka.

The first written reference dates back to 1211. The town was mentioned in an Esztergom archbishop's document stating the income of the local church a part of which was submitted to the Esztergom abbey. In 1238, Trnava was the first town on the territory of the present Slovakia to be granted the privileges of a free royal town. Its importance grew in the 16th century, when the archbishopric of Esztergom moved here in 1543 in order to escape from the approaching Turkish army. Trnava thus took over the role of the cultural and religious centre of the country. The first bridges across the moat apparently existed already when the fortification was begun to be built in the 13th century, but one of their first portrayals dates back only to the 17th century. The engraving shows two bridges crossing the moat. The wide one was for carriages, the narrow one for pedestrians. In the 18th century, when the fortification walls were gradually demolished and the moat ceased to exist, the bridges lost their function. Besides the fact that Trnava was among the oldest university towns in the former Hungarian Empire, it was also famous for its brick factories. By the end of the 19th century there were four of them and bricks became rather a cheap material in the region. As a consequence, there are many brick bridges to be found in the surroundings of the town. Unfortunately the majority of them have been reconstructed and the original material is not visible anymore. One of the few well preserved bridges is the bridge near the Calvary, which was built in the beginning of the 20th century, probably in 1904 in connection with the rebuilding of the sugar factory. The bridge crosses the stream Trnávka, and its arch has a clear span of approximately 7.5 m.

TURANY

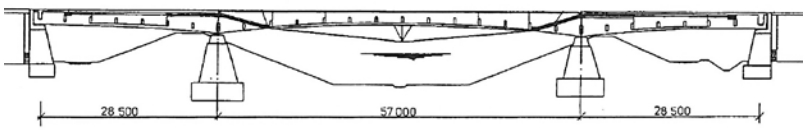
STRENG THE NED REINFORCED CONCRETE BRIDGE

The bridge crossing the Krpeliansky Canal was built in 1958 and it is a good example of a reconstruction which improves the structure not only structurally but also aesthetically.

Regarding its technical solution, the main span of the bridge was quite long at 57 m (the bridge superstructure was originally designed as a reinforced concrete continuous girder without the use of prestressing tendons). At the time of the construction, little attention was paid to the durability of bridges and thus in the beginning of the 90s of the 20th century, approximately 40 years after its construction, it was in poor condition due to advanced corrosion of the reinforcement. To remedy the bridge, external prestressing tendons were used. By this means forces of opposite direction to those from the bridge loads were introduced to the superstructure.

GPS +49° 07′ 21.44″S
+19° 02′ 40.10″V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

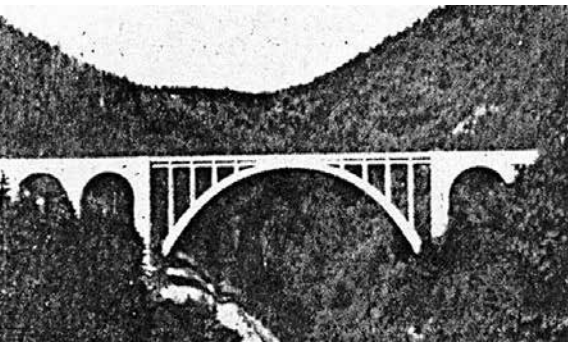


Although the prestressing tendons together with the anchorage blocks were designed mainly with regard to their structural effects, they are also aesthetically attractive. The strengthening project was done by the Research Institute of Engineering Constructions from Bratislava.

FORMER RAILWAY BRIDGE

In the 70s of the 19th century, steel lattice truss bridge structures were dominating in the sphere of railway bridge building.

In the archives of the Slovak Railways a very nice photograph of such a bridge is preserved. The bridge was near Turany, built within the railway between Košice and Bohumín. Due to rising demands on railway bridges, this one as well as many others had to be substituted by a new, wider and stronger structure.



UĽANKA

UĽANSKÝ VIADUCT

GPS +48° 47′ 55.39″S
+19° 05′ 45.20″V

The viaduct on the railway between Banská Bystrica and Horná Štubňa is one of the most imposing viaducts in Slovakia.

Its reinforced concrete structure is composed of three side arches with spans of 19 m and one main arch with a clear span of 55 m. The top of the arch rises to 42 m above the bottom of the valley. Wooden scaffolding had to be used during its construction in 1940 for which 1,000 m^3 of wood was used. After World War II the viaduct had to be reconstructed. In the reconstruction it was decided to preserve the original concept and ever since the bridge has ranked among the largest structures of its kind within Eastern European railways.

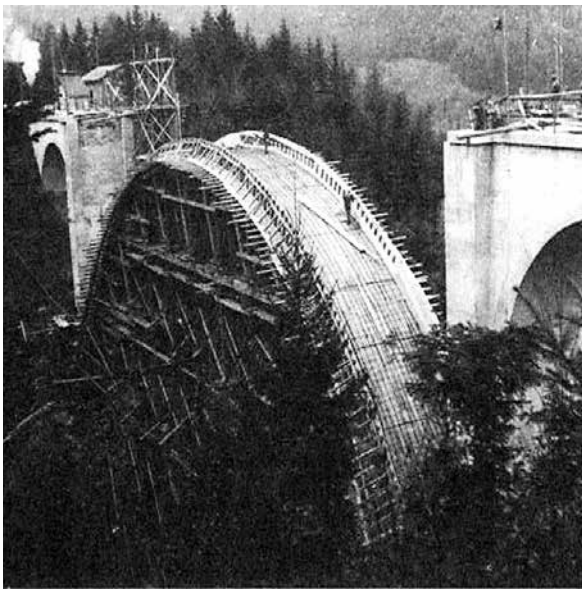


photo: ŽSR MDC

VÁHOVCE

BRIDGE ACROSS THE RIVER VÁH

GPS +48° 15' 33.95"S
+17° 46' 53.84"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

In the years 1985 - 1988 a highway bridge across the river Váh was built within the bypass of the Sereď town. It was built using the balanced cantilever method and with the technology of precast girders.

