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The magazine for large **Plastic Pipe Technology** (up to DN/ID 5000mm)
No.19 / 2019
ISSN 2626-4366

IMPROFIL

Structural design
of profiled Polyethylene pipes

Fish Farms
A special application of Krah Pipes

Rainwater / Stormwater application
in Sultanate of Oman

Under difficult conditions
How to repair Krah pipes - field report

Climate Change and Urbanisation
Driving the future of water management

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Imprint
Krah Pipes GmbH & Co.KG
Betzdorfer Str. 8
57520 Schutzbach

www.krah.net

Dear Reader,

Summer is coming!

After a mild spring, the days are getting longer again and we North Europeans are enjoying the first hot and sunny days. The nature is beginning to explode in our area, the Westerwald, and we are curious if this summer is going to be another so-called "summer of the century".

Still German households, offices and factories are not very well prepared for long periods of high temperatures and in contrast to most southern regions, most of the buildings does not have any air condition at all yet. Should the climate change bring more hot summers, we will have to get accustomed as most of the world does.

Around 40 members of our Krah community from 15 different countries all around the world could already enjoy the hot South American sun in the first days of March 2019, during the annual large pipe conference, the Krah Community meeting. This year it was held in Argentina, being able to take part in the inauguration of their latest production facility in San Juan. In this issue you will find a report about this outstanding event as well as some presentations that were held during the meeting. Some presentations however cannot be published as they were only for the internal purposes and not yet meant for open public, like new trends in the production technology and new pipe developments.

Some of those new developments will certainly be presented to public during the upcoming K-Show in October 2019 this year. We are already planning our booth and activities for the world biggest plastic exhibition! Be excited! We are also only a few months away from finishing the new book for large plastic pipes, which should be printed and published during this year.

Also, this is already the 19th issue of our magazine – I am very proud. We have shut down our Facebook site, because we are concentrating on our own "new" homepage (www.krah.net) and LinkedIn, Youtube – because the level of serious content is much higher. One of the first posts in LinkedIn reached more than 32.000 people, most of them linked directly or indirectly to our business.

I wish us all a productive second half of 2019.

Alexander

How Climate Change and Urbanisation are Driv

When I was younger (many years ago) the weather in the UK just seemed different, my memories of my trips to school were of seasons which were quite distinct. Warm, sometimes hot summers a temperate autumn, wet and often cold winters, before long periods of low intensity rain during the spring and leading back into the Summer. Apart from the Summer of 1976 I do not recall there being much discussion about drought or drinking water shortages, and flooding was not something that regularly made the news.

As I write this 40 years later, it is clear to me that in the UK at least, things have changed. I do not need a climate scientist to tell me our weather patterns have altered, I can see it for myself. In the UK now the seasons seem less distinct. Summer can still be warm, just like the last one, which was the hottest since 1976, but equally they can be very wet. In fact, we often now see some of our heaviest periods of rainfall in the summer months. It is not only the frequency of rainfall events that have changed, its also the duration and magnitude, now the rainfall events are much more likely to be short but of a high intensity.

The statistics seem to support my recollections. A search of the internet revealed that the UK has suffered approximately 25 'exceptional' flooding events since 1300's. Out of these 25 events, 12 have occurred since the year 2000, and 4 of those occurred during the summer months. In fact, summers in the UK have been on average 20% wetter in the last decade, than the average between 1961 – 1990.

Looking forward it seems we have more to come, the UK climate projections assessment published in 2018 suggests that the UK Climate will continue to warm. By 2070 we can expect Summer temperatures to be between 1° and 5°C higher than present levels (on average) and winter rainfall could, at the extremes of projections, increase by up to 35%. Flooding is forecast to become more prevalent and premature deaths due to overheating are expected to rise.

Some may say so what has changed, there has always been flooding, surely this is just natural variation. If flooding is viewed in isolation, they might be correct, but there is another societal trend which is potentially exacerbating the effects of climate change – Urbanization. By 2050, the global human population will have reached 9 billion (Fig. 1); of this, 75% are expected to be living in cities with London alone set to rise from 8.63 million (2016) to more than 11 million by 2036.

As populations migrate from rural to urban areas our cities expand, and where space is constrained, become denser and taller. This trend is clearly shown when you look at the statistics for tall buildings which show significant growth since the 1960's (Fig. 2).

Once again taken in isolation, urbanisation and the resultant densification of cities might not in itself create problems for populations. But what happens if you combine the effects of climate change and

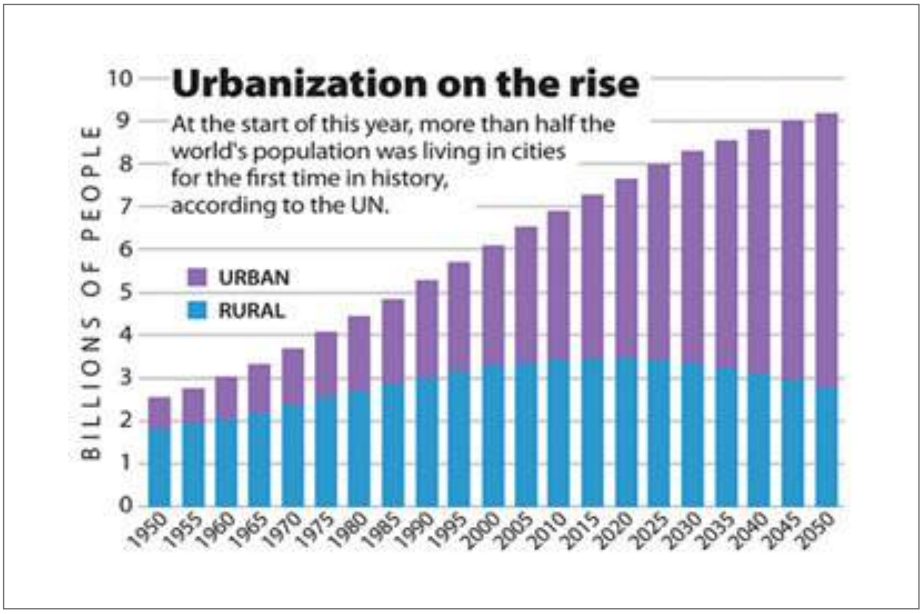


Fig. 1: Urbanization

ving the Future of Surface Water Management

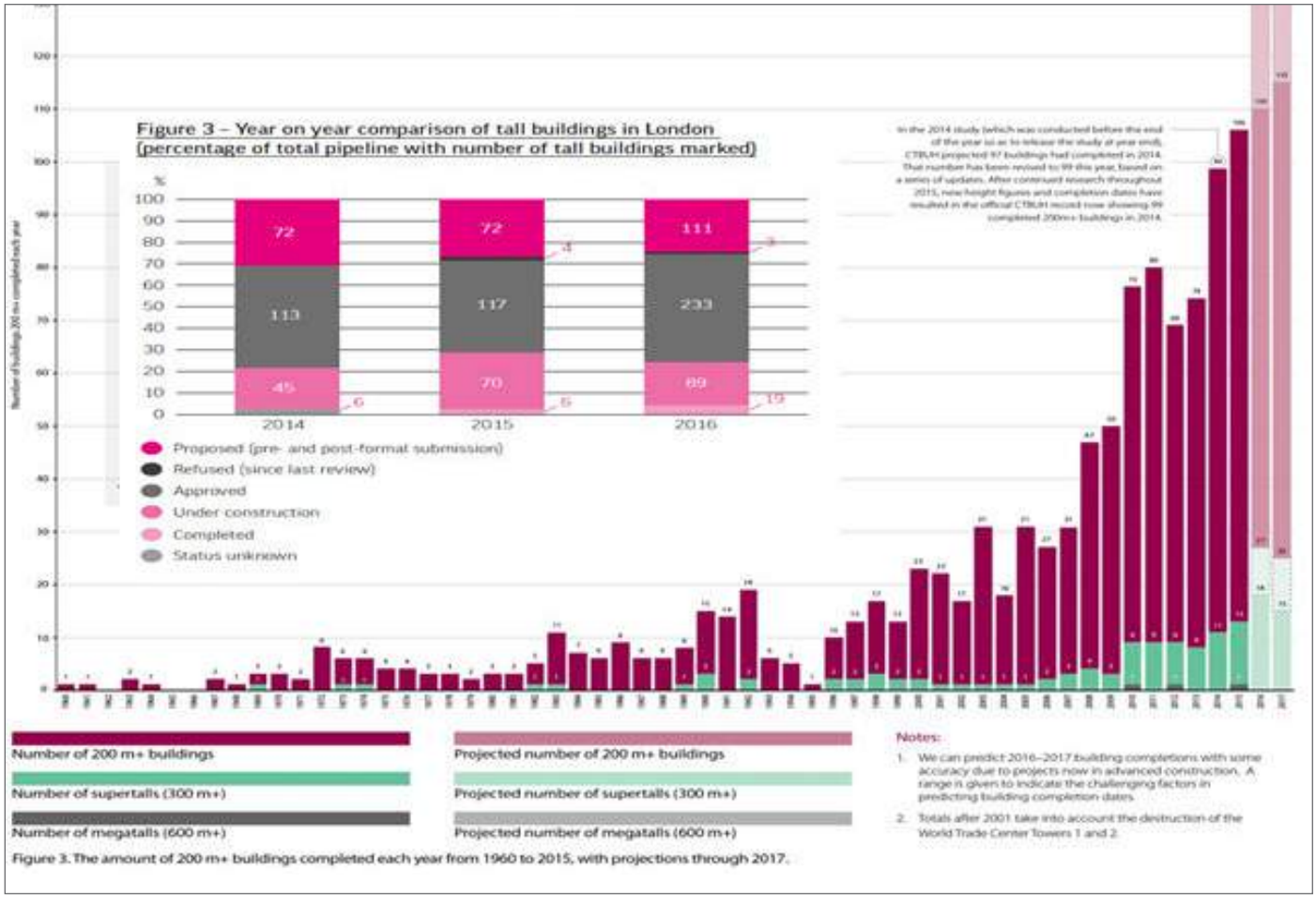


Figure 2. Increasing trend towards the use of tall buildings

urbanisation, how does this manifest on society. Well, one of the biggest impacts is a change in the natural water cycle of the environment. Not only the volume of surface water runoff but also the rate at which the surface water runs off.

In rural environments the volume and rate of surface water runoff are naturally controlled by infiltration or natural attenuation, but in urbanised environments the amount of impervious areas created dramatically increases the volume and speed of the runoff.

The resultant effect being that pipes fill quickly, water is discharged to the drainage system / sewerage system efficiently and eventually into the river system which, if left unabated can then go on to cause fluvial flooding downstream of the urban area. Or, in the case of cities with combined sewers cause sewer overflows with resulting pollution and potential health impacts.

This type of urban / suburban flooding became so widely recognised in the UK that the government acted in 2003. They changed the UK Building regulations, introducing a drainage hierarchy and making flood risk assessments mandatory for all new build developments above a certain size. It was no longer acceptable to start with the installation of a conventional piped drainage system. In fact, the use of surface water sewers was made the choice of last resort, the first priority was the use of soakaways to promote groundwater infiltration and recharge drinking water aquifers. However, much of the UK stands on clay soils which infiltrate poorly and so another alternative was introduced which

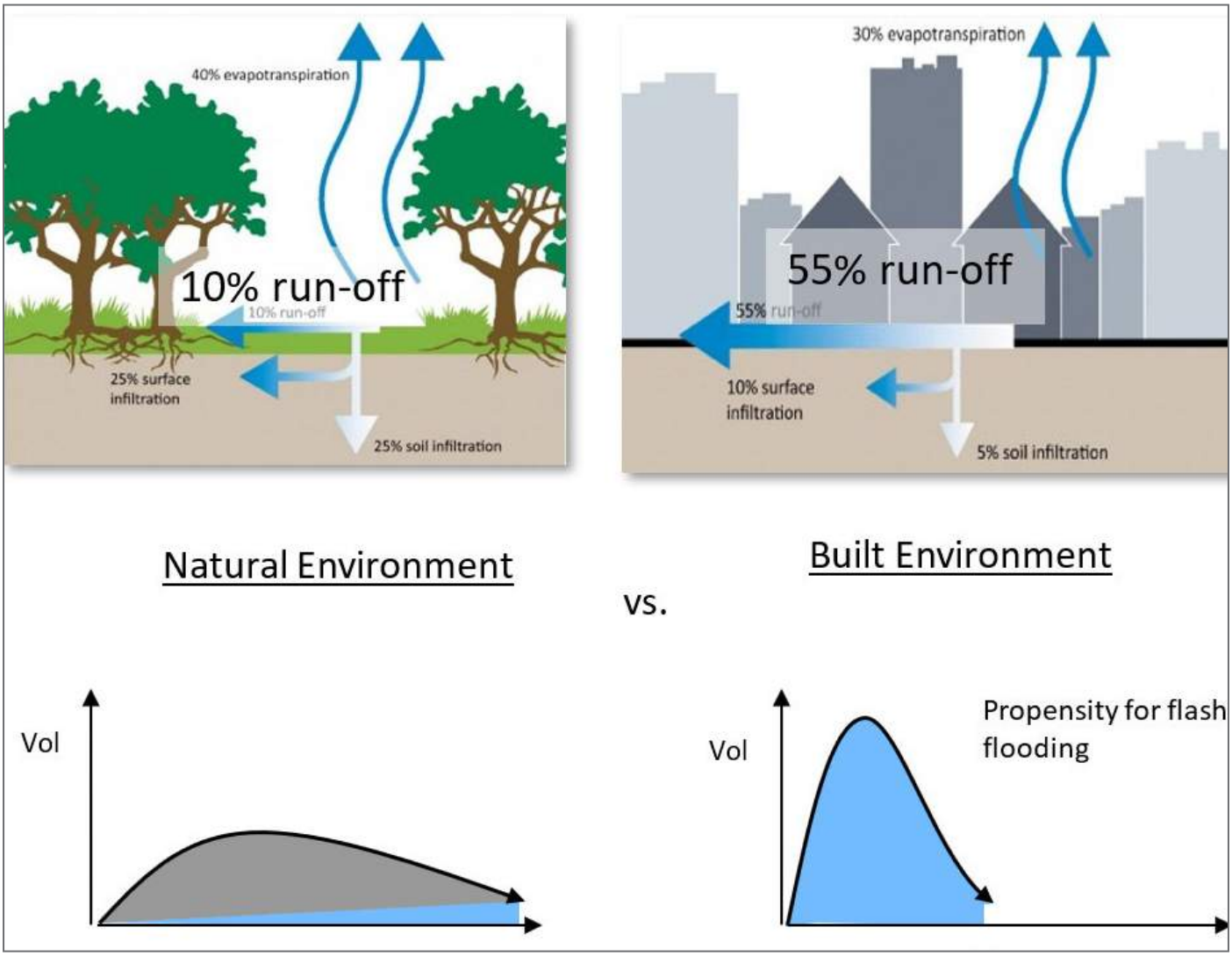


Figure 3. Urban vs Rural run off

was the use of storage systems behind flow throttle valves, which would collect and store stormwater from developments until such time as it could be released under controlled conditions. Thereby providing engineered attenuation.

As a result of the changes to the building regulations drainage designers now had to consider not only how they were going to dispose of surface water but also how they were going to manage it. Where land was freely available some chose to use surface water ponds, but in

Figure 4. Large diameter pipe stormwater attenuation structure on a residential development in the UK

an urban environment land is often at a premium, and so subsurface structures became the norm. These structures took predominantly 2 distinct forms.

