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European Association for Ductile Iron Pipe Systems

Fachgemeinschaft Guss-Rohrsysteme

NEWSLETTER

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Dear Readers,

In two articles we report on the use of ductile cast iron pipes as waste water pipes: One article focuses on a culvert under the Moselle at the Deutsches Eck in Koblenz. After the two culvert pipes DN 800 and DN 1250 made of ductile cast iron had been in operation for 44 years, they could be tested for corrosion using SLOFEC (Saturation LOw Frequency Eddy Current) technology, an eddy current process. The positive result: There is no need for rehabilitation of the culvert pipes and the necessary rehabilitation of the culvert upper head and the culvert lower head could be started. The second article reports on the drainage of a settlement in the Carnic Alps. Thrust and tractive restrained ductile iron pipes with cement mortar coating were installed on an extremely steep slope with complicated geological and tectonic conditions. In this way, at a difference in altitude of 400 m, the wastewater can be fed to the wastewater network of the Carnic region wastewater association by the shortest route.

The Zweckverband Bodensee-Wasserversorgung supplies 320 communities with drinking water from Lake Constance. The high-quality raw water from Lake Constance is sterilised during a treatment process by the addition of highly active oxygen (ozone / O_3). Internally enamelled valve housings and enamelled valve discs ensure a long service life of the valves, ensure good hygienic conditions and reduce energy consumption by reducing pressure losses.

Enjoy and inspire reading
Yours

Christoph Bennerscheidt

Always topical, always informed

The online Newsletter published periodically provides professionals in the field with up-to-date information about interesting European pipeline projects as well as the many and varied activities of EADIPS®/FGR®.

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Imprint

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Inspection of a culvert pipeline in Koblenz

At the beginning of the 1970s, in the immediate vicinity of the "Deutsches Eck", one of the most important sewage structures in Koblenz: the 294 m long **Mosel culvert**. This takes about 70 % of the wastewater beneath the bed of the Mosel to Koblenz-Lützel and from there onwards via a wastewater pumping station to the central treatment plant after Koblenz-Wallersheim. The Mosel culvert consists of two **DN 800 and DN 1250 wastewater ductile cast iron pipes**, four NW 450 (PE) drinking water pipelines and six NW 125 (PE) cable conduits. In addition the **culvert upper head** and the **culvert lower head** also belong to the complex components.

The reasons for the culvert inspection

Apart from the necessary **evidence of the tightness** of the culvert pipelines to be provided for the supervisory authority, the concrete constructions in the upper head of the culvert were found to be in a critical state. So it was quite obvious that there was a need for **renovation** here. For Stadtentwässerung Koblenz (SEK), the decisive question arose: Is the investment for the rehabilitation of the adjacent structures culvert upper head and the culvert lower head including the pumping station still economical in view of the lack of knowledge about the condition of the two culvert pipelines that have been **in operation for 44 years**? Because: Should the culvert be unusable for further use or no longer capable of rehabilitation, completely new planning considerations would definitely have to be made. The **condition of the two culvert pipelines** had to be assessed as well, and this within the scope of an **inspection**.

Limiting conditions for the inspection process

In order to capture the entire problem and to record what the **inspection procedure** has to achieve, it seemed sensible to define the major limiting conditions first. The inspection process should:

- function with the culvert pipelines complete full
- supply information on serviceability
- provide data on the remaining working life
- provide data on the condition of the culvert pipelines
- be able to be performed in an acceptable and calculable period

