

LEVEES Working Group Newsletter



A breach on a coastal levee in Guérande after Xynthia storm in France. Photo by DREAL Pays de Loire



Note from the Chairman

Rémy Tourment

This newsletter comes at an unfortunate time with two exceptionally catastrophic flood events affecting Nepal, India, and Bangladesh in Asia, and Louisiana and Texas in the USA. Although grave, the extreme events remind everyone of the importance and benefit of well-informed flood risk management and efficient flood defence schemes. In this issue of the newsletter, our colleague, Elena Sossenkina, chair of both the Levee Committee of USSD and the USA Levee Safety Coalition, outlines the importance of an international community like ours to share lessons learned and good practice.

Floods in the Czech Republic are also a key item in this Newsletter. July's ICOLD Annual Meeting in Prague marked the 20 year anniversary of the disastrous floods of 1997. In this issue, our Czech colleagues Jaromir Riha and Ivan Vaníček revisit the

1997 flood, as well as some more recent Czech flood events.

This newsletter comes after the Prague 2017 ICOLD meeting, which is an important event for our working group along with the wider levee community of practice. This meeting was a turning point in our community history, as will be the 2018 Vienna Congress.

Our working group has made great progress in its short existence, in terms of output (our two reports in development), membership and recognition from non-member countries.

The working group meeting in Prague, on Friday July 7th, was another success with excellent attendance. Our Workshop was a success despite several other Workshops held in parallel, and although the General Assembly was also held in parallel, it greatly contributed to the success of our WG by voting for a Tech Committee. Our formal morning meeting was attended by 14 attendants from 9 of our member countries, and 5 attendants from associate countries or observers. Our afternoon workshop was even more successful, with

17 attendants from 12 member countries and 15 attendants from 7 other countries. Our newsletter editors, Justin and Adrian, present a summary of this meeting.

I wish, as in our inaugural issue, to thank all our members and partners, as well as the boards of ICOLD and the European Club of ICOLD for their support and input. Finally, I strongly encourage everyone to freely disseminate this issue of the newsletter as well as the address of our web site. Furthermore, the editorial team hope to receive many contributions and levee related information to disseminate.

BY THE NUMBERS

136 000

Flooded buildings in Houston, Texas, caused by Hurricane Harvey

\$45-75 billion

Preliminary estimates of the cost caused by Hurricane Harvey to the US economy

1 200

More than 1,200 people killed from the recent flooding in South Asia

1.8 million

Children unable to go to school in South Asia due to recent flooding

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FLOODS IN THE CZECH REPUBLIC

A summarised view

By Ivan Vanicek

The population of the Czech Republic is relatively well informed about flooding. In the media, mostly on television, there is information about potential flood risk. This risk is specified in three different levels for a potentially affected stream.

An abundance of information on the 1997 flood is currently available, due to the fact that it is the 20 year anniversary of the event. The information varies from the horrific situations caused by the flood, how people have reviewed this event to what was done to improve the situation in the most affected places.

During the last two years, two significant activities were arranged by the Czech Institution of Civil Engineers together with the Ministry of Agriculture, of which the statement was presented by Dr. Punčochář.

The first seminar, on which foreign specialists were invited, was focused on the borderline cooperation during flooding events.

The second activity organized in the frame of "Engineering Day" was focused not only on floods, but also on drought. The problem of retaining the rain water is very sensitive for the Czech Republic as it is a country which drains and loses water easily. Therefore, the attention was also focused on roughly 25 000 small historical dams (from the Middle Ages) which play a very important role from both points of view.

FLOODS IN THE CZECH REPUBLIC

A timeline of the last two decades of flooding

By Jaromir Riha

1997 - REGIONAL FLOOD

In July 1997, severe floods occurred in the Moravian part of the Czech Republic with the flood wave propagating to Poland, Germany, Slovakia, Austria and Hungary. The extreme flood wave claimed 59 human lives and about 2 billion USD (3.8 billion EUR) in material losses. Some river reaches exceeded the 500-year flood discharge.

South-western Poland and the northern Czech Republic experienced two periods of extensive rainfall, the first occurring 3–10 July and the second 17–22 July.