Where the drainage structures were to be adopted by the municipal water company large diameter piped attenuation was, and still is, often installed (Figure 4.). Water companies prefer these types of structures as they afford easy access for maintenance and are known to be durable, providing a long asset life. Contractors like them as they can be prefabricated off site and are easy to install due to the light weight nature of the design and materials, which speeds installation and benefits the health and safety of operatives.

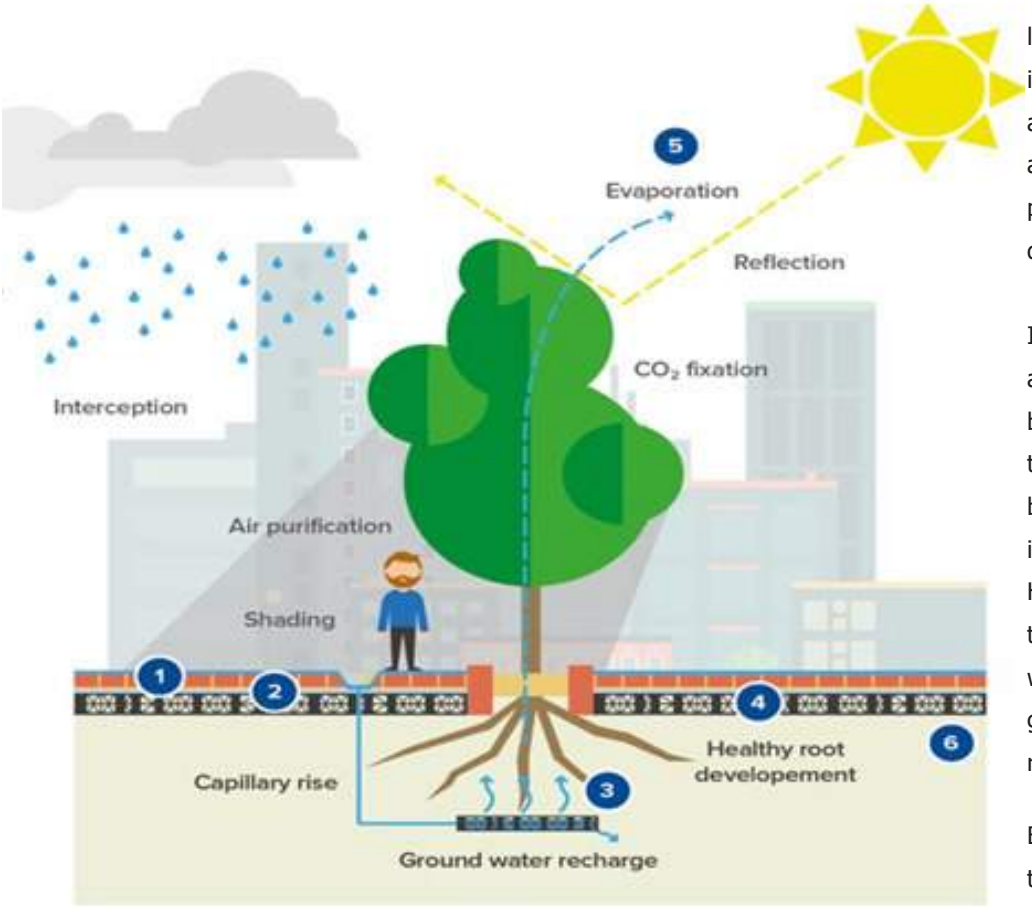
Where the developer is not looking to offer the tank structures up for adoption then the use of geocellular modules became widely accepted (Figure 5). These structures are more cost effective than piped attenuation as their modular nature means they are easily installed on site and are efficient in terms of space for water storage. The problem with these types of structure is their lack of access for maintenance, which requires that upstream silt and pollutant capture devices are required to complement the system. More recent developments have seen some of these systems now having special modules which allow the units to be CCTV inspected and flushed with water if required.

Both piped and geocellular attenuation, together with other forms of water storage, continue to be commonly used on all developments in the UK to ensure that the post development run off rate is no more than the run off rate of the predeveloped land. Thereby, ensuring that the development does not add to any flooding burden and making it more sustainable. However, even though they facilitate land utilisation above the structure these solutions still require a significant amount of space for installation, and in a dense environment such as the city of London the space is not always available. So, in more recent years, attention for dealing with surface water has moved more towards a concept of "Source Control" that is dealing with the stormwater as close to where it falls as possible, rather than transporting it before storage. Source control is not necessarily a new concept, but it has only recently gained recognition as a technique particularly applicable to urban environments.

Figure 5. A geocellular stormwater attenuation structure on a residential development in the UK

The main benefits of a source control approach to water management is that it allows the management processes to be more localised. Now, instead of a catchment area approach to collecting and storing water the water management can start to be applied at building level and then combined with a street or catchment approach this means costs can be shared between building owners and municipalities. There are additional benefits too, in that source control is one of the main functions of "Green Infrastructure".

Green Infrastructure (GI) is the very latest approach to dealing with the combined effects of climate change and urbanisation being utilised by many Cities across Europe. In London it forms one of the principle themes of the New London Plan and all boroughs of London are encouraged to apply its principles during planning considerations. GI not only provides water management it also delivers many other multifunctional benefits and, if designed correctly, adds to making inner city spaces more attractive (plants vs concrete), useable and ultimately valuable. By applying GI as part of a placemaking approach to development not only can you manage stormwater at source, but you can



❶ Rain intercepted via permeable paving and rain garden to reduce run-off

❷ Geotextile removes oil and other road contaminants

❸ Permavoid units provide space for water and unse capillary cones to irrigate trees above

❹ Air gap to allow roots room to growwithout causing damage to surface and protects roots from damage

❺ Helps cool through evaporation

❻ Soil is naturally recharged with water

Figure 6. How trees for a natural part of GI and how engineered solutions can be used to make space for water and provide support to the urban environment and the tree.

also create amenity spaces where people can rest or exercise, improving health and wellbeing. GI also provides shading and cooling, helping to offset the Urban Heat Island effect which is a common phenomenon where cities can be up to 3°C during the day and 12°C during the night hotter than surrounding areas as all the concrete surfaces release heat stored during the day. By way of demonstration Figure 6 shows a schematic of the role a simple tree can play as part of GI. A fully-grown oak tree can consume and lose up to 420lts of water per day through transpiration.

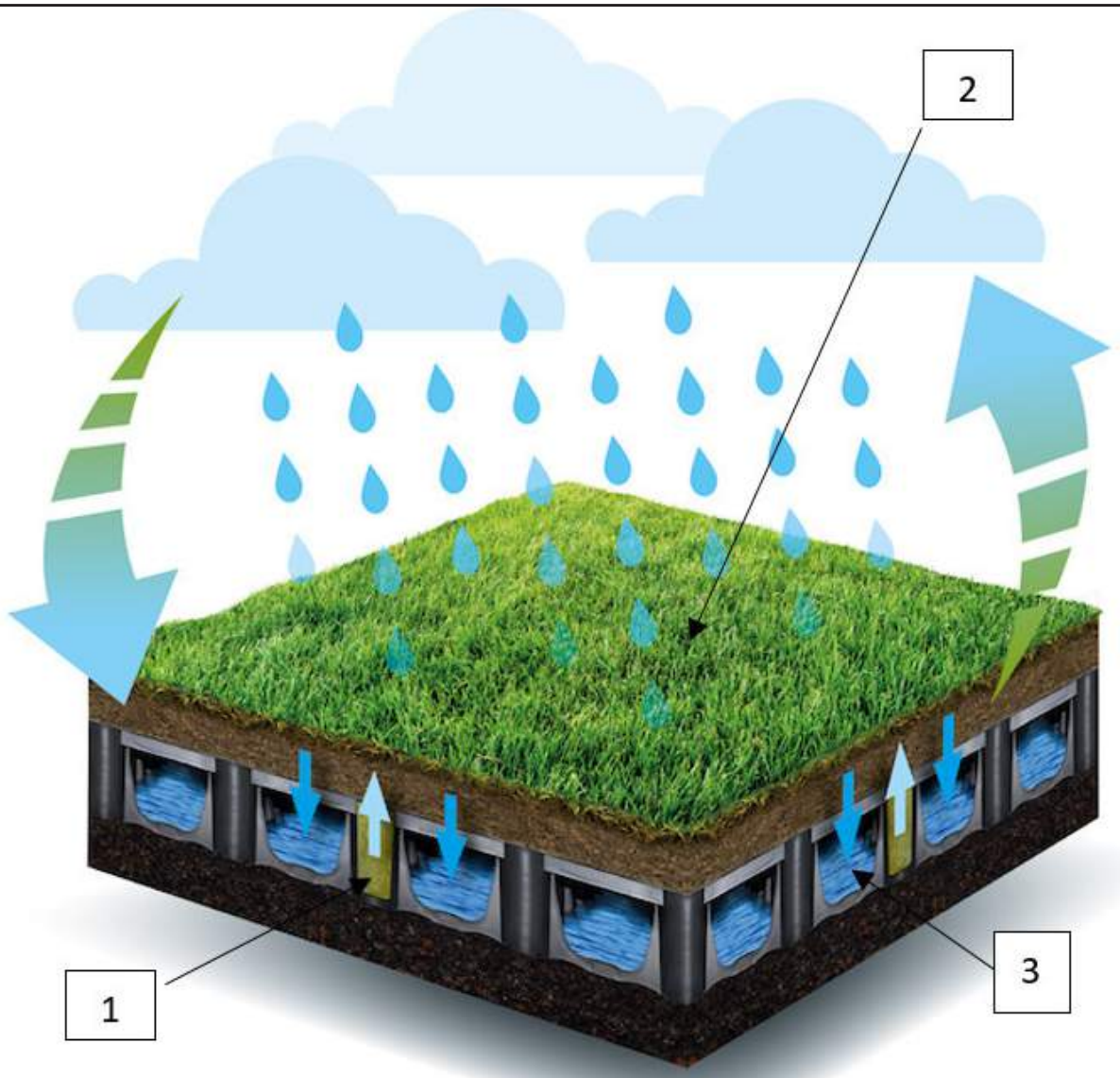
One other benefit of GI is that it can be applied not only at in streets but also on roofs, meaning that the principles of source control can be taken to new levels. One of the main techniques for introducing GI historically has been the application of green roofs. These systems are widely used in Europe, (Germany in particular) where local regulations have driven their use.

In other European countries where there are fewer regulations their take up has been slower, as they primarily provide for the softer benefits of GI e.g. increased biodiversity and some amenity, with little, if any, water storage and attenuation. However, this is beginning to change with the concept of the Blue-Green Roof. One where water is stored beneath the soil and green foliage and reused to irrigate the roof thereby recreating a circular system.

By applying the Blue-Green roof concept in the city context there is now built in space for managing water that was previously adding to the problem with run off, but you have also created valuable public amenity space which can be monetised. Figure 8. Below shows one such project in London where the roof of the building is used to provide recreational and exercise space for the inhabitants whilst the subbase for the roof collects stores and reuses stormwater ensuring that water flowing from the building is manged.

Conclusion

Whilst this paper has drawn from the authors experience in the UK the themes and solutions presented are equally applicable in almost any other geographic location. Climate change and urbanisation are now ubiquitous in the modern world, and are, if anything, increasing. The changing



❶ Water re-used to passively irrigate soil and plants above

❷ Stormwater attenuated as it passes through the soil

❸ Stormwater stored beneath soil with discharge attenuated

Figure 7. Typical Blue-Green roof solution

new solutions are developed to allow the spaces in which we live to adapt and become more resilient.

Author: *J. A Shingleton - Polypipe*

Figure 8. Rooftop running track and recreational area in London which has a Permavoid Blue – Green stormwater storage and irrigation structure beneath the surface

Structural pipe design

according to AWWA M55

Introduction

In accordance with the different norms and standards, the pipes must be selected in accordance with their class of nominal ring stiffness (SN), as SN2, SN4, SN8 or SN16 (in accordance with the standard ISO9969), or in accordance with any other stiffness standard (DIN 16961, ASTM F894, NBR 7373 etc.) notwithstanding the testing methods (at constant speed or constant load). For an example, a project requires pipe stiffness of 5.5 and the nearby standard value is that of pipe stiffness 8 and hence engineer could only provide details of profile with stiffness 8. In addition to this and in accordance with article 9.1 of the standard EN 13476-3, the manufacturers are allowed to produce pipes that fall between the above listed SN-classes. To qualify for this admission the producer must be able to prove this solution with static calculations. With Krah pipes, are able to provide any project with pipes of the precise stiffness that the project demands.

It is useful to perform static calculations for pipes taking into consideration the specifications of each particular project. In 99% of cases the pipes selected for a particular project are over dimensioned in the original project design documentation. Using the calculations, it is possible to prove that it is sufficient to install a pipe with less stiffness but the correct profile, including the required safety factor which is also cost-efficient and faster to install.

The ATV A127, a German standard for static calculations for all kind of pipes is widely spread and used in the European region. It latest version dates from the year 2000. The software used by Krah was provided by IngSoft and is called Easypipe.

Globally, a different design manual is used for static calculations of flexible polyethylene pipes published by the American Water Works Association called M55 PE – pipe design and installation. Therefore, the Krah group developed a new software in Mickey for static calculations called structural pipe design according to AWWA M55. Static calculations according to AWWA M55 don't need many parameters and information. It is user-friendly and easy to use.

The following chapters of this article will explain which input data is needed and which formulas are necessary to analyse, if a buried pipe verifies.

Input data

First of all, it is necessary to define the pipe which shall be calculated. Mickey is linked to the Krah pipe database. By choosing the diameter and the material (e.g. PE80/100), all information which are necessary for the calculation will be automatically transferred to Mickey. To calculate the nominal pipe stiffness (short-/long-term) the following parameters are needed:

$$PS = \frac{E * I}{Dm^3} \; [kPa]$$

Where:

E = *short-/long -term modulus of elasticity of pipe material [kPa]*

I = *moment of inertia [mm4/mm], directly calculated by Mickey*

Dm = *mean diameter*

A special feature in Mickey is, if one only knows the diameter of the pipe, but is unsure about the size of profile type, Mickey is able to calculate the best suitable pipe for installation under the given circumstances.

Secondly, it is necessary to define the specifications about the Trench and the details of the Installation of the pipe. Needed Input e.g. is Cover height, Trench width, Bedding Angle, soil type etc. To define the earth load pressure (P_E) on the pipe, this input is necessary.

Thirdly one should define what kind of loads exist over the buried pipe to determine the live loads (P_L). The AWWA has several types pre-defined and are integrated in Mickey e.g. no traffic, normal highway traffic etc. Also, the type of pavement is necessary to define e.g. rigid, flexible or non.