The two main spans of the 634 m long bridge are 90 m.

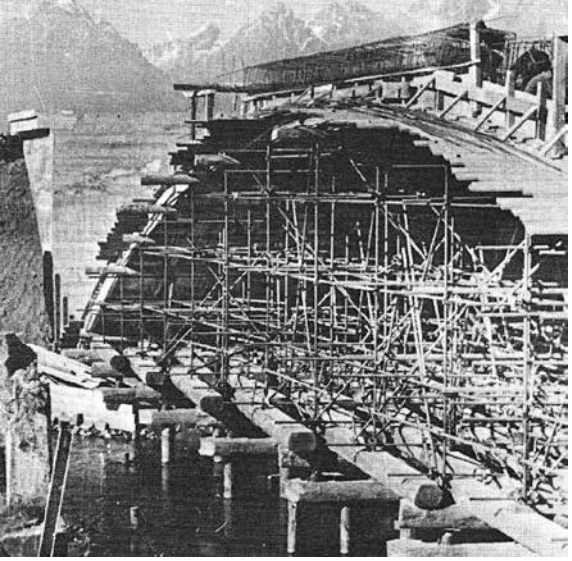
VALASKÁ

BRIDGE OF THE ČIERNOHRONSKÁ RAILWAY

GPS +48° 48′ 17.41″S
+19° 33′ 36.27″V

Near Chvatimech, within the longest forest railway in Slovakia, a steel truss girder bridge was built in 1946.

Nowadays, even though it has a simple structure it is registered as an industrial monument. The steel through truss bridge was made in Podbrezová, as a substitute for the timber bridge built around the year 1910. The bridge crosses the river Hron. In the surroundings of the bridge there is a rest area, where a locomotive, which was once operating on this narrow gauge railway, is nostalgically exhibited.



VEĽKÁ LOMNICA

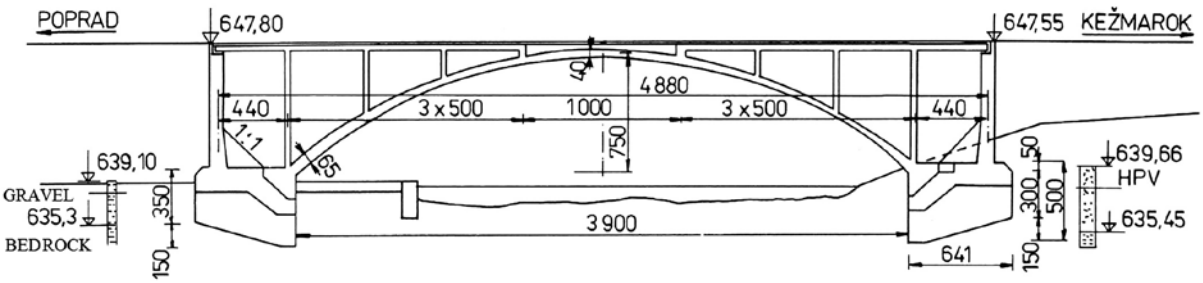
CONCRETE ARCH BRIDGE

GPS +49° 06' 41.85"S
+20° 21' 58.71"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

In the years 1954 and 1956 the company Inžinierske stavby Košice built an arch bridge following the project prepared by the company Dopravoprojekt. Its span is 40 m.

The arch was casted on combined scaffolding composed of wooden formwork and a steel falsework. The bridge is one of the few concrete arch bridges built in Slovakia after the year 1945.



VEĽKÉ BIEROVCE

PIPELINE BRIDGE

GPS +48° 50' 55.85"S
+17° 58' 15.00"V

Near the town of Veľké Bierovce, there is a gas pipeline bridge spanning over the river Váh with a superstructure suspended from only one pylon. The gas pipelines themselves are the part of the structural system.

I have not found the exact dimensions of the bridge, but I assume that the main span is approximately 105 m long. This kind of gas pipeline bridge can be found in various places in Slovakia.

VÍGĽAŠ

GPS +48° 33' 20.46"S
+19° 18' 47.08"V

BRIDGE MADE OF A RAILWAY CARRIAGE

Improvisation in bridge building has no limits. This is proved by the 20 m long railway carriage which has been serving as a footbridge for pedestrians and cyclist in the village of Vígľaš since the 60s of the 20th century.

The bridge was built across the river Slatina by the workers of the nearby agricultural farm and so a shortcut between the local parts of Pstruša and Hájnik was created. Once even cars used to cross the bridge. A structure of this kind is really unique in Slovakia as well as in Central Europe, however, within Western Europe railway carriages put out of service, after being sufficiently repaired, have been already used as footbridges in several places.

VINICA
STONE ARCH BRIDGE

GPS +48° 06' 49.17"S
+19° 07' 19.05"V

In the village of Vinica, a stone arch bridge from the 17th century can be found. It has three arches and in the past it served within the important old royal commerce route between Šala and Tornaľa.