Fig. 1 The collapsed levee at Kvasice on the Morava River

The precipitation was very high, measuring 300–600 millimetres, which, corresponded to several months' average rainfall over a few days. The waters rose 2 to 3 m above the previously recorded averages and were so high that they flooded over standing measurement poles. It was one of the heaviest rainfalls in the worlds recorded history. It was dubbed the Millennium Flood as the likelihood of such an event in a particular year was estimated at 0.1%.

Flooding began on July 5 in the Czech Republic and spread to Poland on July 6. Those early floods were very rapid flash floods (water levels rose by up to four meters in half a day).



Fig. 2 Flooded statue of Tomas Bata in Otrokovice

During the flood, several levees were damaged with some totally collapsing. The most significant losses were indicated in the case of the Kvasice levee collapse (Fig. 1) when the city of Otrokovice was completely flooded with the water depth exceeding 4 m (Fig. 2). Another serious collapse was the right-bank levee of the Odra River, which produced an ecological catastrophe caused by the extensive spills of oil stored in the floodplain behind the levee.

2002 - REGIONAL FLOOD

In August 2002 a flood caused by over a week of continuous heavy rains ravaged Europe causing billions of euros in damages to the Czech Republic, Austria, Germany, Slovakia, Poland, Hungary and other countries. The flood was of a magnitude expected to occur roughly once a century and locally once in 500 years.

Prague, the capital of the Czech Republic received significant damage from what were deemed to be the worst floods ever to hit the city. The flow of Vltava culminated at 5300 m³/s, 20% more than during the flood of 1896. Most of Prague's artwork was saved due to advance warning of high water levels, however there was significant damage to the Prague Metro subway system, much of which was completely flooded.

The evacuations before the worst of the flooding has been cited as one of the reasons for relatively low loss of life in the capital. An estimated 40,000 people were evacuated from Prague. In total, 16 people lost their lives in the Czech Republic due to the floods, and damage from the flood was estimated at 2.3 billion USD.

2006 - FLOOD FROM SNOW MELTING

From February to April 2006 many rivers across Europe, especially in the catchments of the Elbe and Danube rivers, swelled due to heavy rain and melting snow and rose to record levels. The Elbe River also rose 13 centimetres higher than in 2002 in some areas, creating 150-year-record-highs. The Czech Republic was not as affected, because in the four years after the flooding in 2002, two partners built a stronger levee system along the Elbe.



Fig. 3 Collapse of the Horka levee at the Morava River

Many dikes and levees breached because of the poor construction by local and national officials along with an unusually long and hard winter in Central Europe. The snowfall lasted well into April and many areas were frozen, so frost emerged, soaking the earth full of water.

An example of levee failure is the Horka levee (Fig. 3) due to the internal erosion along the buried, incorrectly embedded pipe.



Fig. 4 The camera log of the pipe before the collapse

2009 - FLASH FLOODS

The June 2009 European floods were a series of natural disasters that took place in various places in Central Europe. In the Czech Republic the heavy local rains caused overflowing of the streams, which propagated to the large rivers like the Oder, Elbe and the Danube.

In the Czech Republic, persistent heavy rainfall beginning on June 22 led to the rise of smaller Vltava tributaries like the rivers Malše, Blatnice and Černá. On the same evening, the Rožnovská Bečva in the Moravian part rose about 1.2 m in Valašské Meziříčí and its water level at the estuary into the Bečva rose to ten times its normal level.

The floods in North Moravia and Silesia took on a different character. In the span of two hours on June 24, strong rainfall brought flash floods with up to 80L/m² of rain at the Jičínka and Zrzávka streams. The level of the Jičínka swelled to 5.5 m and exceeded the 1997 flood by 2 m. In Jeseník nad Odrou, the stream Luha rose to 2 m in the span of thirty minutes; four people died in that community, three by drowning.

2010 - REGIONAL FLOOD

During May and June 2010 a devastating series of weather events occurred across Central European countries. Poland was the worst affected along with Austria, Czech Republic, Germany and others.

2013 – REGIONAL FLOOD

Extreme flooding affected the western regions of the Czech Republic (Bohemian part). The heaviest rain in the region for eight years was reported, a state of emergency was declared in a total of 302 municipalities across the region.