Furthermore, details about the static loads are needed before starting calculating. One should define the existing surcharge loads P_ES and the load area length at each side of the

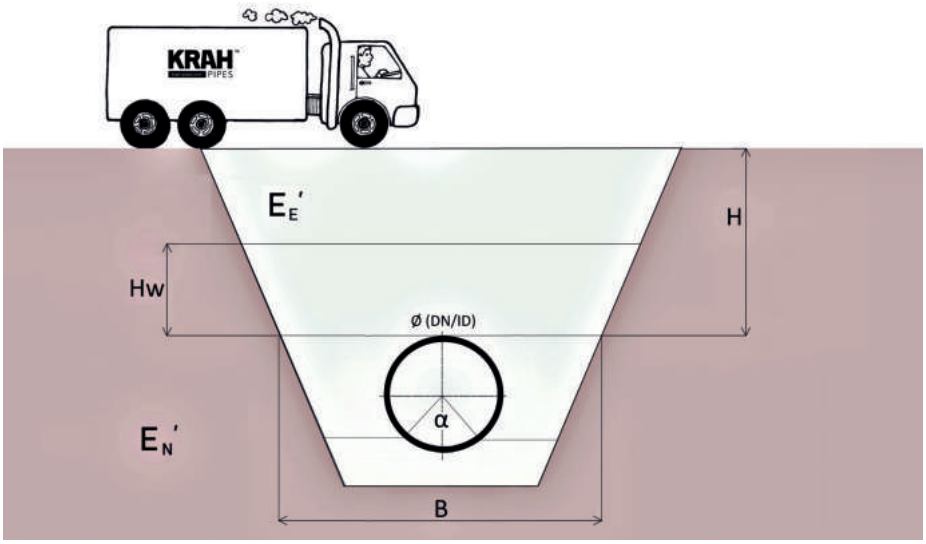


Fig. 2: Sketch for installation and trench and a schematic load above the pipe

Where:
Hw = groundwater height above pipe [m]
H = depth of cover [m]
B = trench width [m]
α = bedding angle [°]
EN' = design modulus of soil reaction for natural soil [kPa]
EE' = design modulus of soil reaction for embedment material [kPa]

The earth pressure on the pipe is, P_E = ρ H [kPa]
Where: ρ = soil saturated unit weight [kN/m3]

pipe. A surcharge load is any load which is imposed upon the surface of the soil close enough to the excavation to cause a lateral pressure to act on the system in addition to the basic earth pressure. Groundwater will also cause an additional pressure, but it is not a surcharge load. The surcharge load is

$$P_{ES} = 4 * I_c * W_s \text{ [kPa]}$$

Where:
I_c = influence coefficient from table 5-5 AWWA M55 and Fig. 5-2
W_s = distributed surcharge pressure acting over ground surface [kPa]

The AWWA M55 recommends using an allowable ring deflection of 7.5%. In comparison, the German ATV A127 calculates with an allowable ring deflection of 6%. Buckling safety factor (FSp) and hoop compression safety factor (Fsc) are both 2, to ensure enough safety for the static calculation.

Calculations

In the first instance, intermediate results are calculated, because they are necessary for the final results. The figure below shows the intermediate results calculated by Mickey.

The calculated figures above are needed for the final results and to check if the chosen pipe verifies the loads and is suitable for installation.

For giving a Statement if the Pipe is suitable for Installation, the following indicators have to be calculated and determined. For a conservative design, the pipe must be within its safe allowable limit for each of these three reactions – deflection, buckling and ring compression.

Percent ring deflection:

Ring deflection is an essential response of flexible pipes to soil load. Deflection promotes arching, allows the pipe to shed load and develops supporting reactions in the surrounding soil. To calculate ring deflection according AWWA M55, Spangler's modified Iowa formula is used:

	Symbol	Unit
Outside diameter	*OD*	*mm*
Mean diameter	*Dm*	*mm*
Nominal ring stiffness short-term		*kPa*
Nominal ring stiffness long-term		*kPa*
Groundwater height above pipe	*Hw*	*mm*
Bedding constant	*Kx*	*-*
Design modulus of soil reaction for natural soil	*EN*	*kPa*
Design modulus of soil reaction for embedment material	*EE*	*kPa*
Earth pressure on pipe	*PE*	*kPa*
Live load pressure on pipe	*PL*	*kPa*
Influence coefficient	*Ic*	*-*
Surcharge load pressure on pipe	*PES*	*kPa*

Tab. 1: Intermediate Results calc. by Mickey

„Don´t think – calculate !"

In 99% of cases the pipes selected for a particular project are over dimensioned in the original project design documentation

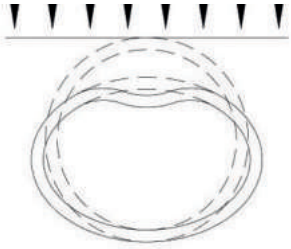


FIG. 1A

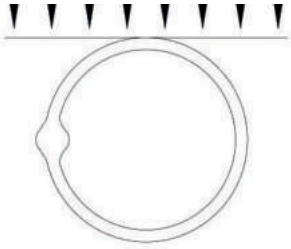


FIG. 1B

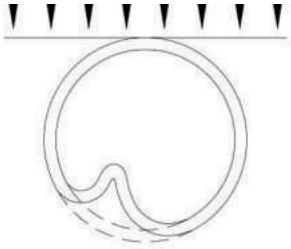


FIG. 1C

A buried pipe is verified, if it can withstand three reactions: ring deflection, wall compressive stress and buckling. The alloweble ring deflection according to AWWA M55 is 7,5% and the safety factors for wall compressive stress and buckling are both 2.

$$\%\frac{\Delta Y}{D_m} = \frac{K_X*(T_L*P_E+P_L+P_{ES})}{\frac{2*E}{3*(DR-1)^3}+0{,}061*E'}\text{x}100$$

Where:
T_L= time - lag factor
E = short-term modulus of elasticity of pipe material [kPa]
DR = dimension ratio, OD/s1
E^' = modulus of soil reaction [kPa]

The calculated percentage of ring deflection must be smaller than the allowable percent ring deflection of 7,5%.

Allowable short-/ long-term external pressure (buckling)

When buried pipes are subjected to external loads such as negative internal pressure, groundwater or extremely high earth loads, an instability can occur in the pipe wall that may lead to large inward deformations called buckling.

Allowable short-term external pressure:

$$P_{CA,s} = \frac{5{,}65}{N} * \sqrt{R_w * B' * E' * \frac{E}{12*(DR-1)^3}}$$

Where:
N = safety factor 2,0
R_w = buoyancy reduction factor (Eq. 5-11 AWWA M55)
B^' = soil elastic support Factor (Eq. 5-12 AWWA M55)

The allowable long – term external pressure (P_(CA,l)) is calculated equivalently to the allowable short – term external pressure with the only difference of using the long-term modulus of elasticity of the pipe material.

To give a statement if the buried pipe can withstand buckling, the allowable external pressure must be greater than the summation of external loads applied to the pipe.

$$P_{CA,s} > P_E + P_L + P_{ES}$$

$$P_{CA,l} > P_E + P_{ES}$$

Wall compressive stress

The earth pressure applied to a buried pipe creates a compressive thrust stress in the pipe wall. When pipelines are pressurized, the compressive stress is usually cancelled by the tensile thrust stresses form pressurization.

$$S = \frac{P_E * (DR-1)}{2}$$

The compressive wall stress should be kept less than the allowable compressive stress of the material. A pipe is verified if the above requirements are fulfilled.

Conclusion

The use of an own structural engineering calculation allows a neutral and realistic assessment of project specific conditions.

As a pipe manufacturer and supplier, you will be able to determine important dimensions quickly and the economical projection can be carried out precisely. It is also possible to export the calculations as a PDF file and use it for documentation of a project and also present the results to the customer.

Mickey offers diversity and flexibility by considering the latest standards. Experts of the Krah team are also in the most important standard committees and therefore internationalism is ensured.

The PE pipe design and installation manual (M55), seems to be an easy approach, which is sufficient in most cases. For a more detailed solution, the finite element method or the ATV A127 can be used.

Author:
Hussein Tahmaz - KAT GmbH

Separator systems for light liquids

(e.g. oil and petrol) according to EN858

These systems are mainly used to treat the surface water collected from the parking lots, air strips, road surfaces etc. The basic function of the light liquid separation systems is the liquid/liquid separation - separating the light oil, petrol products to the surface water that is further sent for regular treatment. The separated and collected oil and petrol products are collected and treated separately. The quality requirements for the systems somewhat differ between regions, in Europe there is a specific standard EN858 covering the design and usage of these systems.

The European standard EN858 is governing the basics for the separator systems of light liquids. This standard covers the separation systems for light liquids (for example oil, petrol) with density below 0,95g/cm^3. The standard itself is devided into two parts:

- **Part 1** that covers the design, performance and testing requirements
- **Part 2** that covers the selection of the nominal size, instalation, operation and maintenance related areas

I shall cover the types of the separators and their basic design in this brief report about the light liquid separation systems. Separator systems for the light liquid separation can be divided into the following main categories:Static separators, where no extra options besides gravity are used for enhanced separation capability

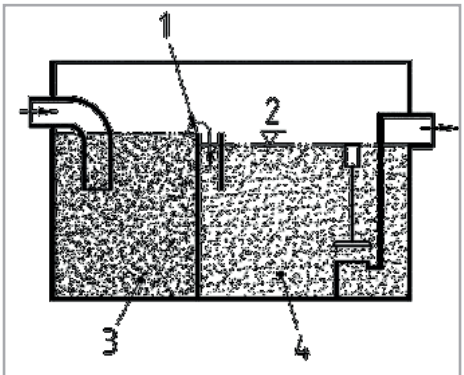
- Hydrodynamic separators, where hydrodynamic manipulation for enhanced separation is used
- Lamellar separators, where lamellar filter packs are used for enhanced separation cabability
- Coalescent separators, where coalescent filter packs are used for enhanced separaation cabability

The separators are divided into two classes rated by the performance:

- **Class I** separators: residual hydrocarbon content less than 5mg/l after the separation process. These are mostly coalescent and lamellar separators. (see fig. 1)
- **Class II** separators: residual hydrocarbon content less than 100mg/l after the separation process. These are mostly static separators. Also most of the purely hydrodynamic water treatment systems fall under this category. (see fig. 2)

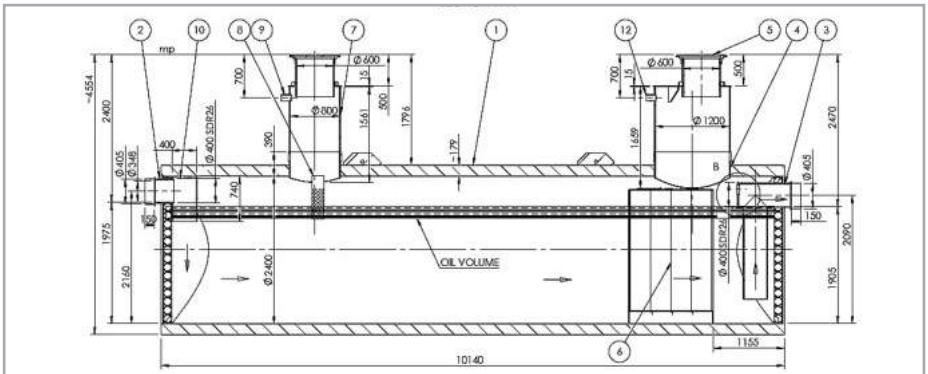
Light liquid separator systems can also be designed with by-pass system (see fig 3). This is neccessary when the whole amount of surface water do not need treatment. The usual setup is 1/3 is to be treated and 2/3 to go through the by-pass system without treatment. In this case the NS of the separator system is still expressed via the actual l/s of water to be treated. For example NS120/360 would mean that it is a light liquid separator system with 120l/s of treated water and 240l/s would be passed via the by-pass system.

The nominal size (l/s) of an separator is determined by testing. The testing procedure is thoroughly described in the standard. Some main aspects for the



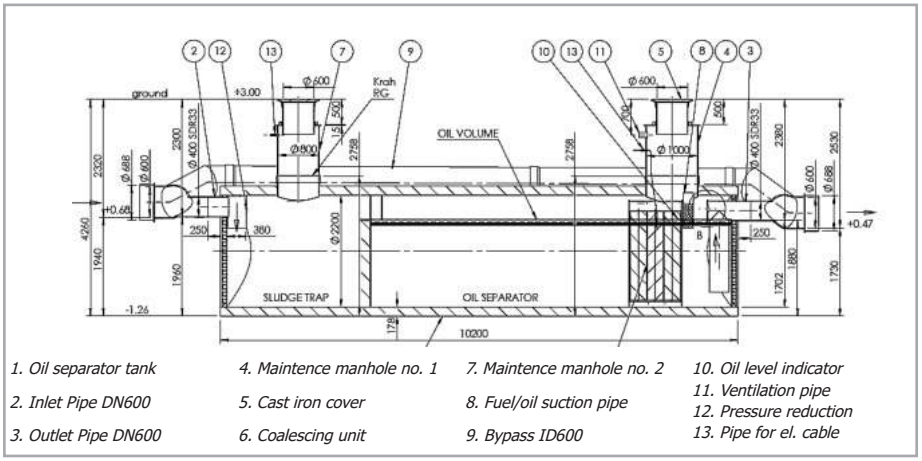
1. Scum board ***3. Sludge trap***
2. Static water level ***4. Separator***

fig.1: Simple static separator with sludge trap



1. Oil separator tank *4. Maintence manhole no. 1* *7. Maintence manhole no. 2* *10. Pressure reduction*
2. Inlet Pipe PE400 SDR26 *5. Cast iron cover* *8. Fuel/oil suction pipe* *11. Oil alarm unit*
3. Outlet Pipe PE400 SDR26 *6. Coalescing unit* *9. Pipe for cable* *12. Ventilation pipe*

fig 2: Separator system with coalescent filter pack



1. Oil separator tank
2. Inlet Pipe DN600
3. Outlet Pipe DN600
4. Maintence manhole no. 1
5. Cast iron cover
6. Coalescing unit
7. Maintence manhole no. 2
8. Fuel/oil suction pipe
9. Bypass ID600
10. Oil level indicator
11. Ventilation pipe
12. Pressure reduction
13. Pipe for el. cable

fig.3: Separator system with external by-pass

fig.4: Separator system at installation

testing are brought out here:

- The water used for testing shall be drinking water or mechanically purified river water. The temperature must be in the range of 4-20C and the pH level 7 +/-1
- Light liquid used in the test shall be fuel oil in accordance with ISO8217, designation ISO-F-DMA and having a density of 0,85 +/- 0,015 g/cm3 at 12C
- The fuel oil shall be inserted to the test unit at a rate of 5ml/l or 4250mg/l
- The running period of the test shall be equal to the time needed to exchange the volume of the water four times, but not less than 15 minutes
- The sampling period shall be 5 minutes, where with the interval of 1 minute a new sample of total 5 is taken. The minimum size of each individual sample is 500ml
- Arithmetical mean shall be the base for the class specification. Individual results from the 5 samples cannot exceed:
  - 10mg/l for Class I separator
  - 120mg/l for Class II separator

There is an option to approve the nominal size by design only for the separator systems with nominal size bigger than 50l/s, although according to the standard EN858 the nominal sizes are deemed to be determined by testing. The option is based on the EN858-1 Contribution of the French Mirror Group (P16E/GM8) concerning the hydraulic performance of separators larger than TN50. Shortly summarized nominal size of the separators with NS higher than 50 can be approved by testing minimum 3 separators of smaller NS classes, where at least 2 NS sizes must be tested from the range of NS10, NS15, NS20, NS30, NS40 or NS50. For detailed conditions and approval requirements please consult the document EN858-1 Contribution of the French Mirror Group (P16E/GM8).

There are also separate requirements and specific guidelines brought out in the standard regarding the the separators of NS150 and bigger, that are built in-situ.
Coming back to the start of this small report, in some countries the acceptance levels for such treatment systems differ completely from the European norms.

To bring you an example. In Europe the nominal size of the treatment system is determined by the testing – the oil concentration at the inlet of 4250mg/l has to be reduced to the level of 5mg/l at the outlet. In Russian Federation the separator system has to be capable of reducing the hydrocarbon content to the level of 0,05mg/l, so specific units for additional treatment are used to reach those levels.

It is always a good idea to make sure what are the local standards and design your unit around those.

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Structural analysis of profiled PE-HD pipes

acc. ATV-DVWK-A 127

Introduction

For the static calculation of buried pipes, there are various regulations available on an international level. The publications of AWWA, SIA and DWA ([1] – formerly ATV-DVWK) are important for pipe statics. This article describes the basic procedure for the dimensioning of profiled pipes using the ATV-DVWK-A 127 (Germany) worksheet, as this set of rules also enjoys great international recognition.