In its shape it resembles the bridge in Poltár, and the clear span of its arches, being 5.5 m, is similar. The bridge was reconstructed and widened by a concrete structure, which has been designed in such a manner as to preserve the original appearance of the bridge. Although from one side it looks like a concrete bridge with an imprinted square pattern, from the other side the original material is still visible.

VINIČKY

RAILWAY BRIDGES

GPS +48° 23' 37.25"S
+21° 44' 25.64"V

The river Bodrog was originally crossed by a single railway bridge built in 1872. Two identical truss bridges were built in 1947 and 1949.

They were three-span truss bridges, being 157 m long with the main span being 88 m. The side spans were shorter and thus also their structural depth was lower. Due to the former frequent transport of corrosive substances and ores the bridge in the right railway has corroded and thus in the 90s of the 20th century its reconstruction was needed. The new bridge was finished in 2003. The original three-span structure was substituted by a two-span truss structure with the span being 77.6 m (upper photo). The bridge in the left railway has been standing in its original shape up until today. It was saved by the fact that it was crossed by trains in the opposite direction and with a completely different, not aggressive, cargo (lower photo). Among the important railway bridges in Slovakia, these two are located in the lowest altitude being 100 m.

VOJANY

PIPELINE BRIDGE

GPS +48° 34' 10.56"S
+21° 58' 53.48"V

Vojany is famous mainly thanks to its thermal power plant built in the years 1961 – 1966, which is the biggest thermal power plant in Slovakia.

You can also find a very elegant pipeline bridge there. The three hinged arch truss crosses the river Laborec with a span of approximately 70 m (rough measurement). On the upper part of the arch truss, there is also a catwalk enabling inspection of the structure and the pipeline.

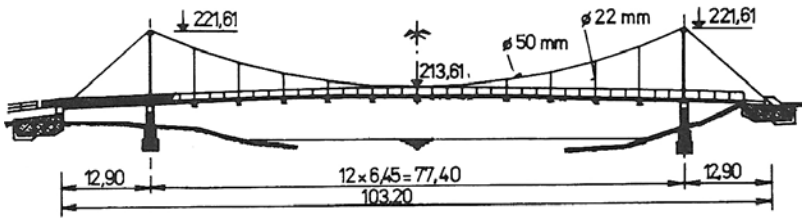
VOZNICA
FOOTBRIDGE

GPS +48° 27′ 38.82″S
+18° 41′ 33.25″V

The footbridge with a maximum main span of 77.4 m crosses the river Hron and connects the village of Voznica with the railway station.

The pylons are more than 10 m high and they are anchored to massive reinforced concrete blocks. On their tops the suspension cables with a diameter of 50 mm run through the saddle. The length of the superstructure is 103.2 m.

The former bridge



VRANOV NAD TOPĽOU

FOOTBRIDGE ON THE WAY OF THE CROSS

GPS +48° 52' 59.21"S
+21° 41' 54.01"V

Neither the footbridge nor the modern Church of Saint Francis from Assisi belongs to traditional structures.

This cable-stayed, 24 m long footbridge makes a part of the Way of the Cross with 14 stations. The pylon is approximately 4 m high. The longer span (14 meters long) is additionally supported by a short pier. The pylon was made of two halves of a cylinder connected at the top by a crossbeam, to which the cable stays are attached.

VRBOVÉ

HISTORIC STONE ARCH BRIDGE

This inconspicuous little town was first mentioned in documents dating back to 1113.

However, its greater development was stopped by the invasion of the Tartars and later by the invasion of the Turks in 1599. They ravaged and completely burnt down the whole town. In this infamous time of the occupation in the 17th century the stone bridge was probably built with three arches made of stones. After the withdrawal of the Turks it served the inhabitants up until the beginning of the 20th century. The picture of the bridge, capturing also the piers with cutwaters, is preserved on a period postcard.

VRÚTKY
HISTORIC RAILWAY BRIDGE

GPS +49° 07′ 06.60″S +18° 54′ 56.50″V

The bridge over the river Turiec was built within the railway line between Košice and Bohumín.

The original bridge from 1871 was in the year 1910 replaced by a lattice steel structure with a span of 29.6 m. Within the double-tracking of the railway in 1939 a new plate girder bridge was built. This one served until the end of World War II when both bridges were destroyed. Unfortunately, the first truss structure could not be repaired after the war. However, in the case of the second railway bridge, the railwaymen succeeded in provisionally putting it into service just in four weeks, even though they neither had any experience with bridge building nor appropriate equipment. In 1946 a new plate girder structure was assembled.

VYSOKÉ TATRY (HIGH TATRAS)
FOOTBRIDGE OVER THE STUDENÝ POTOK

GPS +49° 09′ 54.01″S +20° 13′ 21.94″V

The footbridge was built in 2009 as a substitute for the original timber bridge crossing the waterfalls of Studený Potok.

Being 25 m long, it is the longest footbridge on marked paths in the High Tatras. Almost 45 tons of material was used for its construction, all of which had to be carried there by hand from the Rainer's chalet. This simple steel footbridge is unusual thanks to the polygonal ground plan and also by the handrail balusters capped with stones.

ZA VODOU (ORAVSKÝ PODZÁMOK)

FOOTBRIDGE

GPS +49° 15' 52.02"S
+19° 22' 36.95"V

The name of this local part meaning "beyond the water" has geographical origins, since it is situated in front of the Orava Castle - beyond the water – the river Orava.

It is one of the many simple suspension footbridges in Slovakia the span of which is approximately 80 m. Transversally it is stiffened by two cables the function of which is to minimize its side movements in the wind.