In the Czech capital Prague, floodwaters covered the esplanades along the Vltava, which on 3 June flowed at a rate of

3,200 m³/s, compared to the almost 5,000 m³/s during the floods of 2002. Parts of all subway lines were closed. Heavy machinery was brought in to protect the historic Charles Bridge in the city to remove debris from accumulating at the upstream side of the bridge. One thousand troops from the Czech Army were called in to help build flood defences

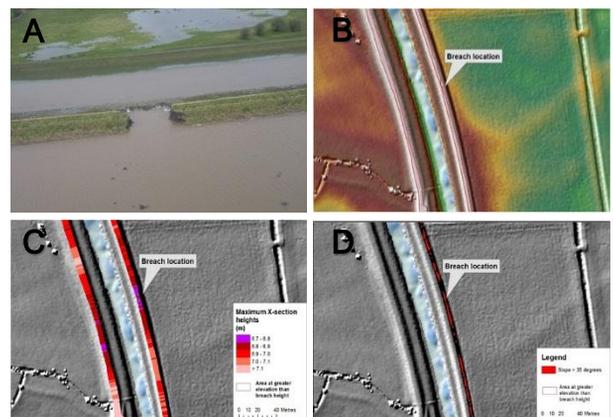
LIDAR IN THE U.K.

Exploring remote sensing technology

By Adrian Rushworth

The environment agency is currently exploring options to make better use of remotely sensed data to enhance existing practices for the condition assessment of flood defence infrastructure. Reviews of how our assets performed during recent flood events have identified that irregularities in, on or near the flood defences were a significant contributing factor in a number of failures. We are therefore looking at how these irregularities, as well as other indicators of weakness, deterioration or damage, which may not always be immediately visible on the surface, can be identified using remotely sensed data, and in particular lidar (light detection and ranging) data. We have produced and piloted a series of automated tools which use this existing lidar data, and can identify features on embankments such as low spots, overly steep rear faces and excessive settlement. Our analysis is also making use of aerial photography and historic maps to identify palaeo-features or historic crossings which could impact on an embankment's performance.

The figures below show examples of some of the data analysis produced during our pilot study, in locations where breaches have already occurred. This has allowed a clear, retrospective review of the potential indicators of weakness that we may have been able to identify with these methods prior to breach. By applying similar analysis to apparently healthy embankments, we may be able to improve our prediction of potential failure points and act to rectify these concerns before they are tested by high water.



Mosaic of photos and LIDAR data showing point of a flood defence failure which occurred on the river Douglas at Croston (Lancashire) 25th December 2015. Panel A - photograph of the breach location on the 27th December 2015. Panel B - LIDAR image with a maximum contrast stretch at the location of a breach. Panel C - LIDAR showing the area that has greater elevation than the breach point. Panel D - LIDAR highlighting in red where the embankment slope is greater than 35° (1 in 1.4)

ICOLD - 1 YEAR EARLY

Feedback from Prague, lookout to Vienna (and beyond...)

By Rémy Tourment

The 85th ICOLD meeting held in Prague on 1-7 July 2017 was a turning point in the history of our Levees and Flood Defences International Community. The General Assembly of ICOLD approved the creation of a [Technical Committee on Levees](#), for the first time in its history.

After the [choice of Question 103](#) (Small Dams and Levees) during the 2016 Johannesburg meeting, which was also a "first time event" in ICOLD history, we can now say that ICOLD has completely integrated the topic of levees in its scope. In fact levees will in the near future be present in two key [productions from ICOLD](#) - The Congresses Proceedings and The Bulletins.

Prague - What we planned

Following discussions initiated during the USSD annual conference in Anaheim, it was decided in agreement between the USSD board and our own LFD Working Group to promote a Technical Committee (TC) on Levees in ICOLD. We aimed to have this discussed in next year's General Assembly in Vienna, after which we hoped would be successful sessions on Question 103 (Q103). Shortly before the meeting, two joint letters from the Presidents of the National Committees from France, Netherlands and USA along with the President of the European Club of ICOLD were sent. The first to the Board of ICOLD, presenting the [business case for Levees in ICOLD](#), and the second, to the Board of ICOLD and Chairpersons of ICOLD National Committees requesting feedback on the [interest toward Levees in the different ICOLD National Committees](#). The ICOLD Central Office soon disseminated this as circular letter no.1913, which allowed some interested National Committees to send us information and/or attend our WG meeting in Prague.