Preface to the 3rd edition A127

"Due to new findings in pipe statics (experiments, comparisons with the finite element method, European standardization, etc.) and due to new developments in pipe systems (e.g. pipes with profiled walls), there is a need for regulation in various sections of the worksheet, which are summarized here in a third edition.

The mathematical limit between rigid and flexible behaviour is redefined with V_{RB} = 1. A new chapter is inserted for special features in the design of profiled pipes; a relevant data sheet ATV-M 127 Part 3 is in preparation". [2] p. 7. German edition translated.

The ATV-DVWK-A 127 worksheet

The A 127 is a self-contained standard for earth bedded pipes, newly laid in trench or embankment. DWA-A 161 [3] regulates trenchless installation (jacking) and DWA-A 143-2 handles renovations.

Pipe soil system

When laying new pipes, only the radial cross-section of the pipe wall is considered. The longitudinal direction remains disregarded. The pipe always carries the loads together with the surrounding soil. Without the soil, the pipe would not be verifiable, which is why the worksheet assumes a "pipe soil system". It also contains information on the dimensioning of perforated pipes for drainage and profiled pipes.

System stiffness and locations for verifications

The concept of the A 127 requires different verifications, which have to be made at the three prominent points crown, springline, and bottom. The verifications depend on the system stiffness V_{RB} of the pipe soil system. V_{RB} decides whether a pipe soil system is a) flexible or b) rigid. The stiffness depends on the pipe's geometry, material, and soil conditions.

$$V_{RB}=(8*S_0)/S_{Bh}$$

[2, eq. (6.15)] Where
V_{RB} = System stiffness,
S0 = Pipe's stiffness,
S_{Bh} = Soil's horizontal bedding stiffness

From a static point of view, each of the three positions on the inside and outside must be considered. At pipe's crown, for example, compressive stresses occur on the outside (top) under earth and traffic loads, and tensile stresses occur on the inside. It is not possible to predict which stress would be exceeded first; therefore both sides must be verified.

Materials

A generalization regarding the material is difficult. Pipes made of concrete, reinforced concrete, polymer concrete and vitrified clay will generally behave "rigid". In this case, the deformation and stability check is not required. Pipes made of most plastics, including GRP, are usually "flexible". If pipes made of steel or plastic are very thick-walled, they may well behave rigidly.

Time dependency

Some materials are time-dependent. This is taken into account in the statics by examining such pipes for two points in time: a) short-term, b) long-term with a) after one minute and b) after 50 years. All plastic pipes are time-dependent, and so is polymer concrete and GRP, while e.g. steel or concrete are not.

Soil groups

What regularly surprises some subsoil experts is common practice in pipeline construction: The A 127 knows only four soil groups G1...G4. Group G1 stands for non-cohesive soils, G4 for cohesive soils. G2 is for low cohesive soils, G3 for cohesive mixed soils and silt. In general, it should be noted: The "smaller" the soil

Table 1: Types of soil

Group	Spec. gravity	Spec. Gravity under buoyancy	Internal friction angle	Elasticity modulus E_S in N/mm² with degrees of compaction D_{Pr} in %						Exponent in Eqn. (3.02) *[Amended]*	Reduction factor for creep
	γ_S kN/m³	γ_S kN/m³	φ' °	85	90	92	95	97	100	Z -	f_1 -
G1	20	11	35	2[2)]	6	9	16	23	40	0.4	1.0
G2	20	11	30	1.2	3	4	8	11	20	0.5	1.0
G3	20	10	25	0.8	2	3	5	8	13	0.6	0.8
G4	20	10	20	0.6	1.5	2	4	6	10	0.7	0.5

Figure 1: soil parameters in ATV-DVWK-A 127 Table 1 (via [2])

group, the "better" the soil – which is expressed, for example, in the modulus of elasticity according to Table 1 of the A 127, see Figure 1.

In addition, the degree of compaction D_{Pr} must be observed: The higher the "Proctor density", the more stable the soil will be.

Soil zones

Section 6.2.2 of the regulations contains the Young's modulus of the soil zones E_1... E_4, see Figure 2. There is: E_1 = soil above the pipe, E_2 = soil next to (and below) the pipe within the trench, E_3 = grown soil laterally outside the trench, E_4 = natural soil below the trench. The grown soil on the side of trench E_3 is of special importance. According to A 127 the silo theory is applied, see below: $E_1 \leq E_3$ or in other words: The filling above and next to the pipe is supported laterally against the natural soil. A supporting effect is only given if the natural soil has at least the modulus of elasticity of the backfill. Figuratively speaking: Grown soil from e.g. rock has a good supporting effect; grown soil from mineral wool has a poor supporting effect.

Loads (influences)

The regulations distinguish between short-term and long-term loads. Short-term are usually traffic loads and short-term internal pressure, if any. All other loads are regarded as long-term, i.e. the pipe's dead weight, earth loads, groundwater, long-term internal pressure.

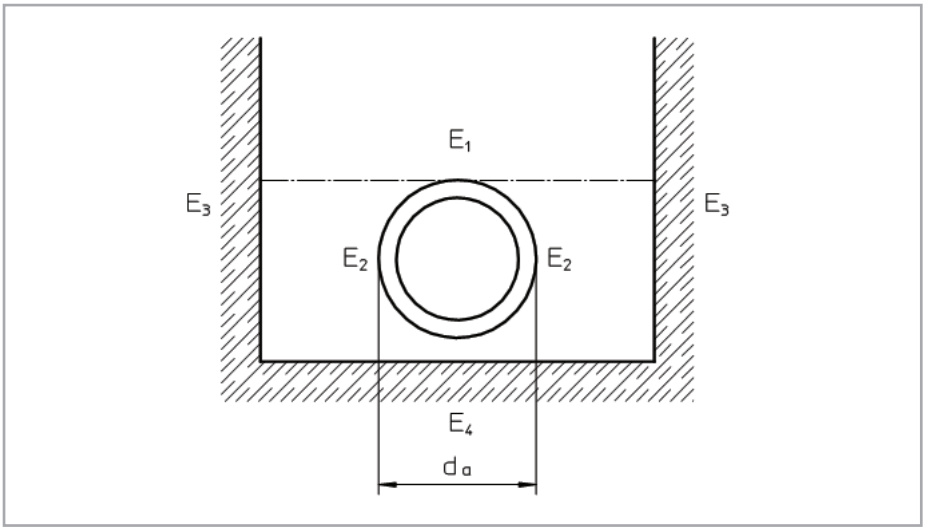

Figure 2: Deformation modules for the various soil zones (via [2])

The A 127 states the following as traffic loads: SLW (HGV) 60, SLW (HGV) 30, truck (CV) 12. Under railway tracks the load model UIC 71 has to be considered. Aircraft traffic loads are the so-called "Bemessungsflugzeug BFZ" (Dimensioning Aircraft DAC) 90/180/350/550/750. In the long run the SLW 60 will die out and be replaced by the Load Model 1, LM 1. A comparison of SLW 60 and LM 1 can be found under [5]. Whether the currently largest passenger aircraft, the Airbus A 380, can be assigned to a BFZ 750 can be found under [8].

Groundwater

If groundwater is present, the number of necessary calculations is usually doubled. On the one hand, groundwater has a favourable effect because it reduces the earth load above the pipe by buoyancy; on the other hand, it is unfavourable because it worsens the bedding properties of the soil under the pipe. In addition, proof of safety against floating/uplift is recommended.

Verifications

For a flexible pipe soil system in groundwater, the number of required calculations is maximized. Verifications are necessary in each case at crown, springline, and bottom level as well as in each case inside and outside the cross-section:

- Proof short-term, without groundwater
- Proof short-term, with groundwater
- Proof long-term, without groundwater
- Proof long-term, with groundwater

This results in: 3x2x4=24 calculations per pipe – and per verification. A manual

calculation is very inconvenient and it is recommended to use a powerful calculation program [4].

A stress analysis is always necessary for all pipes. Under road, railway and air traffic loads the so-called "Safety against Failure with Loading that is not Predominantly Permanent" – simplified: dynamic proof – can be required.

Rigid pipe soil systems require further considerations depending on the material, such as the verification of the crack width and compliance with the exposure classes and minimum concrete cover for reinforced concrete pipes.

Flexible pipe soil systems must also be verified for deformation and stability/ buckling (from earth and traffic loads as well as water pressure, if applicable). The number of required calculations must be multiplied by the number of checks.

Silo theory and embankment condition

The frequently encountered trench installation assumes that the trench walls remain intact in operational state and over the service life of the pipe. If suitable soil types are used, a vault can then form above the pipe. The silo theory "hangs" the soil above the pipe by friction in the trench walls and thereby reduces the vertical load on the pipe. This is expressed in the coefficient k. k depends on the cover height, trench width and soil friction angle.

$$\kappa = \frac{1 - e^{-2\frac{h}{b}K_1 \cdot \tan\delta}}{2\frac{h}{b}K_1 \cdot \tan\delta}$$

[2, eq. (5.04)] where
k = Reduction factor for trench load saying the Silo Theory,
h = cover depth,
b = trench width,
δ = Soil's inner friction angle,
K_1 = Earth pressure ratio = constant = 0.5

In the worst case k = 1, i.e. no Silo Theory. If the trench width b exceeds four times the outer diameter of the pipe d_a, the effect of the trench walls (too far away from the pipe) has subsided. The pipe thus receives the full load, similar to $b/d_a > 4$ – which is embankment.

Foundation angle

In the bottom area of the pipe, the contractor must ensure an even subgrade of suitable material. Very coarse-grained material such as boulders as a bedding layer is harmful for any pipeline. Graded sands are better suited. Many pipe manufacturers provide information on this in their installation instructions.

The bedding angle 2α determines the width over which the effects are derived from the pipe into the load-bearing subsoil. With the same load, a larger angle has a more favourable effect. According to the rules, four bedding angles can be considered: 60°, 90°, 120°, 180°. For plastics 120° are usual. 180° can only be achieved in exceptional cases.

Bedding reaction pressure

Flexible pipe soil systems can withstand smaller deformations relatively well. The A 127 permits 6%, in exceptional cases up to 9%, but only 2% under Deutsche Bahn tracks. Under a vertical load, the pipe deforms, i.e. it becomes flatter and wider and ovalizes horizontally. Due to the horizontal widening, the pipe presses laterally against the ground and causes the so-called bedding reaction pressure q_h^*. It depends largely on the system stiffness V_{RB} and the soil properties. q_h^* helps the pipe with load transfer.

Shuttering

Trench walls – also for space reasons in urban areas – are often not inclined but vertical. Very few soils remain stable, so that shuttering is usually provided. A suitable type of shuttering depends on the soil conditions and any water retention during the construction phase. Depending on the type of shuttering and the time of pulling (before/during/after filling the pipe zone and the overfill), the A 127 names the conditions A1...A4, which should correctly be named A0...A3 – where A0 is best and A3 is worst. A sheet pile wall shoring, for example, which is pulled after backfilling, loosens the soil between backfilling and the grown soil. This has a negative effect on load transfer and may lead to subsidence.

Backfilling and compaction should be carried out carefully and in layers; ideally, this process is recorded on the construction site (figure 6). Poor backfilling and/or unsuitable material are often the cause of later damage. Quality monitoring of the material and foresighted planning, including static calculations, are ineffective in the event of improper execution.

Solid wall and profiled pipes

Forces and stresses

Until now, it was tacitly assumed that

solid wall pipes were used where the wall thickness was the decisive parameter. In the case of steel, concrete and many plastic pipes, it is often the only criterion that can be changed during the planning phase. Its advantage lies in its ease of manufacture and standardization of wall thicknesses. A solid wall pipe can be manufactured as axial extruded pipe (e.g. Polyethylene: DIN 8074/75) or as spiral wound pipe (e.g. Polyethylene: DIN 16961). Solid wall pipes provide a smooth inner and outer surface.

The cross-section must bear stresses as elegantly as possible. In the design case, a combination of stresses is usually decisive, namely: normal stresses superimposed with bending stresses.

Normal stresses act perpendicular to the surface under consideration. For example, pure internal pressure alone produces a positive normal stress in the entire cross-section, the pipe wall is completely under tension. Material is required for load transfer; the location of the material is almost insignificant. A solid wall pipe is well suited to carry normal stresses.

In reality, pure normal forces are rarely encountered: Earth and traffic loads generate additional bending moments. It can be assumed that normal and bending stresses are *always* present in an underground pipe. For the distribution of the bending moments it is very important *where* the material is located.

Solid wall pipes

If the planner wants to increase the stiffness of the desired pipe – for example, because the deformation check in the software fails – he usually increases the wall thickness of solid wall pipes. The static relationship is determined by the moment of inertia I (capital letter "i"). A typical rectangular cross section for a wooden beam is:

$I=b*h^3/12$

Where
b = width,
h = height of the cross-section. I is measured in mm⁴
The width b = 1 is set for solid wall pipes.

The height h corresponds to the wall thickness s, so a simplified equation $I = s^3/12$ applies.

This shows that the height or wall thickness of the profile has a decisive influence on the moment of inertia and therefore the stiffness of the pipe. Wall thickness s enters in the third power. Two examples:

s = 10 mm → I = 83 mm⁴
s = 25 mm → I = 1,303 mm⁴

A 2.5-fold magnification of the wall thickness increases I by a factor of 15 here.

Profiled pipes

Mostly profiled pipes will be manufactured as corrugated pipes or spiral wound pipes. Especially the spiral winding allows a tailor- made design (figure 4) of the wall structure for required stiffness, occurring pressure load and all other internal and external loads. Profiled pipes are also national and international standardized (e.g. DIN 16961, ASTM F894, EN13476).

For the flow characteristic it is notable that spiral wound pipes provide a fix inner diameter, even if stiffness classes or pressure classes change.

Geometries deviating from the rectangular shape are known from structural steel engineering. Here, the bending moments are absorbed by the flanges, which are connected to each other by a shear-resistant fillet. A clear advantage lies in the weight and material savings compared to an equivalent rectangular cross-section. But it has to be considered that the profile

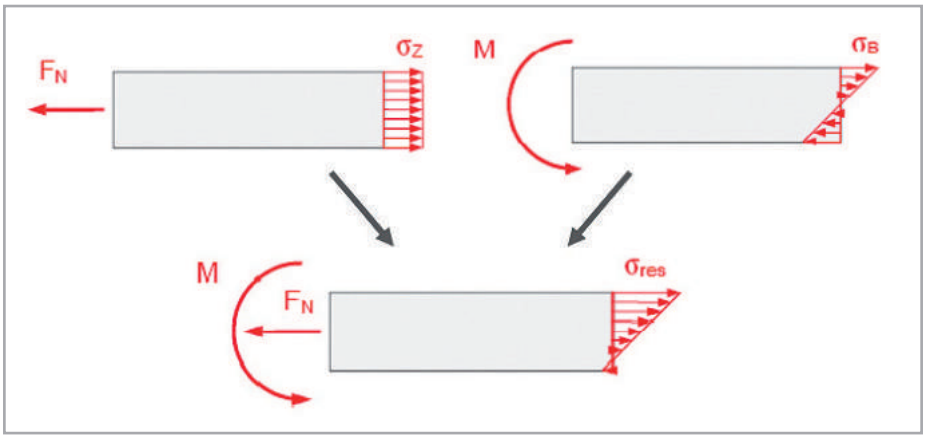

Figure 3: Normal and pure bending stress + interaction (via [8])

In Figure 3, we use:
F_N = Normal force,
σ_z = Stress due to normal force,
M = Bending moment,
σ_B = Stress due to bending,
σ_{res} = Resulting stress

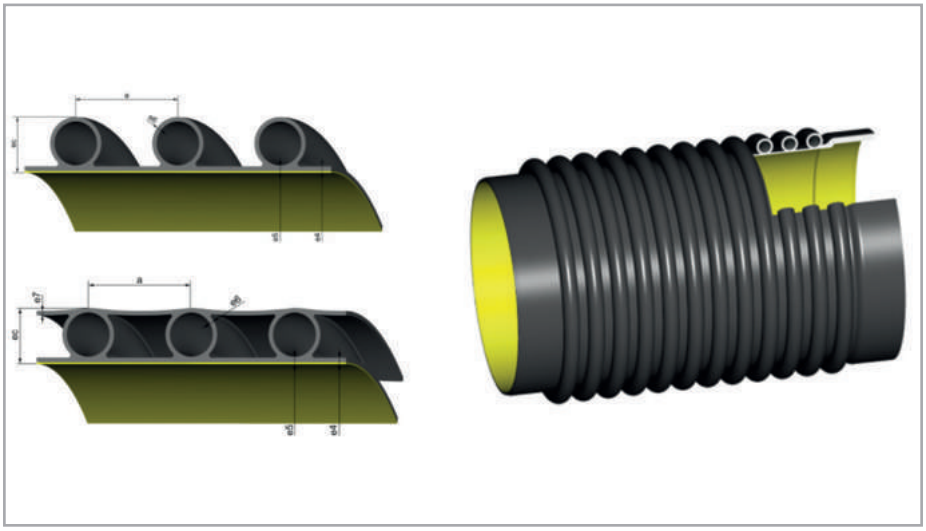

Figure 4: Profiled pipes

itself has to provide sufficient stability, a slender fillets must be stiffened or verified against buckling.

