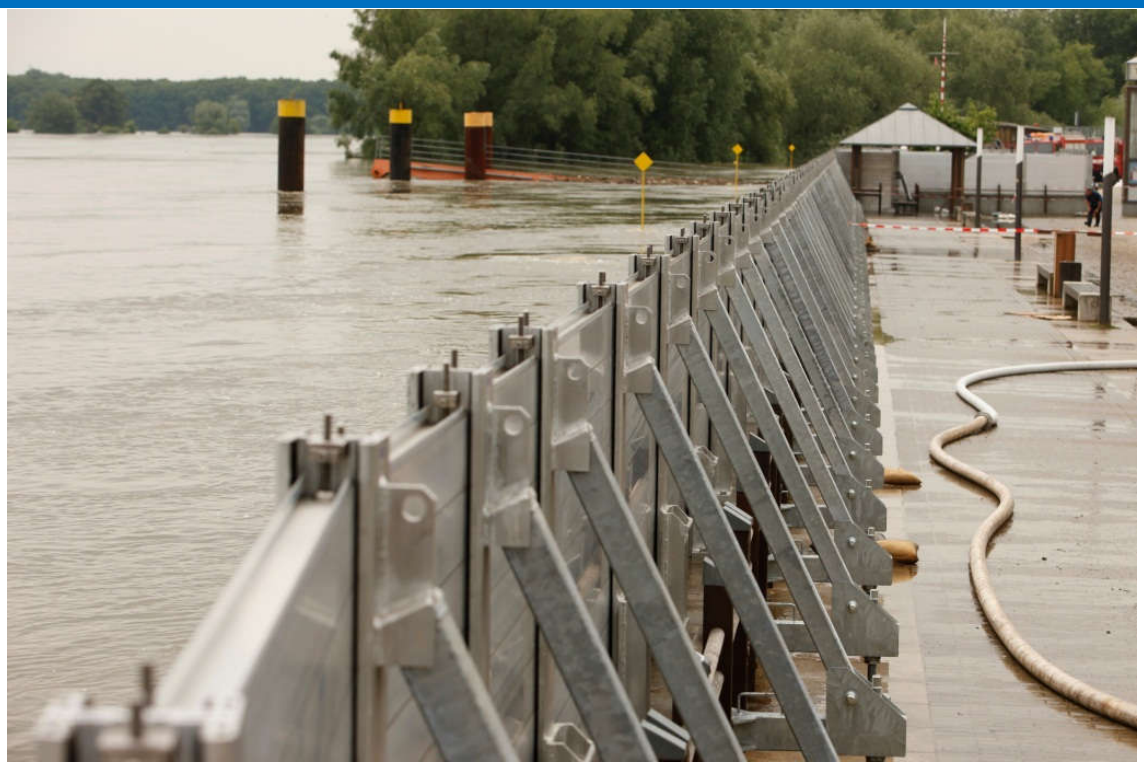
Demountable and mobile flood protection systems

Recommendations on planning, selection, procurement and using

CFPA-E Guideline No 7:2022 N



CFPA EUROPE®
Fire Safety | Security | Natural Hazards

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The CFPA Europe develops and publishes common guidelines about fire safety, security, and natural hazards with the aim to achieve similar interpretation and to give examples of acceptable solutions, concepts, and models. The aim is to facilitate and support fire protection, security, and protection against natural hazards across Europe, and the whole world.

Today fire safety, security and protection against natural hazards form an integral part of a modern strategy for survival, sustainability, and competitiveness. Therefore, the market imposes new demands for quality.

These Guidelines are intended for all interested parties and the public. Interested parties includes plant owners, insurers, rescue services, consultants, safety companies and the like, so that, in the course of their work, they may be able to help manage risk in society.

The Guidelines reflect best practice developed by the national members of CFPA Europe. Where these Guidelines and national requirements conflict, national requirements shall apply.

This Guideline has been compiled by the Natural Hazards Group and is adopted by the members of CFPA Europe.