We were prepared to take the opportunity of the Prague ICOLD meeting to:

- expand our network of ICOLD National Committees interested in the topic of levees and flood defences outside our Europe / USA initial core group,
- have the discussion and vote on the Levee Technical Committee added on the agenda for discussion and decision during the Vienna Congress.

Prague - What happened

And... we were a lot more successful than we expected. On 2 July we learned from the Vice-President of ICOLD representing the USA, Michael Rogers, that the ICOLD Board had approved to bring the new Technical Committee on Levees to the General Assembly on Friday 7 July. No need to say, but this news caused a big surprise along with a sense of achievement. However, the new announcement provided us with the stressful task of revising the week's plan in minimal time.

In preparation for the General Assembly, as General Reporter of Q103 and chairman of our LFD WG, I attended meetings before the General Assembly with links to levees in ICOLD. Networking

and discussions took place to build new contacts and make as many National Committees in favour of the new TC. With great help from our Secretary Marcel Bottema and USA colleague Elena Sossenkina, I was able to give the [final presentation to the General Assembly](#) along with the initial terms of reference of the TC. Follow the link to see the argument that was developed to convince the large dams community of the strategic importance of integrating levees.



Rémy presenting the proposed Technical Committee to ICOLD in Prague
Photo credit: Eija Isomäki

Finally, the Friday was difficult for me to manage, as I had, with Marcel, to lead our Working Group meeting, but also to be ready to be called at the [General Assembly](#) to make the case for the new TC. The presentation that I gave, kindly introduced by ICOLD President Anton Schleiss, was followed by a vote by show of hands, which was very largely in favour of the TC creation (I could not see in this large room if there were any votes against...).

This excellent, maybe even historic, outcome was definitely a group effort involving many people: Michael Rogers, the Presidents of France, Netherlands and USA National Committees, ICOLD President, Board and Central Office, EURCOLD Board, all our members and associate partners who were present at the Prague meeting and helped, directly or indirectly, in their discussions with national delegates to defend the levee cause. We must not forget the essential people: the members of the LFD WG and USSD, who contributed with their commitment and actions to demonstrate to the boards of EURCOLD and ICOLD the energy and importance of the levee community.

Onward to Vienna

Now what? We still have a lot to do until the Vienna congress to completely initiate the new TC. This includes finalising the list of member countries and their representatives and preparing the final Terms of reference that will have to be approved in a TC meeting in Vienna. As we do not have the resources to maintain both our LFD WG and the new TC, we will have to make a transition in terms of production between the two groups: both our reports will have to be finalised to a point that they can be presented to EURCOLD as our LFD WG production, then they will be handed over to the new TC to be later expanded and improved as an ICOLD production (position papers, bulletins, ...).

The preparation of the sessions on Q103 will also take a lot of our time, to prepare the final version of the reports, presentations for the Congress, or the General Report. We have to make the Vienna congress a huge success in terms of technical and scientific content on levees and in demonstration of the value of an international community. I hope to see all of our WG members in Vienna, some form of celebration will need to happen.

The future of our levees community after the Vienna congress

For our WG, the Vienna congress will be pretty much the end, let's make it happy, successful, and an opening to an even better future. For the international community of levees in ICOLD, it will only be the beginning. A lot more will be left to do in order to become permanent. Let's all work together to share information and to produce valuable documents with this goal in mind. The [following ICOLD congress will be held in Marseille](#) (France), the city where I was born. I hope we will have even more levees and flood defences content than in Vienna!

With a special mention to Ignacio, secretary of the European club of ICOLD, for his many years of help but is to be replaced in the near future.



Rémy presenting to the ICOLD community in Prague
Photo credit: Cees Henk Oosting

PRAGUE WG MEETING

Summary of the working group meeting

By Adrian Rushworth and Justin Watts

Although overshadowed by the ICOLD announcement, the Levee Working Group meeting in Prague was a success. The central outcome from the meeting was the reduced future of the working group along with the forward look to the technical committee.