The κ_Q coefficient

The coefficient κ_Q is frequently queried. In general: $\kappa_Q \cong A/A_Q$ where A = total area and A_Q = transverse force area (~ fillet area for profiled pipes). κ_Q becomes 6/5 = 1.2 for rectangular sections, or solid wall pipes. Samples are given in figure 6.

It is relatively insignificant. Common CAD programs are able to determine this factor from the profile geometry. Alternatively, a qualified engineering office like [10] can determine κ_Q exactly.

Dimensioning of profiled pipes

From a structural point of view, pipes are dimensioned similar to solid wall pipes. Software usually runs all required approvals automatically, taking into consideration the "equivalent wall thickness", if applicable.

Timeliness of the A 127

The ATV-DVWK-A 127 from the year 2000 is partly outdated. For example, the materials mentioned therein (PE80 instead of PE100, concrete B25 instead of concrete C25/30) or the load model are no longer state of the art and are considered obsolete. Regularly updated software [4] reliably maintains the state of the art. A new edition of the regulations is in progress: The DWA is currently preparing a data sheet for material properties A 127-10 as well as the 4th edition of the A 127, which is to be called DWA-A 127-2 Solid wall pipes in trench installation in future [6]. Additionally, the DWA schedules the worksheet DWA-A 127-3 Profiled plastic pipes in trench installation.

The future DWA-A 127-2 will contain:

- Semi-probabilistic partial safety concept replaces global safety concept. Required so far: Safety against failure > 2. Demanded in the future: Utilisation ≤ 1, saying utilisation < 100%. This concept is based on European standardization (EuroCodes, EC)
- Road traffic load LM 1 instead of SLW/HGV 60
- Adaptation factor α according to EuroCode 1-2 [7] section 6.3.2 must be taken into account
- Railway traffic load LM 71 instead of UIC 71 with
  - » 1x108 instead of 2x106 load cycles

Figure 5: Pipe installation (New Mena Plast, Egypt) and manhole installation (UGPM, Oman)

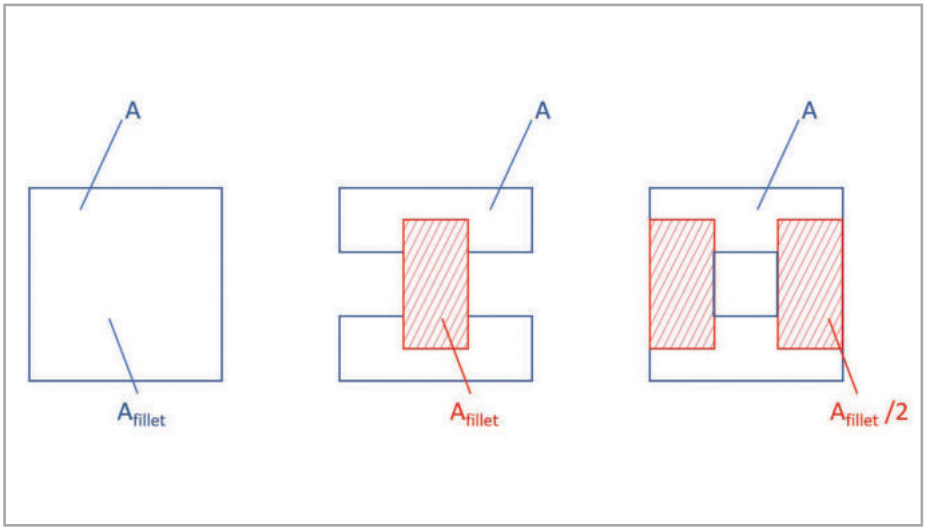

Figure 6: κ_Q for different profiles. A = total area, A_{fillet} = fillet area

- » (status: 2019-02-21; experts in Germany have been discussing for three years now whether the cycles can be reduced from 1x108 to 5x107, final decision pending)
- » Permissible stress using steel as an example: For 1x108 load cycles, only 40.5% of the stress of 2x106 cycles may be used. 140 N/mm² (at 2x106) x 0.405 = 56.7 N/mm² (at 1x108). Source: [3], Table 22
- » Cover depths from 1.10 m instead of 1.50 m deposited
- » Impact factor max. 1.67 instead of 1.40

- Temporarily flowable, self-compacting backfilling materials (Zeitweise fließfähige, selbstverdichtende Verfüllbaustoffe ZFSV also known as "liquid soil") shall be contained
- Cover and embedding conditions A1...A4 and B1...B4 are renamed A0...A3 and B0...B3 respectively

Conclusion

The ATV-DVWK-A 127 worksheet is a self-contained set of rules that permits the design of circular (and wall-reinforced) pipes made of any (!) material. It uses formulas, tables and diagrams. In comparison to M55, which handles compressive stresses only, and in one point only, the A127 checks all the critical sections in a pipe (top, springline, bottom). This is, from a civil engineer's point of view, the more precise approach.

Structural engineers and consultants around the globe use and accept this standard work of pipe statics. It is established, tested and proven. Of course, it is subject to an ageing process in sections; nevertheless, it is valid and applicable as an overall concept until the DWA publishes the 4th edition in white print.

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Software for structural calculations according ATV 127

A reliable software receives updates regularly and reflects state of the art regarding standards, installation-procedures, product and material properties. Especially the participation in standardization committees and continuous exchange of experiences with other experts is an important element to guarantee the state of the art.

The software IngSoft EasyPipe, developed and maintained by IngSoft company since 1997, is a positive example for a successful software solution for buried pipes and manholes, up-to-date and well established worldwide.

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Insect mortality

and how Krah is working against it

Since 1989 the mass of insects in Europe has decreased up to 76%. It's a topic which is constantly present, but nobody seems to take it serious and label it as a matter which is exaggerated by animal rights activists.

Modern agriculture, climate change and habitat destruction lead to massive cuts in the number of Europe's insects.

One third of the food we eat wouldn't exist without bees. Honey, apples, berries, cocoa (chocolate), cotton, oils, creams, Make Up... just to name a few. This is the reality as it could be in 20, 30 or even 10 years.

The factor we can influence the most is modern agriculture. The modern agriculture uses around 2.5 kilograms of pesticides per hectare of arable land per year. In sum that's almost 40.000 tons in Germany per year. Pesticides, especially glyphosate or neonicotinoids, are mostly used in large companies which live from agriculture. They grow various fruit and vegetables and want them to look perfectly shaped and free of small insects like bugs or worms. To reach that they spray the fruit or vegetables with pesticides, so they can guarantee a perfect-looking, shiny end product, because that is what today's society wants. And this is where the dilemma begins. The obvious pro of conventional agriculture is the output. While the biological agriculture reaches 75-87%, the conventional reaches 100%. Also, the price for biologically produced food is a little bit higher than "usual". But what are these factors compared to clean, non-poisoned foods and animals living in much better conditions? Animals that aren't fed with preventive medication and antibiotics (which we then take up), animals that can live free and aren't squished together in a tiny stable with no sunlight or hygiene?

Additionally, as side effect, no insects or bees are attacked or poisoned with chemical plant protection products. But insect mortality isn't the only problem we are facing if we keep on acting as if we had a Planet B. Most birds feed from insects and worms. Accordingly, the number of birds has also decreased up to 50% in the past 30 years. Krah has decided to take a seemingly small, but effective step towards insect protection. For the past decades the lawns next to the company have been kept short due to optical reasons, but now we have seeded a large flower meadow. It has 3500 m² and has many different flowers for bees and insects to ensure a safe "resting place" and feeding station. If all of us would be a little bit more careful with our environment and would actually actively do something about it (e.g. taking care where and from whom we buy our food and thinking twice if we really have to mow all of our lawn with its flowers) we could eventually help the nature and animals to go back to a normal situation again.

In the next issue of ImProfil we will hopefully be able to show how the meadow is growing and blooming.

***Author**: Lisa Bläcker, KAT GmbH*

Jürgen and Lisa seeding the flower meadow

10 Questions to:

Mr. Gustavo Mastelono - CEO Krah America Latina

1.

Gustavo, you have been in contact with the Krah company and Alexander Krah for nearly 20 years. How did you first meet and how did the relationship develop?

>>*Our first contact with the Krah company was through a brochure that came to my hands around the year 1998. At that time, I made contact with Alex whom I personally met some time later at a plastics exhibition in Buenos Aires. From there, we began to work together, first exploring potential interested in technology within our region, and later starting Krah America Latina challenge in Argentina. Nowadays I can say that Alex, more than a supplier, is a great friend.*

2.

What was the reason to set up a pipe production plant in Argentina in 2004? Was there a special project?

>> *Yes, initially we were able to obtain an important contract for the supply of sewage pipes in Buenos Aires. Argentina was emerging from a deep economic recession and sanitary infrastructure market was booming. We loved Krah technology and we wanted to produce locally. A few months earlier we had managed to obtain a small contract for the local sanitary company, and to supply that project we imported pipes from Germany. It was a success, which motivated us to take the next step.*

The story is that when the machine was already shipped from Germany to Argentina, they took away the contract that we had, citing standards issues. Therefore, we had to go out and look for a new contact in the few days we had until the equipment were arrived. Luckily, we got it with an important work in the south of Argentina.

Finally, we were also able to reverse the other contract and obtained at least part of it.

3.

You had some hard years because of the weak Argentinian economy. What did you do to continue and stick to the pipe production?

>> *Although the Argentine economy had, and still has, many ups and downs, our maximum initial production capacity could cover only a small percentage of the market, even in the worst moments, which we could achieve in one way or another. This condition and the high pipes profitability allowed us to withstand these bad moments.*

4.

After those hard days you bought your second machine in 2015 and then another two brand new KR800 production machines recently installed in San Juan,

what brought the change in your business and made you grow that quick and big?

>> *Once we were able to issue local standards, make known the product and the Krah brand, build trust in the system and have experience in the region, the work was greatly facilitated. Nowadays, the product and the brand are considered technological leaders in our region and, what positions us as the best alternative in terms of cost, service and technology.*

We also started the production of pressure pipes, entering a very large and demanding market. One of the important milestones in this change was the 4 meters and 220 mm wall thickness pipe development, which positioned us very well within the market.

This growth forced us not only to expand our initial production capacity, but also to decentralize this production to optimize logistics costs, within a very large region such as Argentina.

5.

You have just opened a subsidiary on the other side of Argentina, in San Juan province, close to the Chilean boarder. What do you expect from this second production facility?

>> *This new plant, recently inaugurated, aims to produce large diameter pressure pipes for north western Argentinean market and for nearby export markets. It consists of two KR800max lines specially arranged to achieve high productivity levels with low operating costs. New mandrels pre-production heating and conformed pipes cooling systems have been developed, which will allow us to enter a high-volume market in which we did not participate before.*

Enjoiying talking about Krah

We have great expectations to position ourselves as the largest producer of large diameter pipes in pressure and non-pressure applications in the region.

6.

In San Juan you are mainly producing solid wall pressure pipes. Why there is such a great demand for those kinds of pipes in Argentina and what is the application?

>> *Argentina is a country with a large deficit in water infrastructure area. The great demographic growth that exists in the country obliges the provincial governments to invest in new sources of drinking water supply for this growing population. On the other hand, Argentinean north western region is poor in water sources and therefore, it must be brought from faraway places, usually in the mountains. For this reason, mains must be for high pressure rates, for long distances and large diameters.*

This project is an approximately 50 km length aqueduct to draw water from a lake called Punta Negra, located in the west side of San Juan province.

Gustavo and Mr. Leonardo Beccaceci (commercial director Krah América Latina) are well versed with the rain water situation in Krah América

7.

Being the this year's community host, tell us a little about your experience with the Krah Community please.

>> *The experience was incredibly exciting. For us it was a whirlwind of emotions, not only for the KCM but also for the opening of the new plant and the start-up of the new lines KR800max.*

I have been lucky enough to participate in almost all the KCM since its inception and I can affirm that it is a very special moment for all the participants, where in addition to sharing technical and commercial experiences, we also share very pleasant moments, we reinforce friendship ties, we travel spectacular cities and we meet new people who join the group.

This year we had to be the hosts and that means having the responsibility that everyone has a good time and feels comfortable, far from home. To achieve this, we set up a working group 6 months before, with people from Argentina and Germany, who worked together in a synchronized and efficient manner. The result was spectacular!

Personally, I was very involved before and during the meeting, and I will keep those days in my mind for all my life.

8.

How was it for you to have guests from 15 different countries all over the world showing them your country, business and lifestyle?

>> *Tremendously exhausting and enriching.*

Combine the needs and customs of so many different and distant cultures in a real challenge, which I think we could meet.

9.

Some personal questions to terminate the interview: What is your favourite food?

>> *I should say it is Argentine meat, but my daughter Renata is teaching me veganism and my tastes are adapting.*

Anyway, I could say, given my Italian origin that spaghetti with "pesto-pasta" is one of my favourites.

Nor should I forget about the German Schnitzel mit Bratkartoffeln…

10.

What are your favourite places in the world?

>> *I have my heart broken. My origins are Argentine, and I love this country, but I have lived a few years in Santiago de Chile, and I have many beloved people there. Also, it's hard for me not to visit Cologne frequently.*

If I could be three people, these would be my addresses ...

Interview April 2019
Katrin Harbi / Sabrina Fernandez

Admin on fire

Krah supports volunteering

Being used to precarious situations as an IT specialist is nothing special. But it is unusual for a computer freak to be able to rescue people from flames and disoriented paragliders from trees as well as deleted data records.

For around 14 years Christopher has been taking care of the digital network and safety in the companies of the Krah Group. Even longer he is ‚on duty ‘at the local fire brigade. At the age of 10 (back in 1998) he became a member of the youth fire brigade. Later, he joined the team of the voluntary fire brigade in his hometown Weitefeld.

The task in the service of the fire brigade is a passion in honorary office. This means that Christopher makes a large part of his private free time available, both for training and for the actual emergencies, without fee.

Volunteering is important and needed

The Krah Group supports these activities fully. If Christopher is called to an emergency, he can immediately leave his office workstation to drive to the operations centre. Also, for trainings, which might last from 1-14 days, he is released from his tasks at Krah.