ZELENICE

PIPELINE BRIDGES

GPS +48°23' 40.90"S +17°43' 29.80"V

In the surroundings of the villages Horné Zelenice and Dolné Zelenice, there are several pipeline bridges, while two of them, spanning the river Dudváh, are clearly visible from the nearby highway.

While the first one is a truss structure on which the pipelines are placed, the structural frame of the second one is made up of the pipeline itself. Both bridges have a span of approximately 60 m.

ZVOLEN

HISTORIC COVERED TIMBER BRIDGE

In the beginning of the 20th century, historic covered bridges were still quite common in Slovakia, but in the course of time they were replaced by more modern structures.

Compared to classic timber bridges they had the advantage of longer durability, because their load-bearing structure was not directly exposed to rain. Although it is not known when the building of covered bridges in Slovakia began, the oldest portrayal of such a bridge dates back to the 16th century. It bridged the river Hron near Zvolen and it was painted by J. Willenberg in 1599. Another similar bridge is pictured also above the river Slatina on the painting of Gérard Bouttats from the 17th century.

ZVOLEN

COVERED COMPOSITE STEEL-TIMBER FOOTBRIDGE

GPS +48° 34' 54.80"S
+19° 06' 51.70"V

This footbridge is also open for cyclists, and was built in 1993 above the Kováčovský stream, enabling the creation of a continuous recreational area along the river Hron.

The construction of the footbridge with a span of 26 m quite unconventional; its superstructure consists of a composite steel-timber truss system. The heaviest loaded truss members were made of steel plate with a maximum thickness of 40 mm sandwiched between wooden prisms. The joints of the truss members are also interesting as is the roofing of the footbridge. There are some nodes at which as many as ten truss members meet. The largest cross section used in the superstructure has the dimensions of 160 x 160 mm. Within all the timber bridges in Slovakia, this one definitely is among the most interesting ones. The design was done by the company Andante.

ŽARNOVICA
CONCRETE FOOTBRIDGES

GPS +48°29′ 01.86″S
+18°43′ 52.01″V

In the town of Žarnovica, near the centre, the local Klakovský stream is crossed by three reconstructed concrete footbridges.

Each of them is composed of two true arches with spans of 20 m. The bridge deck is hung from the arches using reinforced concrete hangers.

The pipelines are crossing it in a very elegant manner; they were painted with the same colour as the bridge and thus they are hardly visible.

BRIDGE OF LUKAVICA

GPS +49° 15′ 52.02″S
+19° 22′ 36.95″V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The village of Lukavica and the town of Žarnovica were in the past connected by a ferryboat, which, in the middle of the 19th century, was substituted by a suspension bridge.

This served only till the year 1907 when it was destroyed during the floods. The ferryboat began to operate again and later it was again replaced by a footbridge. In 2005 a new bridge was built, in which rod hangers were used instead of cable stays. This 65 m long bridge with a span of 40 m is unique mainly thanks to the shape of its pylon. The design, and also the experimental analysis of the hangers, was carried out by the company Projstar, The bridge was built by the Doprastav Company.

ŽDIAR

SMALL CONCRETE BRIDGE

GPS +49° 16' 13.11"S
+20° 15' 45.62"V

This typical "Goral" village in the High Tatras, situated only a few kilometres from the Polish border, is famous for its folklore and its skiing resorts.

Thanks to the abundance of wood and skilful craftsmen, timber structures reflecting the signs of the folkloric traditions are typical for this village. Although the footbridges are mostly made of timber here, some small stone arch bridges with a clear span between two and three metres could be found here too. The builders of the new bridge across the local stream near the petrol station tried to preserve this nature of the village and, although the bridge is made of concrete, it is faced with stone from each side. The shape of the bridge was influenced by the parameters of the obstacle, this being a narrow but deep valley of a stream, and thus a quite unusual shape of the arch was chosen (parabolic arch). This way the builders, probably even unknowingly, accentuated its uniqueness.

TIMBER FOOT--BRIDGE ON A CYCLING DOWNHILL TRAIL

GPS +49° 16' 56.51"S
+20° 18' 47.81"V

As representative of timber footbridges, I chose two, which are intersecting each other above the bobsleigh track in the skiing resort. One of them serves within the bobsleigh track and the other is used in the summer by the fans of extreme downhill cycling.

These structures are very simple but practical without any aesthetical compromises.

ŽIAR NAD HRONOM

ROAD BRIDGE ACROSS THE RIVER HRON

GPS +48° 34' 51.40"S
+18° 52' 04.51"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

The strategically important location of the town - in the neighbourhood of mining areas -predetermined it to become the commerce centre of the region.