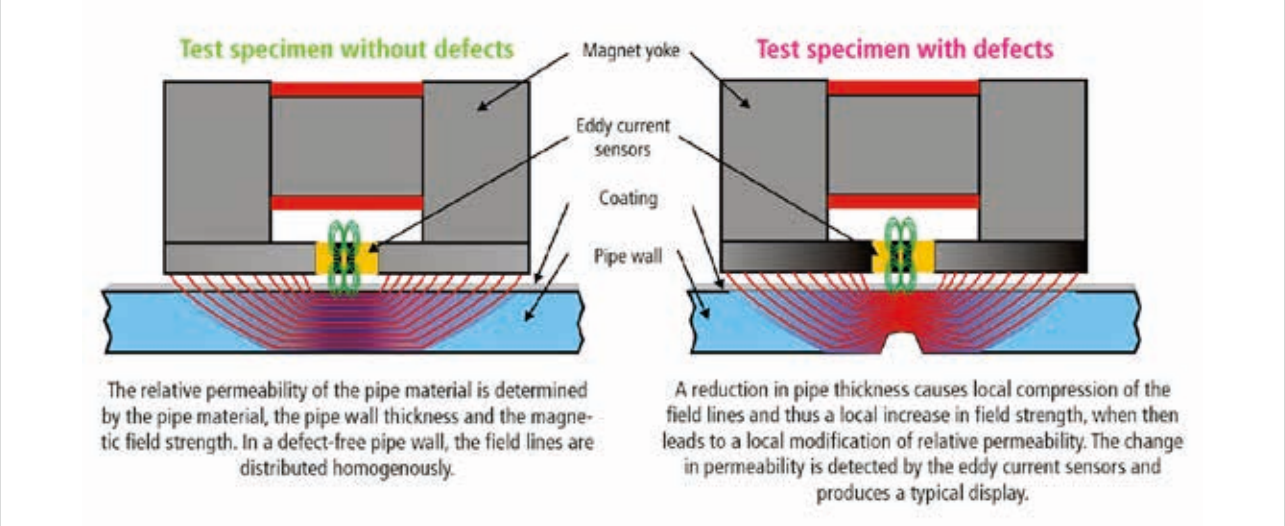
Requirements for the inspection system

Based on this, a **test system with special features** had to be found and the necessary requirements were specified, which resulted almost exclusively from the accessibility of the object to be inspected:

- The culvert pipelines are not designed for inspection by pig. There are no pig traps. The insertion of an inspection device has to be done at the lower head of the culvert.
- Access to the culvert pipelines is only possible from one end. The inspection system must allow bi-directional operation.
- The inside surface of the culvert pipelines is coated. The inspection system must be able to be used for checking the pipe wall through the coating.
- Thorough cleaning before the inspection is not possible. The surface may still present residues or deposits. Inspection must also be possible in the presence of low-level residues or deposits.
- The pipeline needs to be inspected in the filled state, whereby complete filling without air bubbles cannot be guaranteed. The inspection system must be able to be used regardless of the coupling medium under water and under atmospheric conditions.

The approach for the inspection

Finally, an inspection system was chosen that examines the metal pipe systems with eddy current according to **SLOFEC™** (**S**aturation **LO**w **F**requency **E**ddy **C**urrent) technology for corrosion. It is based on the **eddy current technique**. The Andernach engineers convinced the officers from the Koblenz municipal drainage service of the application and success of this inspection technology, and the public call for tenders was then carried out for separate lots: **culvert cleaning and culvert inspection**.



SLOFEC™ functioning principle

Implementation

The contract for the **cleaning** was won by Norand Industrieservice GmbH from Löbnitz, the one for the **inspection** went to 8SEAS consulting engineers – water + energy from Nackenheim. 8SEAS commissioned the experienced company KontrollTechnik GmbH from Schwarmstedt, which specialises in **inspection processes** and had developed various types of **SLOFEC® internal pipe scanners** for inspecting underground pipelines in industrial plants.

For the intensive cleaning of the two culvert pipelines, four working days per pipeline were required in 24-hour operation, and the pipes were then filled with clean water. Then their **position in the XYZ position** under the river had to be determined. The 8SEAS consulting engineers used the **3D gyroscope measurement** with the Ductrunner measuring method for this purpose.

The **non-destructive inspection** of the pipe walls was then carried out with the PLS type SLOFEC® internal pipe scanner starting in the lower head of the culvert, passing through the culvert pipes (DN 800 cement mortar lining, DN 1250 epoxy lining) and ending at the upper head of the culvert:

Lowering the SLOFEC® scanner into the lower head of the culvert

The **wired scanner** was lowered into the culvert opening at a depth of approx. 15 m, inserted into the culvert and pulled through the culvert with a winch. For data recording purposes it was positioned in an axial direction by the winch, the sensor head was “pressed” against the pipe wall and moved **circumferentially**; the corresponding inspection section was 150 mm. After completion of a full circumference scanning by the rotating sensor unit, the scanner was pulled forward by a further 150 mm in axial direction and a new measurement started until the complete data recording across both culvert pipes was complete.

Evaluation

Even after 44 years of continuous operation, strong currents and flooding, the ductile cast iron culvert pipelines only showed **slight corrosion** along the whole of their **outside**: at the "foreshore", most areas were detected as having only slight local inhomogeneities (weak corrosive attack); it was only at the start of the inspection run, close to the pumping station (lower culvert head) that areas of more severe inhomogeneity had formed. On the Mosel riverbed no damage at all was found on the **inside and outside of the pipes**, in other words the pipe wall is unchanged after 44 years of operation!