More information: www.cfpa-e.eu

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CFPA Europe

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Contents

Key words: flood, demountable and mobile protecting system, functional characteristics, criteria for selection, quality assurance

1 Introduction

Experience clearly demonstrates that natural hazards can endanger life, health, and the environment and cause considerable property damage. Therefore, protection against natural hazards is an essential task for society, which the Natural Hazards Group (NHG) of CFPA Europe has also taken on since 2012. Furthermore, natural hazards are also affected by ongoing climate change, so this protection against natural hazards plays a vital role in climate change adaptation and sustainability. The impacts of natural Hazards are greatly increased by ongoing climate change this is evidenced by scientific studies and can be seen and reported all over the world . The consequences of climate change can be caused by extreme weather events and changes in meteorological parameters, regional and seasonal increase of average temperatures, and changes in precipitation distributions.

Concepts and measures for protection against natural hazards should be regularly checked in risk management and adapted, if necessary. This adaptation should take regional and local differences into account as well as the impacts of climate change, regional and local exposure, and vulnerability to natural hazards. The resilience of society, the ecology, the economy, each as a system, including infrastructure, must be considered as the objective within all adaptations and concepts to ensure or maintain the necessary system function.

Concepts and measures to protect against natural hazards should also be sustainable, in accordance with the sustainable development goals of the United Nations. Particularly in terms of climate action (mitigation and adaptation), resilient infrastructure, sustainable cities and communities, and quality education. In relation to the subject of this guideline, flood events of recent years have shown that significant damage can occur. Floods can also seriously affect companies and other enterprises due to prolonged business interruption and potential loss of market share.

Experience demonstrates that losses caused by flooding can be significantly limited by preventive measures. In this context, exceptionally well-designed and detailed fixed protective measures have proven successful. Furthermore, demountable, and mobile protection systems can complement or replace stationary protection systems due to their inherent flexibility and operational deployment.

Existing hazards must be identified and analysed, and the associated risks assessed for establishing appropriate protection measures. The relevant objectives, e.g., the height of the protecting wall, are defined as object-related and completely depend on the legal requirements and risk assessment.

Object-related protection measures should be interoperable with local protection concepts, using planning and operational coordination. Floods are usually large-scale events. The location and the protection objectives and measures are more practical if embedded in the local protection Plans. Potential threats to the stability of buildings by buoyancy or groundwater percolation are also to be considered.

2 Scope

The present guideline covers the planning, selection, and procurement of mobile flood protection systems. Mobile flood protection systems are currently widely available. The approval test of these systems is, however, conducted to a variety of methods and criteria. For this reason, notes, and criteria for the selection of suitable mobile flood protection systems should be systematically prepared as recommendations in order to support the decision-makers, planners, and managers of flood protection to take appropriate measures in practice.

This publication is based on current knowledge and previous experience of loss prevention and risk management. It will be reviewed regularly and updated when there are significant improvements resulted that in the specified fields.

Legal regulations are not affected.

3 Definitions

Stationary flood protection systems: permanent structural protective measures that are in the most part deployed .

Note: An online catalogue of flood-resistant construction types has been published in Germany with the research report and additional explanation for practice to make flood-adapted planning and construction more concrete for the first time, based on current research results:

https://www.gdv.de/de/themen/politische-positionen/schadenverhuetung/service.

Mobile flood protection systems can be divided as follows:

- Well-planned systems that are transported and assembled on site. The installation of these systems requires physical provision on-site.
- Standard emergency systems that are marketed and assembled without physical provision on-site.

Stationary systems with movable elements, which are activated when deployed, can be assigned to mobile systems within the meaning of this guideline.

4 Examples of available systems

Mobile flood protection systems can be designed and used both for the protection of large areas and the protection of specific objects, e.g.. fitted in building openings (doors, gates, driveways). Most mobile flood protection systems are listed without any claim to completeness. They are briefly described with schematic illustration and by the following characteristics:

- basic structure
- area of application and
- Logistics and Maintenance.