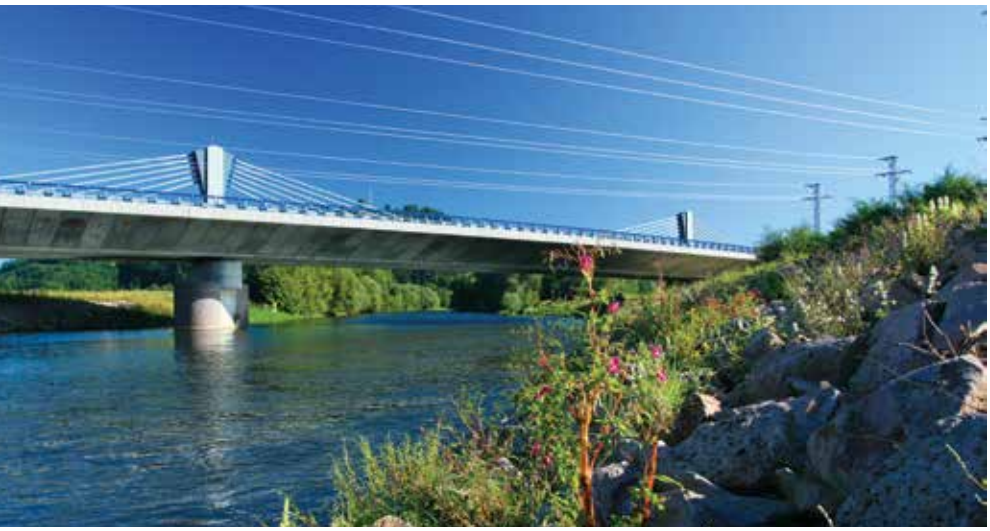
Here, there was also a passage through the river Hron on which toll was paid at least since 1075. To this year dates back the first written document about the toll on the bridge between the towns of Ladomerská Vieska and Žiar nad Hronom (till 1955 the town was called Sv. Kríž nad Hronom). The inhabitants were freed from paying the toll in 1547 on the order of the king Ferdinand I. The original timber bridge was destroyed or damaged by floods several times. A flood destroyed it also in 1899 and thus it was quickly substituted by a ferry boat. Due to many problems with timber bridges and thanks to the well -developed bridge building industry in the former Hungarian Empire, a new plan for the bridge was worked out. The bridge was designed as steel Pratt truss with curved top chord, which was quite common at those times. The bridge was finished two years later; in 1901. It was later destroyed by the rebel army during the Slovak National Uprising in 1944 intending to slow down the advancement of the clearly stronger German army. It was substituted by a timber temporary bridge serving up to year 1954 when a new 76 m long concrete bridge was built.

ŽIAR NAD HRONOM

HIGHWAY BRIDGE ABOVE THE RIVER HRON

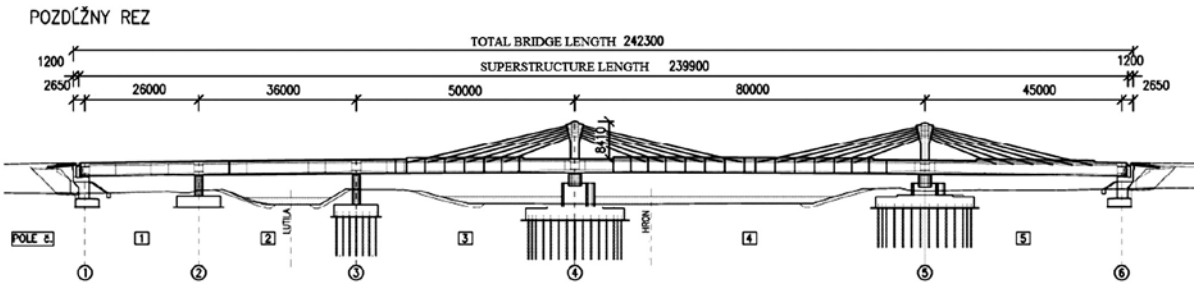
GPS +48° 35' 03.35"S
+18° 52' 20.36"V

General Designer: DOPRAVOPROJEKT, a.s.,
Bratislava, Slovakia



The bridge was built within the R1 highway above the river Hron and the stream Lutila in 2010 as a so called extradosed type of bridge with prestressing tendons elevated above the bridge deck and anchored at the pylon. (This type of bridge is also often called a Cable-stayed bridge by laymen, however this is an incorrect term for this kind of structure.)

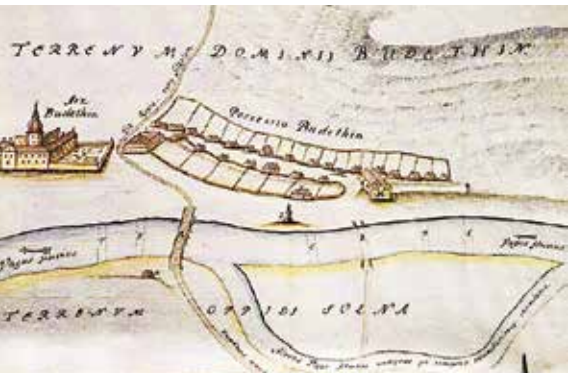
The bridge follows the full profile of the highway and the main span is 80 m. It crosses the river Hron at a skew angle of approximately 50 degrees. Its pier had to be adjusted to this fact; it is orthogonal to the structural frame, but it is faced with stone so that its final shape causes as little resistance to the river flow as possible.



ŽILINA

GPS +49° 14' 05.37"S
+18° 44' 05.51"V

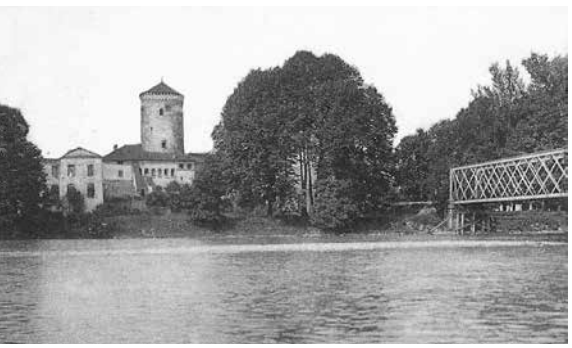
BRIDGES NEAR THE BUDATIN CASTLE



Žilina, 1749 – the location of the timber bridge with the markings of the previous locations of timber bridges

The castle came into existence as a watch castle in the 13th century at a strategic position; on the confluence of the rivers Kysuca and Váh, where it was to protect the commerce routes from the regions of Ponitrie and Považie in the direction towards Silesia and Poland. The road bridge nearby the castle was first mentioned already in 1438.