There was (and is) **no need for renovation** of the culvert as any significant impairment to wall thickness by corrosion and/or other ageing damage was able to be definitively excluded, even in the lower head areas of the culvert. With the results showing the good condition of the culvert pipelines, the way was opened for the investment to renovate the dilapidated concrete structures of the adjacent culvert upper and lower heads and thus **further long-term use of the culvert structure as a whole**.

Authors: Hans-Jörg Schulz, Eigenbetrieb Stadtentwässerung Koblenz, Wilhelm Kelb, Kontrolltechnik GmbH

The article was slightly shortened by the editors. You can find the complete article with various illustrations as a PDF in the download area under Downloads Annual Issues EADIPS FGR.

Installation of a sewer of ductile iron pipes on a steep

Framed by the idyllic backdrop of high mountain peaks, sun and snow spoiled: the Nassfeld in the Carnic Alps attracts tourists in their thousands every year. With 1.4 million overnight stays a year – and the trend is upward – communities and investors in the region want to develop yet more tourist structures and/or extend existing ones. An essential precondition at all is a well-functioning **water supply and wastewater disposal system**. And for sewage disposal in particular, **ductile iron pipes** have been used for a long time.

At the Nassfeld and in the valley floor (Tröpolach, further projects are planned in the coming years. Wastewater from properties on the Italian side of the border region is already being handled by the Carnic region wastewater association which is responsible for the Nassfeld.

In order to protect ductile iron pipes against external factors, pipes with cement mortar coating were used. Delivering the usual pipe-bedding material on the steep slope was not possible.

The geological and tectonic conditions in this region make it prone to landslides. The use of ductile iron pipes with cement mortar coating was therefore a "must".

Drainage for a scattered settlement with ductile iron pipes

Actually, the drainage of the scattered settlement with 25 properties at the Guggenberg is no longer part of the Carnic region wastewater association. But because of the touristic development to be expected, the lack of alternatives and the unequal distribution or increased occurrence of wastewater in specific months, it was decided to connect the outlying properties on its **wastewater network**: With a straight-line route over a length of 1.5 km and steep terrain with a gradient of up to 45°.

A construction project holding many challenges, but individual or group sewage treatment plants would have had an unsatisfactory result because the utilisation rate in the Summer and Winter months is extremely high and very low in the off-season. Another option to the directly running steep route would have been the much more expensive pipeline route over the 4.5 km long winding access road to the scattered settlement. The solution with **thrust and tractive restrained ductile iron pipes** quickly became clear while planning the construction work.

Cement mortar coating protects the pipes against external factors

The construction of the wastewater pipeline involved overcoming around 400 metres of altitude difference and crossing a wide variety of alpine zones. In addition, the pipeline had to be resistant to external influences such as landslides. The requirements for the pipe material used were correspondingly high and the decision was made to use robust DN 80 **ductile cast iron pipes** with the **VRS®-T push-in joint** from Tiroler Rohre GmbH. These also score points with the abrasion resistance of the **cement mortar lining (ZM-A)**, which is guaranteed even at high flow speeds, as occur in steep slopes.

The bedding of the pipes in conventional bedding material was not possible in this steep terrain, which is why **ductile iron pipes** with **cement mortar coating** were used. The coating provides reliable protection against e.g. rockfalls during installation which could damage the pipe. Thanks to the **VRS®-T restrained push-in joint**, there was no need for additional thrust bearings. The constant movements make it necessary to use **expansion compensation** (long-sleeve sockets), developed by Tiroler Rohre GmbH.

Excavation work on the extremely steep gradient

The greatest challenge when constructing the wastewater pipeline was without doubt the earth-moving work and the transport of the pipes on the extremely steep gradient. The installation of the pipes was only possible with a so-called “spider”, a walking excavator. With the help of independently controllable walking legs, it is also possible for the driver to carry out operations even in difficult terrain. But even with the equipment constructed for challenging earth-moving work, there were misgivings about its feasibility – a comparably steep construction site had not existed before.

The equipment operator from the Porr-Seiwald consortium took up the challenge with the “spider” and an additional winch securing device. So a trench was able to be excavated for the pipes in the conventional way, without the need for cost-intensive boring into the rock. The pipes were also transported with the walking excavator – a tough business.