Regarding the future of our Working Group, there is a broadly shared view that we cannot put our efforts in both a Working Group and a Technical Committee. Moreover, a key role of the Working Group was illustrating the business case for starting a Committee (which succeeded somewhat earlier than planned). Hence, we should strive for a transition period, in which we work on the start-up of the Technical Committee on Levees, while finishing the products of the Working Group. The key item to provide is a final and approved version of the Levee Inventory Report before the Vienna Congress. We should also have a pre-draft (containing at least a few chapters) of the dam-levee-comparison report that can be handed over to the Levee Committee.

The progress of these two reports is described below:

Levee Inventory Report

At the Prague meeting a small group volunteered to review the Levee Inventory Report. Reinhard Pohl is leading the group. The final country reports are being collated. We expect to carry out a

light editorial review with limited changes to the content. Some of the longer contributions may need to be edited for size. Our aim is to have a finished draft by the end of the year, ready for final checking.

Dam Levee Comparison Report

The report has a proposed structure of 9 Chapters covering the life cycle and management of levees, including key messages, definitions and some example diagrams. The length is expected to be 50-100 pages. An Internship Report by Nick Stoop from Delft University has provided useful information for the report. Contributions to the report are strongly encouraged since the writing team is not yet fully complete

The afternoon presentations from Prague are listed below:

- Real-time safety evaluation method of levee structures subject to water level change by Dr. Dong-Hoon Shin
- International Levee Performance Database by Robert Slomp on behalf of Bas Jonkman
- Levees in Canada by Andy Small
- Combined dam-levee systems Ignacio by Escuder, Jessica Castillo
- Dam-levee system approach for Omaha City flood risk reduction by Bob Beduhn
- WG paper on a Levee community of Practice including a Floodrisk Conference summary

INTERNATIONAL LEVEE PERFORMANCE DATABASE (ILPD)

International collaboration and data sharing

By Myron van Damme

The ILPD is a database for data on levee failures, breaches and other relevant performance cases. The ILPD has been developed as part of the SAFELevee project which aims to improve the reliability of flood defence systems by improving the understanding of their failure mechanisms.

The database will be available publicly to the scientific and engineering community for purposes of research, education and cooperation. The database contains three types of data:

1. Generic information on (near-) failures of levees,
2. Information on failure processes and descriptive parameters for (near) failures, large-scale experiment and performance case
3. Detailed datasets on physical processes, e.g. lab-measurements from flows, and erosion tests.

All data is made publicly available through our website and via an Application Programming Interface (API). A preliminary version of the database is accessible through <http://leveefailures.tudelft.nl>. The API is available via <http://api.leveefailures.tudelft.nl>. The ILPD is currently under development and we welcome your contributions and information to extend the datasets.

Information in the ILPD is public open access and can be used for research along with statistical analysis or model validation provided the original source of the data is cited. When data is downloaded, a reference file will automatically be provided.

Contributing is easy. You can send in your data directly to leveefailures@tudelft.nl. The team will create a database entry which can be sent to you for review before publication. For further information, please get in touch via email (leveefailures@tudelft.nl)

COUNTRY UPDATE

Presentations from Prague

By Justin Watts

The following points below highlight some interesting facts regarding the WG Member country presentations. They provide a brief overview of each country and its relationship with levees to flood risk, legislation and research.

Belgium

- No national protection level - risk-based approach.
- A knowledge network has been established

Canada

- No national policy and guidelines yet.
- Extensive spring floods Montreal but no levees involved.

England

- Evaluation of recent levee failures and national flood risk assessment.
- Use of LIDAR for monitoring.

Finland

- Dam Safety Act also includes levees; levee classification is underway now.
- Most important levee protects city of Pori.

France

- Recent launch of France-Digue, a knowledge group of levee managers.
- New national regulations passed through parliament in 2014/2015

Germany

- Flood protection is responsibility of the 16 federal States, but there are national guidelines.
- Drones are being considered for levee monitoring.