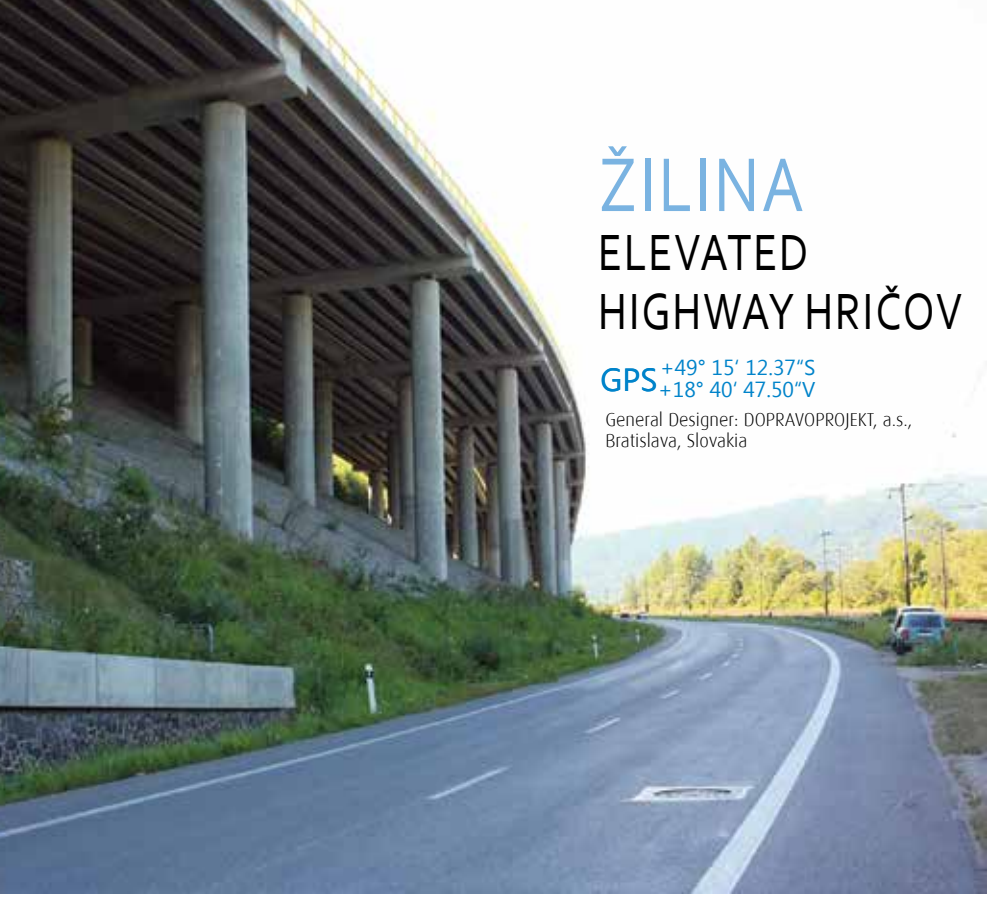
Another bridge which literally cut the garden of the castle in two was built in the 70s of the 19th century during the building of the railway line between Košice and Bohumín. Within it, one of the biggest railway bridges of this line was built above the river Váh with two spans, each being 57 m long. Its building began in 1896. The original latticed structure was substituted by a Pratt truss structure at the beginning of the 20th century, which, however, was in 1945 almost completely destroyed together with the nearby road bridge. Germans succeeded in only destroying completely the road bridge, while the railway bridge was damaged only partially. The engineers of the Red Army made use of it immediately and hurriedly reconstructed it, so that it could carry their 40-ton-heavy tanks. Today, there is a three-span steel plate girder structure on its place. On a postcard from the year 1910, except for the former two-span railway bridge, a part of the three-span road bridge from the turn of the 19th and the 20th century (at the front) is also visible. Only its abutments on the right riverbank of the river Váh are preserved till these days.



The railway bridge, photo from the year 1907

The railway bridge after its reconstruction, photo from the year 1916

The road bridge (the railway bridge in the background), photo from the year 1910



ŽILINA
ELEVATED HIGHWAY HRIČOV

GPS +49° 15' 12.37"S
+18° 40' 47.50"V

General Designer: DOPRAVOPROJEKT, a.s., Bratislava, Slovakia

Within the construction of the highway between the towns of Horný Hričov and Žilina, one of the longest elevated highways in Slovakia was built during the years 2005 and 2008.

The construction of the bridge was under extraordinarily harsh conditions of the steep slope of the terrain and during the full operation of the 1st class road which is in its very close proximity. In order that the construction could start, a part of the inclined terrain had to be excavated and secured. Due to the difficult terrain, this process posed great complexity. Having carried out necessary geotechnical works, the building of the foundations as well as of the bridge itself was started. The bridge is 1,551 m long and it consists of four expansion sections using precast girders and by segmental cantilever method. The bridges were realized by the companies Doprastav, Váhostav and Strabag.

TWINS

GPS +49° 13' 14.51"S
+18° 46' 16.75"V

Near Žilina, the railway crosses the river Váh in two places; near Budatín and near the cellulose plant.