The spider not only dealt with the earth-moving work but it also transported the pipes.

All's well, everything's fine

The **construction logistics** also faced the clients and planners with some major challenges, but with Tiroler Rohre GmbH they had a reliable partner at their side who supplied **pipes and fittings** made of **ductile cast iron** promptly and precisely.

The work of constructing the entire 5.5 km long pipeline took a little over one year; 1.5 km of this is the length of the section of wastewater pipe described on the steep gradient. Even if the rather lackadaisical motto "buried and forgotten" does not apply with the Carnic region wastewater association, it is assumed that there will be problem-free operation for many decades. For this reason, **top quality pipe material** is all the more important here. Luckily, **ductile iron pipes** promise a **long working life**.

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Enamelling – secret ingredient for successful use

Today, more than 130 million m³ of purest drinking water flow annually through a 1,700 km long pipeline network from Lake Constance to the Odenwald forest. The 183 members of the **Zweckverband Bodensee-Wasserversorgung** (towns, municipalities and other special-purpose water supply associations) supply 320 municipalities with around 4 million inhabitants with drinking water from Lake Constance – safely and reliably, day and night, 365 days a year and has been for 60 years. The valves installed there, with pipe diameters of up to **DN 1600**, are designed for pipeline pressures of up to 30 bar and are partly equipped with drop-weight actuators. They are used, among other things, for pipe rupture, overflow and leakage protection.

Sipplinger Berg Waterworks, Zweckverband Bodensee-Wasserversorgung

Treatment of raw water with ozone

The high-quality raw water of Lake Constance is disinfected during the treatment process by the addition of highly active oxygen (**ozone/O_3**). The ozone oxidizes dissolved and particulate organic substances, killing or inactivating any microorganisms still present. The ozone is produced from pure oxygen (O_2) immediately before it is added to the water. For this purpose, the oxygen is converted into ozone in so-called **tube ozone generators**. Injectors transport the ozone into the water, mixers distribute the tiny ozone bubbles evenly throughout the entire water body. The water then remains in large containers for at least 2 hours; during this time, disinfection takes place.

Conversion of oxygen into ozone in so-called tube ozone generators

Higher demands on valves due to climate change

The constant climate change, which also affects the **ecosystem of Lake Constance**, also poses challenges for the Lake Constance water supply and meanwhile requires an **increase in the ozone addition** to an average of 0.2 to 1.4 mg/l. The ozone concentration of Lake Constance water is also increasing. This in turn places **increased demands** on the valves used, which are in direct contact with the ozone-enriched water, in terms of materials and corrosion protection. ERHARD was able to meet these high requirements by installing the **double eccentric** "ROCO Wave" **butterfly valves** in the "enamelled inner body and disc" version. The advantages of the enamelled coating are obvious:

- high corrosion protection as the key to maximizing service life
- perfect hygienic conditions thanks to the smooth surface of the enamel components (Ra 0,05)
- residual substances in the water, as well as oxidized organic components of microorganisms, have difficulties to accumulate on the fitting, which contributes to the maintenance of water purity
- reduction of pressure loss due to extremely smooth surface, which increases efficiency and reduces energy consumption
- existing connection also under bending or other loads, such as internal pressure or pipeline forces
- Butterfly valves of nominal sizes DN 1200 and DN 1400 in pressure stage PN 10 and seals in EPDM (DVGW, KTW) were used for installation in the intermediate tank east/west of the ozone plant.

The enamelled version has proven itself over the last 20 years against other coating systems with regard to contact with ozone-enriched water and in particular as **protection against deposits** by microorganisms or aquatic neozoa and is therefore set as **standard** by the Lake Constance water supply in ozone-polluted areas.

ERHARD butterfly valve ROCO Wave outside EKB, inside enamel coating

Application of the enamel coating by spraying

Enamel pioneer and professional for decades

ERHARD was one of the first manufacturers of enamelled fittings in the 1970s. In the 1980s, enamel was already established as a coating for drinking water as an integral part of the ERHARD product range. With increasing know-how, the refinement of the enamelling process and its application to fittings also increased.

To this day, the company works closely with its suppliers to develop ever better and more durable enamel coatings that do not crack under load. With ERHARD Pro-Email, the most important innovation of which is the development of a special fibre enamel, which is particularly suitable for use in the water industry due to its incomparable impact strength, the company today relies more than ever on the **advantages of enamelling** for the customer.

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