For Thomas Bednorz, the CEO at the KAT GmbH since 2016, this is a matter of course: "Without the honorary office and the achievements of the voluntarily activity many areas of our society would not function", says Bednorz. At a time when soft skills are playing an increasingly important role in job hunting, companies like to make use of members of volunteer organisations, especially those in the fire brigade, teamwork and leadership skills are particularly trained here.

Christopher had to leave for several operations 30 times in the past 3 years. From building and forest fires, person searches, traffic accidents and environmental catastrophes to retrieve dead bodies, everything was included.

Christopher Kirchhöfer, IT Expert and Fireman

Author: *Mitsch*

My most interesting operation:

"That was a big building fire, there were 6-7 fire brigades with over 90 people and several others from the DRK (German Red Cross) mission. At 3 o'clock in the night the fire started, and the firefighting lasted until 9 o'clock in the morning. The inhabitants had luckily noticed the fire early enough and were able to save themselves in time."

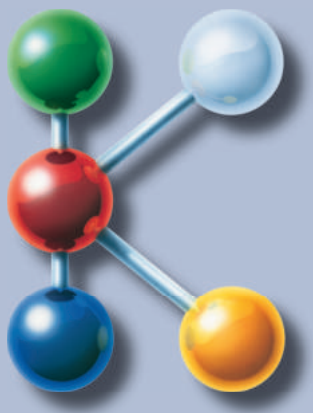
My most dangerous operation:

"The most dangerous (and the most interesting) is to actually go into burning buildings under breathing protection – virtually, you see nothing, because everything is filled with smoke and you can only hear the fire "working" around you. But you are always taught to pay attention to self-protection and if it becomes too dangerous you have to retreat."

REMINDER

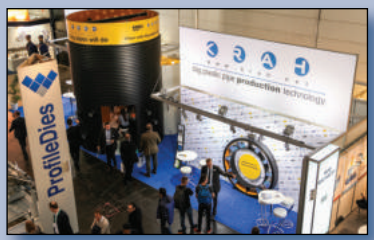
2019 is "K-Year"

This year the K show will open its doors again (16 - 23 October 2019). We will take part at our usual booth. (**Hall 16, booth D77**)



Come over for a self-mixed cocktail from our Krah pipe bar and have an interesting chat with one of our sales representatives. We will answer individual questions, explain new developments and innovations and much more.

We are looking forward to seeing you there!



Fish farms

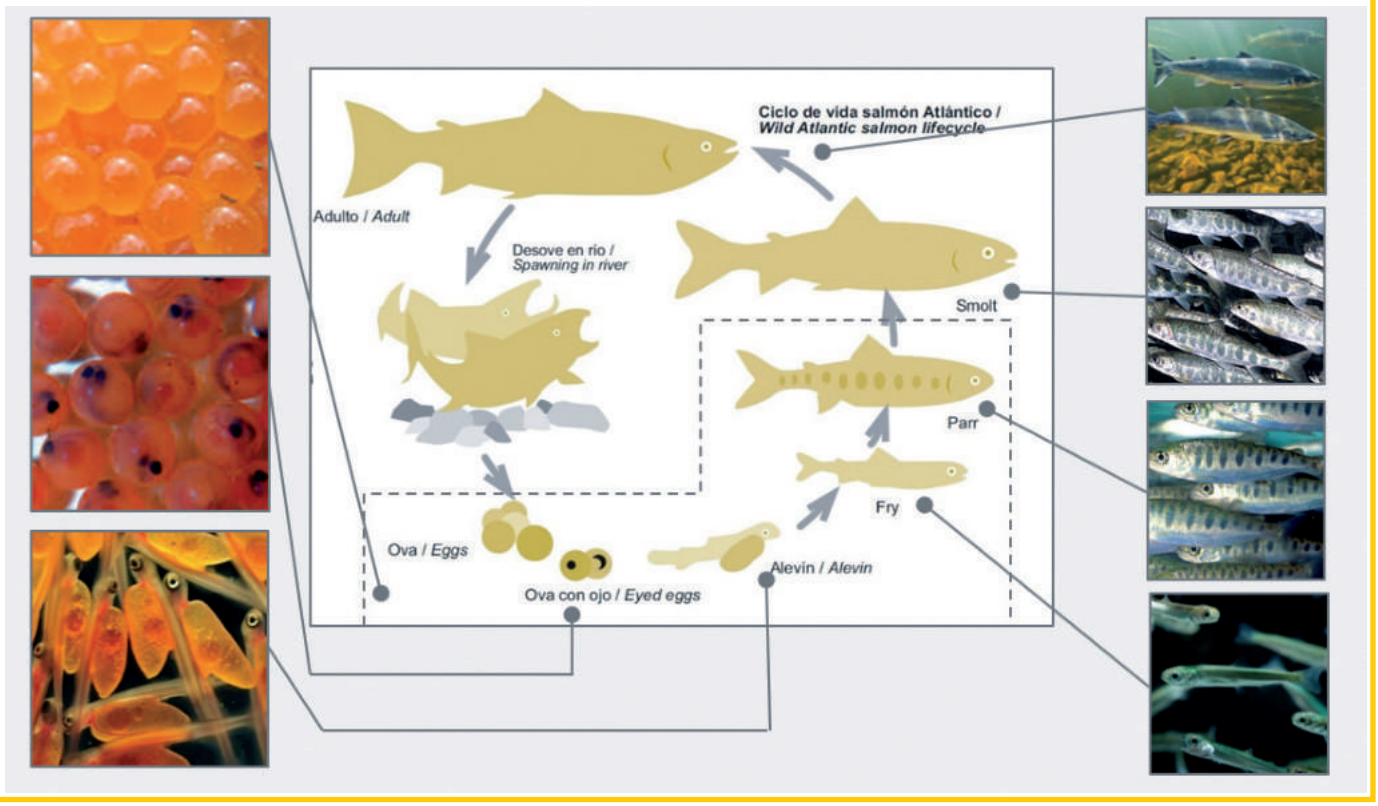
A special application for Krah pipes

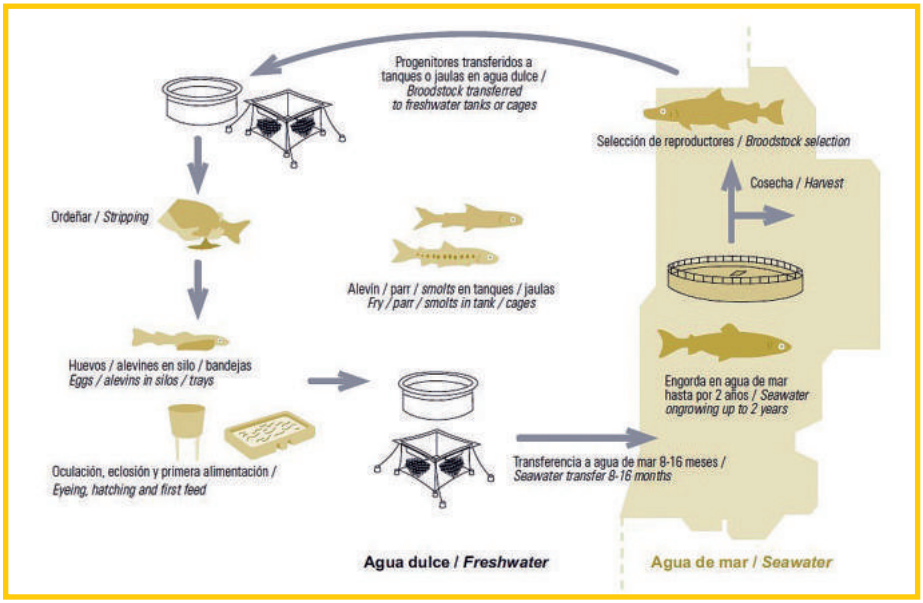
Around 17% of the world population reach their protein level by eating fish. That's even more than vegetables or pork. Accordingly, fish farms have become an important factor in the worldwide fish supply, as wild caught fishes can't meet the demands anymore. Overfishing and mass mortality rates in seas and oceans are the result. The following report shows a typical "cycle" of fish living in such farms and how Krah Pipes are helping to guarantee a safe and appropriate handling of the fishes, using the example of salmon.

Salmonid lifecycle in nature

The salmonid species most commonly farmed in Chile are the Atlantic salmon (Salmo salar), Coho salmon (Oncorhynchus kisutch), and rainbow trout (Oncorhynchus mykiss). These species are anadromous, meaning they spawn in freshwater and remain there until reaching the juvenile phase. They then undergo smolting, a fundamental physiological change that allows them to migrate to the ocean where they grow and mature sexually. The following few graphics show the lifecycle of a salmon, from the fertilized egg to a finished, grown salmon:

Fish Farm Stages





Salmon lifecycle in captivity

Attempts to domesticate and raise salmon have focused on recreating the natural conditions of their lifecycle in the wild. In order to achieve this, fish are kept in net pens, land-based flow-through systems or recirculating aquaculture systems where the overall biological process of the fish can be controlled by regulating water parameters such as temperature, dissolved oxygen and pH. The lifecycle can be altered by manipulating breeders during spawning using hormones and/or modifying the photoperiod or temperature during the alevin phase in the farming systems.

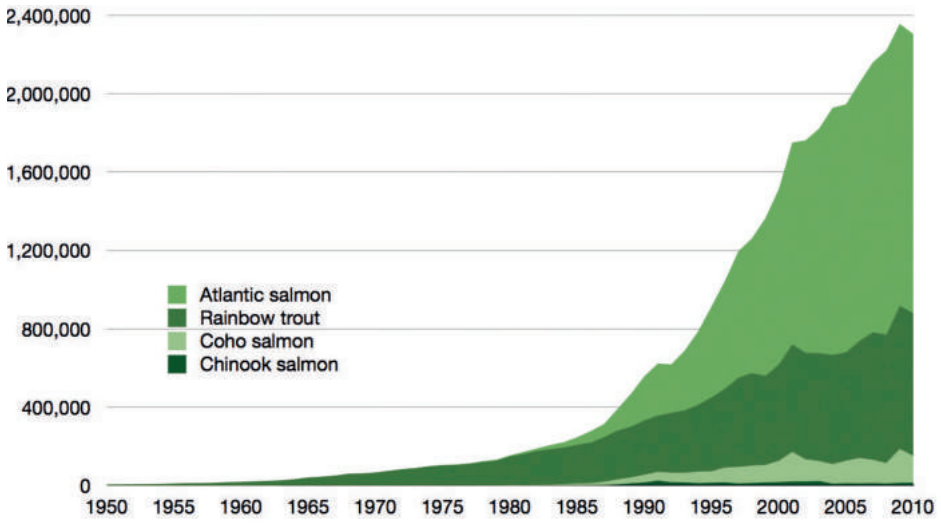
In addition to temperature, fish growth rates also depend on the amount of feed provided. This factor determines metabolic efficiency, which is generally expressed as the feed conversion rate.

Water quality

Available dissolved oxygen is the primary determining factor for maximum farm biomass, which, in turn, depends on temperature, conductivity and atmospheric pressure. Greater farm density results in higher demand for oxygen by fish. It is therefore essential to maintain the quality of the water in which the fish develop in order to obtain the required production and ensure the animals' well-being. Keeping physical, chemical and biological water conditions within appropriate limits will have a positive effect on growth rates and will lower fish stress levels, resulting in a lower risk of disease outbreaks. At a farm with low water renewal or circulation rates, phytoplankton alone can consume up to five times more oxygen per day than the fish. So what exactly does a fish farm?

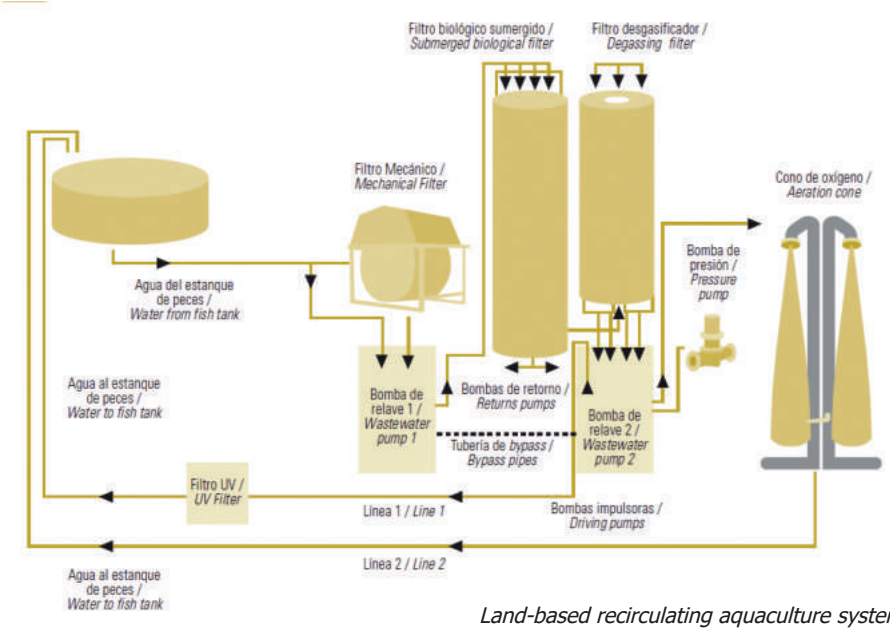
Fish farming or pisciculture involves raising fish commercially in tanks or enclosures such as fish ponds, usually for food. It is the principal form of aquaculture, while other methods may fall under mariculture. A facility that releases juvenile fish into the wild for recreational fishing or to supplement a species' natural numbers is generally referred to as a fish hatchery. Worldwide, the most important fish species produced in fish farming are carp, tilapia, salmon, and catfish. Demand is increasing for fish and fish protein, which has resulted in widespread overfishing in wild fisheries. China provides 62% of the world's farmed fish. As of 2016, more than 50% of seafood was produced by aquaculture.

Farming carnivorous fish, such as salmon, does not always reduce pressure on wild fisheries. Carnivorous farmed fish are usually fed fishmeal and fish oil extracted from wild forage fish. The 2008 global



returns for fish farming recorded by the FAO totaled 33.8 million tons worth about $US 60 billion.

The year 1985 marked the beginning of the boom of the salmon industry, when Chile entered to the exclusive club of producing countries of salmon. Between 1991 and 2005 the industry grew in an explosive way: of 33 thousand tons for a value of 159 million dollars, it passed to 384 thousand tons equivalent to 1.721 millions.



Land-based recirculating aquaculture systems

Different types of fish farms

Flow-through land-based farms

Open farms in lakes, estuaries and rivers

Land-based recirculating aquaculture systems

An aquaculture recirculation system is that which includes water treatment and re-use in the farming process. Approximately 10% of the water volume is replaced daily, although this figure can range from 5 to 20% depending on the type of cultivation tank and filtration. A recirculation system is comprised of mechanical and biological filtration components, pipes, pumps and containment tanks, and may also include additional water treatment elements to improve water quality and disease control in the system.