The first railway bridges were built here within the railway line between Košice and Bohumín, which was begun to be built in 1869. The original bridge was rebuilt in 1911. It had three truss arch spans of 34.5 + 44.8+ 34.5 m. Next to it, there was a newer bridge from the year 1938. As the other bridges, these were also completely destroyed at the end of the war, without any possibility of reconstruction. Thus, a new timber temporary bridge had to be built immediately. Due to the necessary navigational clearance for ships, it was later adapted using a steel girders delivered from the Czech Republic. After the war, between the years 1946 and 1947 the bridges were repaired to their original form and then they were in service up until the year 2000. The new bridges, which were put into service on the 5th of December 2000, are of the Langer girder type. With their span being 112 m they belong to unique structures of their kind in central Europe and they are the longest railway bridges of this type in Slovakia.

ŽILINA

TRUSS BRIDGE

GPS +49° 13′ 18.70″S
+18° 46′ 15.85″V

The last bridge I chose to select in this book is the truss girder bridge near Žilina.

It is situated near the two bridges, which I described on the previous page. In the70s of the 20th century, on the basis of the agreements with the former USSR, an increase of the traffic in the direction east – west was expected. The narrowest part of the railway was between the towns of Vrútky and Žilina. Thus, it was decided that a new marshalling yard will be built in the town of Teplička nad Váhom. However, even before the project could be realized, the year 1989 (fall of communism) came and a decrease in goods transporting resulted in a part of the railway not being fully completed and it remained unutilized. The three-span bridge with spans of 56 + 67 + 56 m is a part of it. It was finished in 1995 and its fate was to duteously wait until its time came. For more than 15 years not a single train had crossed it. Today, the marshalling yard is among the largest in Central Europe and the time of the bridge has finally come.

DEDICATED TO THE BRIDGES WHICH WERE NOT INCLUDED IN THE BOOK

Nearby the village of Soblahov, a small bridge was built on the forest railway at the beginning of the 20th century. It was rebuilt in 1996 to commemorate the former forest railway. This bridge is the only existing bridge on the track which has been preserved. However, attention does not belong so much to the bridge, but to the plaque with a poem placed nearby. The poem is dedicated to the bridge and to its constructors. It was written by Ondrej Mrázik on the occasion of the rebuilding and it also pays tribute to numerous simple bridges in Slovakia, which are hardly noticeable. It emphasizes the importance of each bridge and it points out that even the smallest one has its own fate and story. Just like the Last of the Mohicans in Soblahov.

(Translation of the poem originally written in Slovak language)

Ondrej Mrázik

THE LAST OF THE MOHICANS

I don't know which one of dozens
you are in the Rosary of bridges on track Stará píla – Selec,
which was crossing the mountains.
In this year a new robe they gave,
when fragrant pines were by them felled.

So little time is left until the Centenary,
of when locomotives Selec, Herta, Njusi,
whiningly were greeting you momentarily.
They all have their dream in eternity,
only you lasted from the fraternity
What would Mr. Dreker have said
of your new clothes,
without tracks,
as you link the banks patiently,
even being restored incompletely

From childhood I remember,
legs dangling over the water here,
the crayfish and the snakes in the reeds.
Shouts of the dragonflies in the hot summer
As I hunted them in the swamps over and over.

Man has a home and places,
where he often happily returns to find his traces.
Stone he throws into the water,
in circles he is looking for the childhood as a rover
and with a strange fear he leaves.

Wanderer, if you are here with your love,
kiss her on this bridge as a dove.
Remember those who built this span
and with respect unbent then.

I know a lot of nooks and crannies,
which my native country decorate ,
Guard it, protect, cultivate
because it is our heritage,
..... and others do the same.

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Ing. Peter Paulík, PhD.

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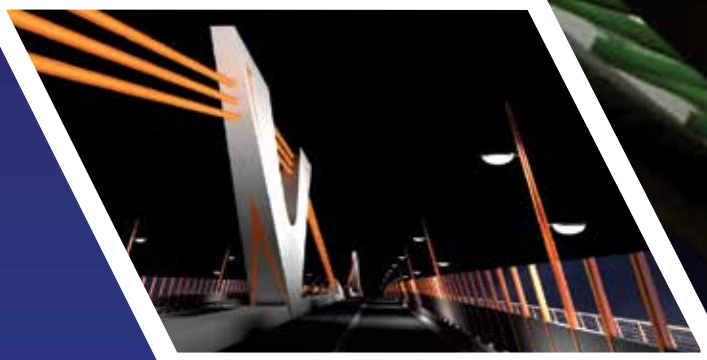

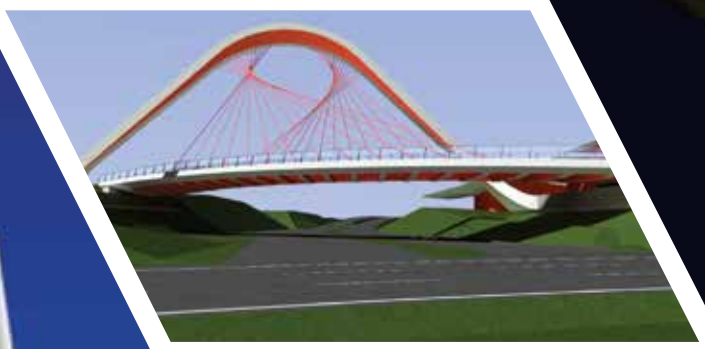

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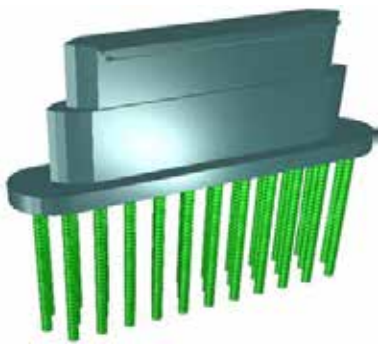