Netherlands

- Step to risk-based approach.
- 'Fundamentals on Flood Protection' publication and a new probabilistic levee safety assessment tool.

Poland

- New water law is planned but postponed, it includes large centralization.
- Retention deserves more attention.

Romania

- Over 10000 km of levees and 1000 hydraulic structures.
- New risk-based laws and approaches were adopted after 2006 floods.

Russia

- Recent floods in 2013 causing \$10 billion damage.
- Flood monitoring with sophisticated aerial means.

INFORMATION GAP

Strong communities of practice

By Elena Sossenkina

Today's news coverage and social media are often plagued with sensationalised headlines, exaggerated information and unverified reports. Even for technical experts, it is difficult to sort facts from fiction. What was the cause of flooding? How did the flood risk reduction infrastructure perform? Were there dam or levee breaches? How bad was the storm surge? What can we learn from this disaster? The questions are numerous.

In the wake of Hurricane Harvey, Remy Tourment, Chairman of the EUCOLD LFD Working Group, reached out to U.S. Levee Safety Coalition and USSD leadership to offer support and request information about the event to share with his European colleagues. No matter where the next flooding occurs, access to accurate and factual data and direct sources of information, such as a great article on floods in Czech Republic featured in this newsletter, is just one example of the value of international communities of practice.

Since the initial work on the International Levee Handbook began nearly 10 years ago, the international community of practice for levees has continued to strengthen. US collaboration with the EUCOLD LFD WG and its partners has been a rewarding and mutually beneficial experience. This can be clearly seen from the increased participation of European levee experts in USSD and U.S. Levee Safety Coalition initiatives and vice versa.

Several experts from UK, Netherlands and France presented at the 2015 levee safety workshop in New Orleans, Louisiana, organised by the U.S. Levee Safety Coalition and an American delegation participated in the 2016 European FLOODRisk conference in Lyon, France. We anticipate this will continue with the recent formation of the ICOLD Levee Committee and look forward to collaborating with our international colleagues at future US and International events, including the USSD 2018 Conference in Miami, Florida and the ICOLD Congress in Vienna.

NL PUBLICATION

Fundamentals of flood protection

By Marcel Bottema

Recently, the Dutch Expertise Network for Flood Protection (www.enwinfo.nl) published an update of their key publication 'Fundamentals of Flood Protection'. https://www.enwinfo.nl/images/pdf/Grondslagen/GrondslagenEN_lowres.pdf

The publication first gives a brief description of the history, context and governance of flood protection in The Netherlands. It then briefly presents the concepts of uncertainty, probability and risk, before describing the backgrounds of the risk-based safety standards which have recently been adopted in the Dutch Water Act. The next chapters globally discuss the backgrounds of technical specifications for Dutch flood defences, as well as the design process. The last chapter discusses some key issues related to the management of flood defences, both in regular conditions and during crisis situations.

Upcoming Events

October 16 – 17, 2017

- [11. Deichtage](#)
- [Karlsruhe, Deutschland](#)

November 29 – 30, 2017

- [Colloque CFBR/SHF Hydraulique des barrages et des digues](#)
- [Chambéry, France](#)

April - May 30 – 04, 2018

- [2018 USSD Conference and Exhibition](#)
- [Miami, Florida, USA](#)

June 06 - 08, 2018

- [Protections 2018, the 3rd International Conference on Protection against Overtopping](#)
- [Grange-over-Sands, Cumbria, UK](#)

July 01 – 07, 2018

- [26th Congress – 86th Annual Meeting of the International Commission on Large Dams](#)
- [Vienna, Austria](#)

A CALL FOR CONTRIBUTIONS

- *News, media or press releases on current storm events involving levees and flood defences.*
- *Current, ongoing or recently complete research projects with web links.*
- *Documents related to levees or flood defences: handbooks, guidance, reports and regulations.*
- *Information on events relating to levees or flood defences*
- *Links to informative/educational web sites and related organisations.*
- *Contact the WG – lfid-eurcold@irstea.fr*



NEWSLETTER TEAM CONTACT – lfid-eurcold@irstea.fr

Rémy Tourment, Marcel Bottema, Adrian Rushworth, Justin Watts, Bruno Beullac