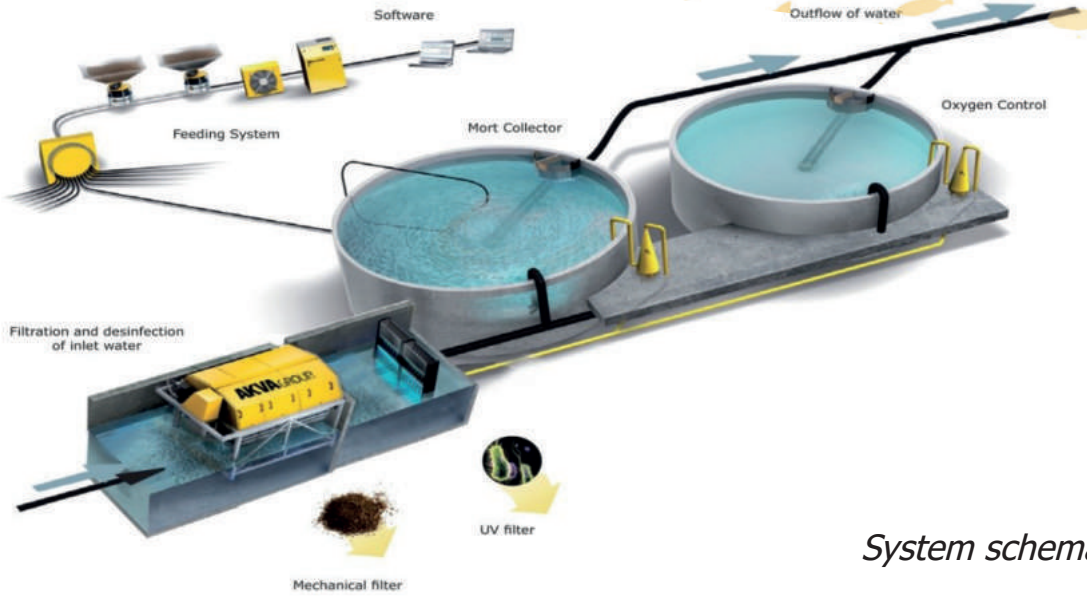
Case Study

"PISCICULTURA RIO LLAIMA – CHERQUEN"

Country: Chile
Region: IX Region of Araucanía,
Commune: Cunco
Category: Fishing and Aquaculture
Start of activities: 2007

Krah pipes in use at every system step

1. **Water collection**
   The water intake must be done ensuring the quality and continuity of water supply. Normally water sources are not too close to consumption, so it must be brought safely.



System schematic

2. Water transportation

Once captured, the water must be transported to the source of consumption quickly and safely. Normally natural obstacles such as streams, creeks, canyons, forests and others must be avoided. For this, the pipe must be strong and flexible enough to adapt to these conditions.

In this case, water is transported by gravity from intake to consumption.

Case Study

3. Filtering, treatment and pumping

The collected water, although it has ideal characteristics for the smoltification process, must be controlled, treated and finally pumped to the different ponds.

For this, the flow of water passes through a treatment and pumping unit and through pipes specially designed to not affect the original water conditions.

4. Distribution

Once the water is treated, it is distributed among the different ponds.

The water must be constantly monitored to avoid changes in the parameters of temperature, oxygen and biological load that could negatively affect the growth of the colony and even cause mortality.

5. Discharging

The water in the ponds must be renewed to avoid contamination and loss of temperature and oxygen conditions. Therefore, between 5% and 20% of the total volume of water used must be renewed daily. The supply and discharge of the water cannot be stopped, with the risk of losing the entire colony in a few hours.

Case Study

Overview about the used Krah Pipe products for the project:

3 km of Krah pipes in different stiffness and pressure classes, all jointed by electrofusion:

Item	Material	Unit	Qty
26	Krah Pipe Profiled (PR), DN 1000, PN 0.5, EF	m	800
1	Krah Pipe Profiled (PR), DN 900, PN 0.5, EF	m	350
6	Krah Pipe Profiled (PR), DN 600, PN 0.8, EF	m	550
13	Krah Pipe Profiled (PR), DN 500, PN 1.0, EF	m	350
17	Krah Pipe Profiled (PR), DN 400, PN 1.2, EF	m	950

Multitude of fittings (bends, Tee's, reducer etc.) and manifolds:

Item	Material	Unit	Qty
32	Tee, solid wall (VW), DN900/900 (section Nº2)	pcs.	1
33	Tee, DN 1000 / DN 250 (section Nº7)	pcs.	1
34	Manifold tangential, DN 1000/ DN 400 (section Nº4)	pcs.	2
35	Manifold with reducer, solid wall (VW), DN900/500 (section Nº3)	pcs.	1
36	Manifold centric, DN 400 (section Nº6)	pcs.	3
37	Manifold centric, DN 1000/ DN 400 (section Nº3)	pcs.	1
38	Bend, solid wall (VW), DN900, 53º (section Nº1)	pcs.	1
39	Bend, solid wall (VW), DN900, 29º (section Nº7)	pcs.	1
40	Bend, solid wall (VW), DN500, 90º (section Nº4)	pcs.	2
41	Bend, solid wall (VW), DN500, 90º (section Nº11)	pcs.	1
42	Bend, solid wall (VW), DN400, 90º (section Nº10)	pcs.	1
43	Bend, 53º, DN 400 (section Nº8)	pcs.	1
44	Bend, 47º, DN 1000 (section Nº1)	pcs.	1
45	Bend, 27º, DN 1000 (section Nº2)	pcs.	1
46	Adaptor flange (section Nº5a)	pcs.	9
47	Adaptor flangesection Nº5b)	pcs.	9
48	Adaptor flange, DN500 (section Nº6a)	pcs.	3
49	Adaptor flange, DN400 (section Nº5a)	pcs.	4
50	Adaptor flange, DN500 (section Nº6b)	pcs.	3
51	Adaptor flange, DN400 (section Nº5b)	pcs.	4
52	"Y-piece" with bend and reducer, DN900/400 (section Nº9)	pcs.	1
53	"S-piece" DN900 (section Nº8)	pcs.	1

6. Conclusion:

Water transportation in fish farms is a complex venture, so it must be done professionally and quickly. Any "natural" disturbances in the water flow must be avoided. That's where Krah pipes come in very handy, as they have the well-known smooth inner surface, are completely tight connected by welding and can be inspected easily due to their bright yellow inner layer. The variety of Krah pipe accessories can be seen in the table above, for every situation and load case Krah has a solution.

The plastic pipe market has been significantly growing in the past decade, and Krah pipes are used for more and more sorts of application. Especially today, where sustainability and environmental protection are becoming more and more important, since we do not have a planet B, Krah pipes are getting more popular due to their more than 100-year-lifetime and their recyclability of up to 100%.

Author:
Gustavo Mastelono
Krah América Latina SA

Rainwater-/Stormwater-Application in Sultanate of Oman

The Sultanate of Oman is part of the Arabian Peninsula well known for high temperatures. Due to change in climatic conditions, the region has started to witness and increase in rainfall. The soil is of dry and compact nature therefore unable to absorb the rainwater. This effect is further intensified in the developed areas where buildings, concrete and asphalt prevail. Pictures of the flooded areas are becoming common place and being circulated on the social media.

Remove and repair of the damaged infrastructure requires a lot of effort and money which is a huge burden on the economy of the country which is already facing global economic challenges. Flooding of the sewage system overloads the system and contaminates the clean rain and surface water.

The Sultanate of Oman, in the recent decades, has invested significantly in order to improve water management by building large dams and reservoirs which are operating successfully. But still a large amount of work remains to be completed in achieving total coverage. Similar to the development in Europe where countless stormwater tanks and reservoirs have been developed to ensure that heavy rainfall does not overload the canalization system. Efficient water management requires using existing water resources, leak-free distribution of water and avoiding contamination of clean water. The contribution of a modern canal system with appropriate dimensions, leak-free joints (to avoid infiltration and exfiltration), and efficient drainage and decentralized water storage cannot be undermined.

Water storage make sense in different ways.

Advantages of Storm-water tanks

- They can be integrated in sewer systems.
- They provide sufficient capacity for rapidly increasing rainwater-quantities.
- They help to avoid flooding of sewer systems, especially during dosed flow to treatment plant.

The rain water can be pre-separated from normal sewage by utilizing smart separation devices in the storm-water tanks.

Storm-water networks & systems:

- Special canal system,
- Over-dimensioned for normal rain and specially designed for heavy rainfalls.

Such systems provide additional capacity that the risk of flooding can be minimized, and these systems can be used in cities and industrial areas.

Water retention tanks:

The best way to utilize rainwater is to catch it up directly and use it commercially, perhaps for irrigation, private or industrial applications. Another interesting application is to use it as a water reservoir for fire fighting systems avoiding the potable water system.

Two applications for storm-water are discussed below:

System: PE 100 storm-water system
Project: Mall of Oman
Location: Muscat, Sultanate of Oman
Client : Majid Al Futtaim Group, Dubai, UAE
Contractor: Sarooj Construction Company LLC, Muscat, Sultanate of Oman
Storm-water system supplier: United Gulf Pipe Manufacturing Co LLC, Muscat, Sultanate of Oman

United Gulf Pipe Manufacturing Co. LLC is the official Krah Pipes producer in the Sultanate of Oman. Krah pipes have clear

advantages in easy handling at site, short installation time and the reliability of the joints, using electro-fusion method.

Sarooj Construction Company LLC was awarded the project to construct the infrastructure for the Mall of Oman. Initial design specified GRP pipes and RCC Manholes. The contractor had a prior relationship with the HDPE system supplier and therefore approached UGPM accordingly. UGPM met the requirements as a supplier for KRAH profiled PE 100 pipes for Storm water application for this project.

The pipe sizes ranged from DN/ID 400 – 1800 SN 4, approximately 2.4 kms for this application and 24 manholes of various diameters were supplied for the project. The largest manhole had a diameter of 3000mm, and was produced using a structural shaft using KRAH technology. The manhole had one inlet and outlet of DN 1800 and other inlets of DN 600. It took 2 days to manufacture this large sized manhole at the UGPM factory located in Rusayl Industrial Estate; and only one day to install it at site. UGPM has assisted the contractor to meet the installation before the timelimit and achieved the required objectives of cost savings as compared to product alternatives such as concrete manholes and GRP pipes.

Storm-water solution for a new Port

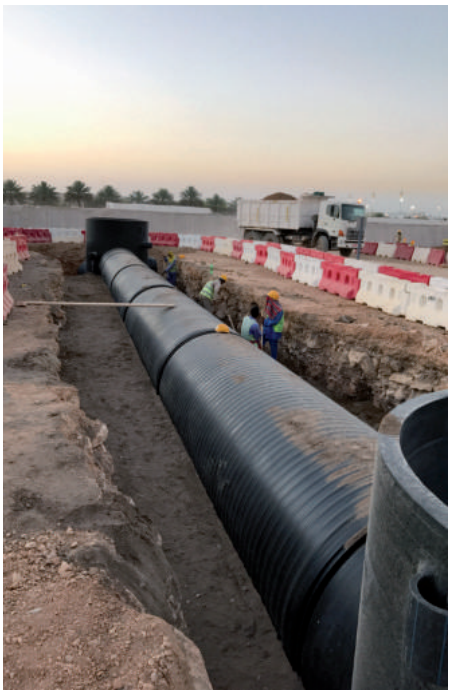
UGPM is a leading supplier in the middle-east market. The pictures below indicate the storm-water network for of a new port and a connected industrial zone. The main contractor wanted to replace the originally planned concrete chambers of the storm-water system with HDPE chambers.
UGPM designed and supplied the HDPE manholes and Gully Pot chambers for the network along with pipes for gravity application. A chamber was provided within the manhole in order to avoid the bottom reinforced slabs.

The requirements for the project were as follows:

- Manholes – A traffic load of 90 Tons, and a water table of 1.68 m from ground level
- Gully pot chambers – Traffic load of 90 Tons

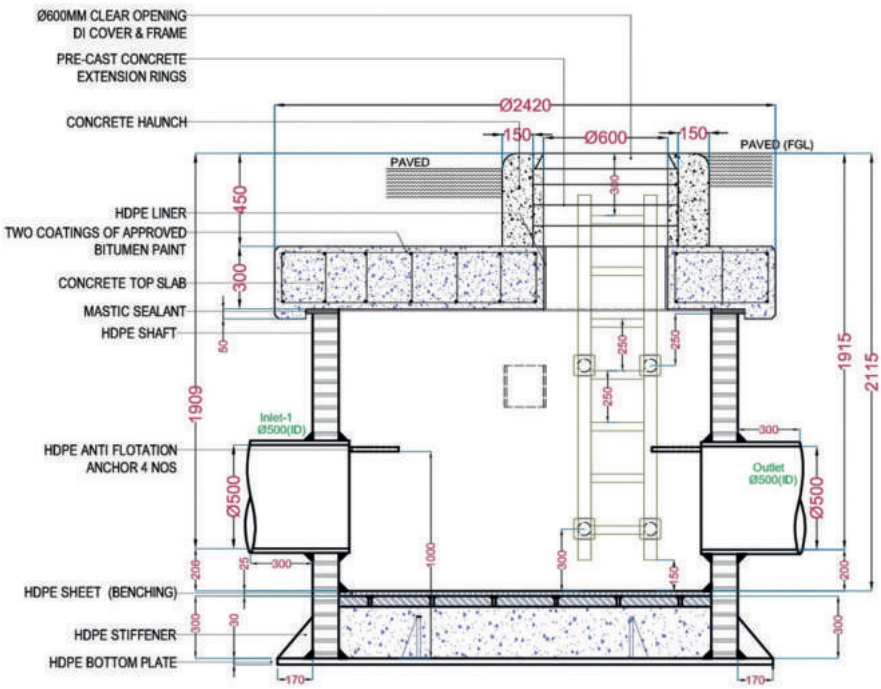
Gully Chambers being fabricated and tested for the load carrying capacity before going into production

The Challenge of UGPM was to reduce the contractor's costs of making the reinforced bottom slab. Manholes were made with a special design which incorporated the bottom (reinforced with stiffner) to provide increased resistance. Additionally, the chamber between the benching and the bottom plate can be filled with the grout.



Stormwater system for Mall of Oman, produced by UGPM

During the installation, blinding concrete was laid before installing the manhole. Then the manhole is placed and grout can be poured between the benching and the bottom plate as shown in the schematic.



Conclusion:

Stormwater systems are an essential element of successful and sustainable water management. UGPM provides customized solutions and provides excellent pre and after sales services along with innovative solutions. The durability of PE100 pipe systems and the leak-free jointing system by electrofusion are convincing arguments.

WATER IS A VALUABLE MEDIUM
AND WE NEED TO DO ALL WITHIN OUR EFFORTS TO CONSERVE IT.

Author:
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Sultanate of Oman, info@ugpm.net

Krah pipes under difficult conditions

How to repair Krah pipes? – our field report from Egypt

Introduction

Since our existence in Egypt we have realized many projects, with kilometres of pipes in several sizes, as well as fittings and manholes. All pipes, fittings and manholes are according to the newest version of DIN16961. Basically, all pipes have an inspection friendly bright (yellow) smooth inside surface and they are jointed with our special integrated electro-fusion jointing system.

Overall, the number of failures due to unexpected loads or wrong handling at site is fairly low, but they exist. One of the major question is always: "How to repair the pipe, the fitting or the manhole?", and from time to time we must also show our repairing skills to the project owner.

One of the biggest issues in Egypt is the existence of very soft, cohesive soil, so all pipes and system components are based on extensive structural analysis, to be on the safe side, because a proper backfilling is not easy at all.

In the day to day business inadequate transport procedures, wrong handling and/or storage can cause pipes damages. External mechanical force may also damage pipes which are already installed. Another origin of leakage can be a bad or wrong jointing of the pipes, for example the power generator stopped during the electro-fusion joining and the worker didn´t check, even the welding report will show a failure (not enough energy in the joint) or manual welding was carried out in dirty conditions.

Depending on the project, the product, the failure and the environment we have different solutions to fix the problem.

All products are produced out of 100% virgin PE100 material – and they passed the requested quality control program, according to DIN16961 and our additional internal guidelines. All manholes are pre-fabricated at the plant and installed on site, by using the electrofusion system. From time to time, special connections are done on site.

The way of repair must consider the origin of the damage, the type of product, the jointing-procedure and the on-site-conditions. That's why we provide several repair-procedures and always choose the best solution accordingly.