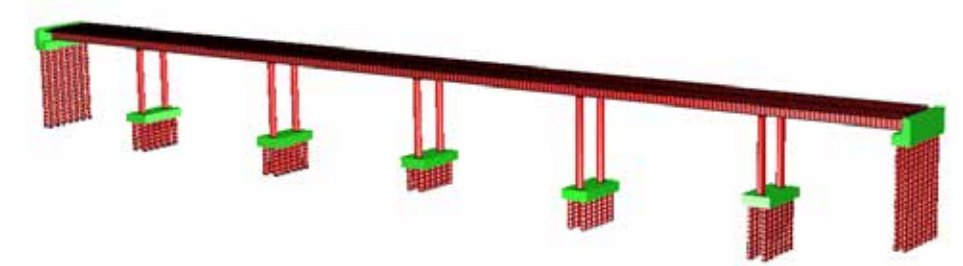

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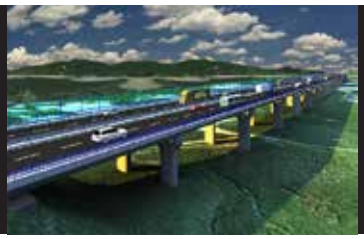

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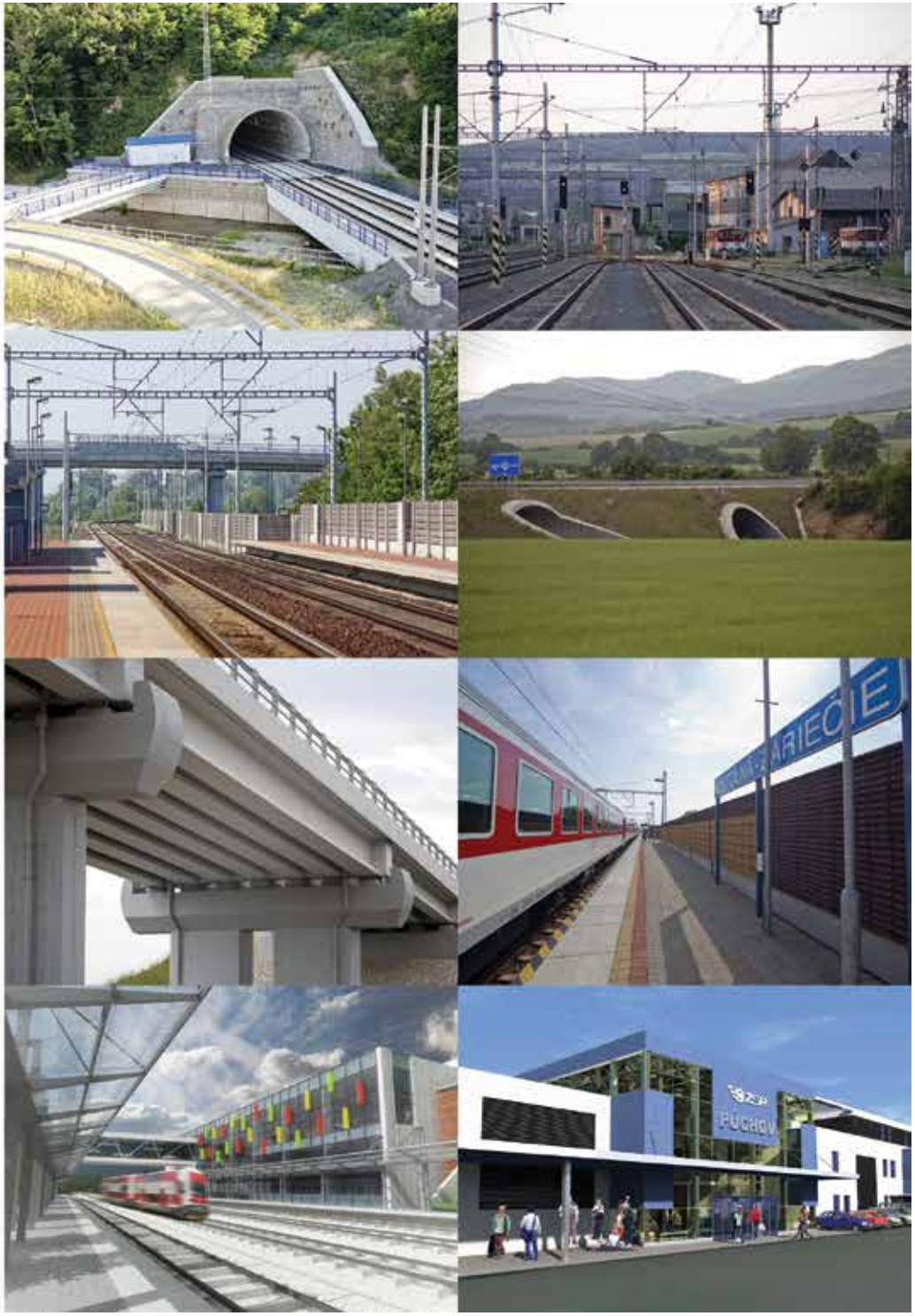

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