A typical view of our loose soil

In this report four different solutions (cases) will be explained, to show the range of possibilities. An important issue is that each solution is a long-term solution (minimum 50 years) and the pipe properties like stiffness and internal pressure rating shall be kept.

Case 1:

A lake connection pipe DN/ID 2500 broke at one position

Project description: High-way is executed in order to connect Suez Canal Economic zone (SC Zone) to Cairo but it will set aside many agriculture lands

Outlet of the Project

Welding under progress

Internal Krah-Electrofusion sleeves

as it crosses many lakes. Road culvert are required up to 2500mm. First it was decided to use the concrete pipes with ID 2500mm but due to loose soil and a high weight of the pipes, the pipes were replaced with HDPE profiled pipes - Krah pipes, namely two adjacent pipelines with an inner diameter of DN/ID 2500 mm and a ring stiffness of 32 kN/m. The depth of installation was 6 m.

Case

Due to wrong handling during alignment and after welding one of the pipes was broken. The broken part was the spigot of one pipe.

Challenge

There was no (payable) way to remove the complete backfilling and change the pipes.

Solution

Internal coupling equipped with two sets of electrofusion wires are installed inside the pipe to be welded to the pipe by electrofusion followed by hand welding. In cooperation with a contractor the ground water level was lowered to guarantee the welding area was completely dry.

Tip: Consider and respect the Krah installation guideline!

Case 2:

A sewage pipe DN/ID 1000 mm was physically destroyed by excavation

Project description: A primary care families' project, planned by the Government to help homeless people who had lost their homes in catastrophes or who live in very bad conditions near Giza Pyramids, the project is designed for 12,500 unit of capacity for 60,000 habitants. It was the first project delivered by Krah Misr and it went into service in 2010 and consists of 3 Km profiled pipes from ID 500 to ID 1000 mm connected by Electrofusion.

In an operating sewage network with an inner diameter of DN/ID 1000 mm (stiffness of 8 kN/m²), maximum installation depth 8m, minimum 0,5 m of a pipe got destroyed.

Case: During the installation of some new electrical cables, the already installed pipe was broken. So, it did not happen during installation, it was a post-installation effect.

Challenge: A very time critical issue, since the pipes are part of an operating sewage network, the maximum time for the repair can be 3-4 hrs.

Solution: As the damage is not repairable and it's not possible to weld within the pipe length, it was decided to change the complete pipe. Thanks to the flexibility in Krah pipe production process, the new pipe was produced with two special ends of solid wall with thickness of minimum 25 mm, so it could be welded by hand welding. Also, the pipe could be cut on site exactly to the needed length.

Case 3:

Storm water pipeline with inner diameter DN/ID 700 mm with ring stiffness 16 KN/m²

Project description: An industrial area built on 331 acres with an authorized capital that reaches 5 billion Egyptian Pounds.

The new city will make a qualitative leap to transform the local furniture industry into a global one. 1500 small and medium workshops of 50 to 150 meters with about 150 large and complete factories, in addition to providing more direct and indirect employment, which is expected to exceed 25,000 employment opportunities. The industrial area is built close to a fishing lake, so the ground water level is almost on finish level and the soil is very loose.

No other pipe material than welded Krah-Pipes could be installed in this region as the settlement expected is significant.

The total project was approx. 5.5 Km of pipes with an inner diameter of DN/ID700

The broken pipe


The broken pipe, is cut by a standard chain saw


The new pipe will be placed


Manual welding under progress

and DN/ID 1000 mm, all jointed by electro fusion, also 550 manholes (in different shapes) were installed.

Case: During installation some pipes were damaged due to crossing heavy vehicles directly on pipes, before proper backfilling. The damages were discovered after the pipeline was tested -after complete backfilling.

Challenge: To stop the leakage with ground water existence and guarantee the pipe flexibility as no welding procedure can be applied with note that pipe might be defected more than allowed due to lower compaction proctor density.

Solution: Amex-liner (Amex Sanivar AG is a German company – www.amex-sanivar.com) offers a very cost-effective way to solve the leakage, during running condition. The range is from DN/ID 600 mm – DN/ID 5000 mm. The solution can even be used, when the pipes is not fully round anymore and under inside pressure conditions – we haven't had this problem, but it might be a good information for other pipe failures.

Tip: The pipe section or at least the pipe joints should be tested before you make final backfilling, to avoid time consuming and expensive work afterwards.

Case 4:

A leaking Krah-Pipe manhole, surrounded by a high ground water table

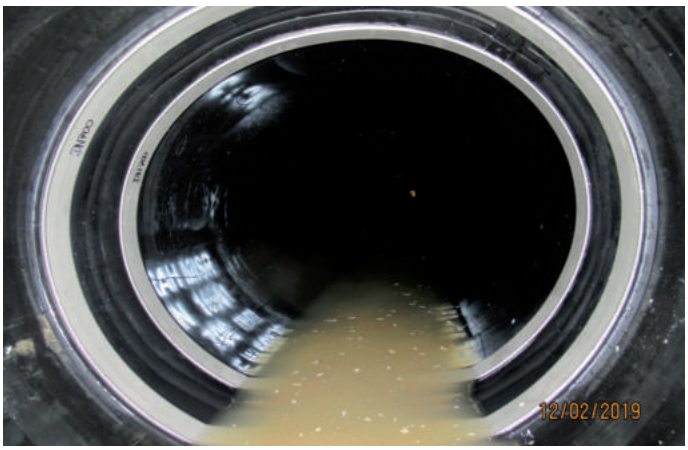
Project description: Integrated in the stormwater network of case 3 also 550 manholes are installed with inlet and outlet according to the connected pipeline.

Case: During installation procedure some manhole connections were damaged due to wrong handling on site.

Challenge: The manhole is already installed and the surrounding ground

Ground water situation

Infiltration of water



Installed Amex-liner

Worker inside the pipe, during installation of the Amex-liner

water table is 30 cm below the surface level and no welding can be done in water presence , and the ground water is infiltrating constantly.

Solution: Using a single-component injection resin on polyurethane base, which is employed for stopping water ingress, for stopping flowing water in combination with acrylate gel grouting, for ground and rock hardening, as well as for numerous other sealing requirements in civil and mining engineering and in tunnel construction.

The material is injected through drilled holes from one point to the adjacent as picture. After water stop hand welding is completed in manhole benching, the manhole is totally repaired.

Conclusion

Failures can always happen, even if the pipe passed all quality control tests during production and after shipment. Everywhere where people are working, human mistakes can happen, and the good news is, that we have solutions to eliminate the problems with several solutions.

And in case we haven't had a specific failure before, we are sure that the Krah Community will find a solution for the problem.

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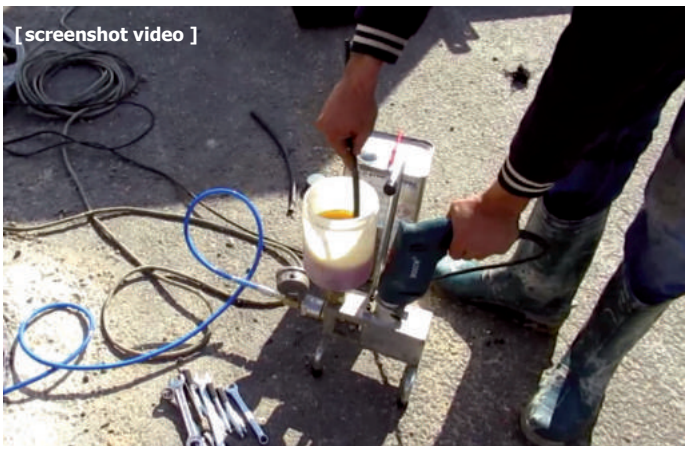
Heavy infiltration of water in the manhole

A manhole filled by gravel, due to leakage



Mixing of components (screenshot video)

Manual welding of the broken part, after the infiltration is stopped

Krah Group - Advanced First Aid Training for Staff

For decades Krah Group employees have been travelling around the globe to provide excellent technical and commercial service to our customers. In the first instance it sounds interesting and funny to travel around the globe. Many people think we're jet setters in well-developed and nice countries when we perform our job role. This could be right and happen if we were busy in luxury cars or fashion business. But we're not!

Our business in the industry is to produce machinery/tools to produce large diameter plastic pipes and therewith we do installation works in different environmental conditions.

Practical exercises deepen the knowledge

If we consider that our staff is working in countries with a very low-level health and safety requirements, or in areas where ambulances can't arrive at the place of an incident in a certain time, then we must consider solutions in advanced health & safety training for our staff. Especially during installation of the production plant, staff is handling and lifting heavy steel frames, or using sharp tools for cutting and adjusting the production plant tools. Without specifying any country or region name, how can we be sure that the lifting cranes are well maintained, or the hazardous tools are in accordance with the international safety regulations? Despite how experienced the staff is, if carrying belts tear up and heavy steel frames or machine parts are dropping on the employee, quick first aid is needed to save the life of the employee.

In Europe a simple phone call to "112" is enough for the ambulance to arrive. But what to do when you are on a different continent, where it's not sure if the phone number "112" even works? Then it's very fortunate, when staff is trained to save life even in very uncomfortable environmental conditions. We decided to find experts, who can provide such an advanced health & safety training to our staff who are travelling to several countries. The association Uniter e.V. (www.uniter-network.de), which is a network of Veterans and Military related people has a division called "Medical Response Unit – We protect humans life".

We organized an advanced health & safety training with an instructor from the Medical Response Unit from Uniter at our facilities in Schutzbach. The instructor of the division MRU explained the most lifesaving actions like how to stop bleeding with a Tourniquet, a very effective belt, which is used to stop bleeding. Also we learned how to assure that the injured person can breathe, or maintaining the physical circulation of the injured person etc.

Sandro Vernillo, the R&D engineer of the Krah Group has been travelling to different countries for 10 years and says: "It was the most effective first aid training which exactly fits our specific activities in the abroad deployments. The training was customized for our needs abroad. Especially with the co-worker it's a mutual feeling of security, to know that we can help us each other on any accident, by awaiting the ambulance or first aid helpers. As time can make the decision of life or death, I prefer to not loose time." Krah Group will provide further advanced and practical health & safety education for staff in cooperation with the Medical Response Unit of Uniter e.V. Association to save live and health of the employees. More security also for other people who are injured through accidents, our employees will help to save life and health.

***Author**: Bülent Kuzkaya*
Health & Safety Officer of Krah Group

Argentina

The Krah Community Meeting 2019

After the last Community Meeting 2015 in Italy, we have invited our partners, customers and representatives from all over the world again last autumn to join us for the next community meeting in Argentina in spring 2019. Although the chance was unique, as two of our latest generation KR800 MAX machines were on their way to Argentina for being installed in the beginning of 2019, we hoped for but did not expect too high participation, due to the event taking place at the other end of the world for most of the people.

Mr. Alexander Krah

But thankfully, we were proved completely wrong and over 30 people from all around the globe registered and took their flights. Coming from Europe, Asia, Africa, America mostly with journeys between 12-30 hours we finally all met on 10 March 2019 in Buenos Aires.

The famous and fabolous Malbec red wine

The biggest Krah community in history could start!

In the evening we were warmly welcomed by our host Krah America Latina with a very nice reception, including obligatory tango dancers, Argentinian traditional music, food and drinks, like the incomparable Malbec red wine. It was the perfect start to getting to know and/or meeting each other again. Already then new alliances have been created, new friends were made and old friendships restored.

Day 1 - 11 March

On 11 March the day started with an early conference session, but thanks to the time difference (-4 hours compared to German time) nearly everybody was already awake since long and ready to hear a lot of news about the Krah pipe systems, its applications, developments etc. During the day we learned many things about different applications and projects of Krah pipes at the most various locations around the world. Some of the technical reports, like fish farms in South America and oil separators in Estonia can be found in this newsletter as well. Furthermore, technical presentations regarding improvement of the production in special cases were being held, providing the audience with a lot of new input, ideas and information.

After a long conference session, it was time for a little bit of fun and sightseeing in Buenos Aires. We started a coach tour visiting the most famous places of Argentina`s capital such as La Boca, with its worldwide famous soccer team and stadium Boca Juniors and its picturesque streets of Caminito. After we strolled

through the colorful little alleys we continued our tour to Plaza de Mayo, the Casa Rosada – the official seat of the government – and the Obelisco, the symbol of Buenos Aires. A typical Argentinian dinner in the restaurant Rio Alba with a lot of meat and a little bit of good Argentinian red wine rounded off the day perfectly.

Day 2 - 12 March

In the next morning it was already time to check out from our nice conference hotel in Puerto Madero to travel to San Juan, in the very East of Argentina, close to the Andes and the Chilean border. But before, we went to visit the local Krah Pipe Production facility, where two older versions of the Krah pipe production lines are installed and have been running happily and efficiently for now already 13 and 5 years. It was a very good opportunity for all participants to see on-site the changes and developments that have been done on the machine during the last years and between the different plant versions. Also, to make a comparison with their own production and in contrast to the two brand new machines they were going to see in San Juan the following day. After that informative company tour, we boarded a catamaran to visit the famous and impressive Paraná Delta, just outside the capital of Buenos Aires to take a nice cruise through some of the uncountable arms of the river.

Although it was sadly also a little wet from above, we really enjoyed the unforgettable trip to an amazing part of the Argentinian

Catamaran tour to visit the famous and impressive Paraná Delta

Nightlife Argentinien style

Sven Jürgens with Martin Mobilé of Krah América Latina

nature before heading to the airport to catch our two hours flight to San Juan, crossing the really huge and very versatile country of Argentina. Coming from a fairly cold Buenos Aires of only about 20°, San Juan welcomed us with a nice temperature of still 25° in the night.

Day 3 - 13 March

The next day was a very important day for our host Krah America Latina as they have invited 150 people for the inauguration of their second plant in San Juan. This new plant covers an area of approximately 3000 sqm, nearly the double of the first plant in Buenos Aires, with „only" 1600 sqm. For now, two brand new KR 800 MAX pipe production machines have been installed, firstly, mainly to serve a local pressure pipe project of DN/ID 1300 mm with 10 bar.

We were very proud to be able to attend this event, representing the whole Krah Community with over 30 people from all around world. But not only for Krah America Latina it was an important day, also for the complete region of San Juan it is a great benefit to have a new plant there, providing approximately 50 new jobs. So even the governor, Sergio Uñac and other high-level politicians followed the invitation to open this factory, accompanied by local television stations.

The inauguration ceremony was followed by a wonderful Argentinian barbecue in an incredible biological winery at the foot of the Andes *(https://www.fincasierrasazules.com.ar/)*. There was time for conversations, to relax and enjoy the stunning view over the vineyards. A small guided tour of the winery gave us an insight into the work of a winemaker and explained the way from the grape into the bottle.

This day was really one of the highlights of the whole event, considering the beautiful ceremony of the inauguration to be rounded off with the lunch in an unforgettable setting.

Day 4 - 14 March

Thursday was already the last day of this year's meeting. Starting with another conference session in which the technical manager of Krah Germany presented the new developments of the production machines to the audience, followed by some speeches about news regarding the standardization of Krah pipes and other interesting topics, such as the repair of existing pipe systems with Krah pipes. After lunch we headed back to Buenos Aires for a very nice last farewell dinner in Puerto Madero.

Farewell

All days of the event were filled with intense technical and commercial discussions, the creation of new alliances and friendships, good food in a very friendly and relaxed yet concentrated atmosphere. The great success and the positive feedback of the participants have showed us, that there is a high demand for a personal exchange everyone to two years and we are looking forward to arranging the next community meeting in late 2020 or early 2021.

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The biggest Krah community in history

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