Using these characteristics, the selection of a locally appropriate protection system in practice should be supported.

Note:

- The selection of an appropriate protective system should be based on the risk identification and assessment for the site and object to be protected. In this connection, the potential flood and its event characteristics must be considered. Typical features of the potential flood are e.g., cause of an event, specific flood duration, the velocity of water, ground conditions, condition of building envelope, duration between the flood alarm and water reaching site, ensuring water tightness with adjacent areas .
- As part of the site- and object-related risk assessment, the following might be considered: associated measures, e.g. soil improvement due to the possible infiltration through the ground, event-specific organizational measures, including the potential need for protection against sabotage, and existing controls, including emergency response planning, In addition, the suitability of mobile flood protection systems must be tested and proved for the intended purpose. Standard methods for approval tests are developed to classify the mobile flood protection systems based on parameters listed in this guideline (see VdS 3855).
- Floating barrier systems

Basic structure: Floating barrier systems consist of underground flood chambers, which are connected to the waters above through pipes or channels and wall elements or sections that rest in the chamber. The individual elements of the flood protection wall are formed as a floating body. In floods, they can either float vertically or lift.

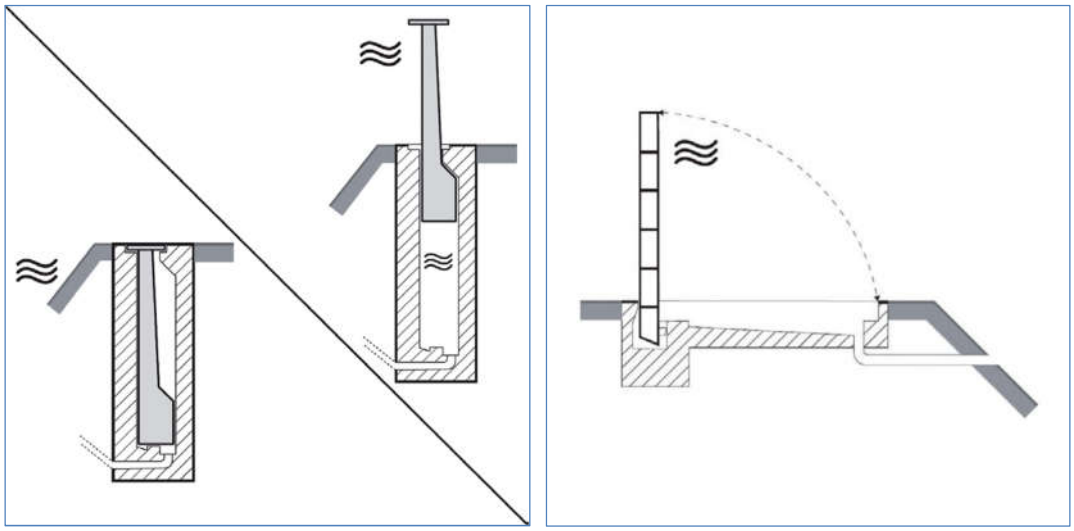

Figure 1 Examples of Floating barrier systems

Area of application: These systems can be used to protect passages - such as dykes, walls, or between buildings. Individual elements can be longer than ten meters and combined into longer walls. With such systems, a level of protection several meters long can be realized.

Logistics and Maintenance: As these are installed systems, logistics are not required. The cost of maintenance is, however, quite high, among other things for the removal of sediments in the flood chamber, eliminating icing, pumping rainwater, corrosion protection.

- Dam beams or board stop log systems
  Basic structure: These systems consist of two types. Type 1, wall elements, which are designed as stackable dam beams or dam boards. Type 2, columns serve as a counter bearing for the horizontally stacked beams or the lined boards. To accommodate the horizontal forces, the mobile columns are force-fit connected by means of foundation in the ground, e.g., with anchor plates, bolt, or bolts.

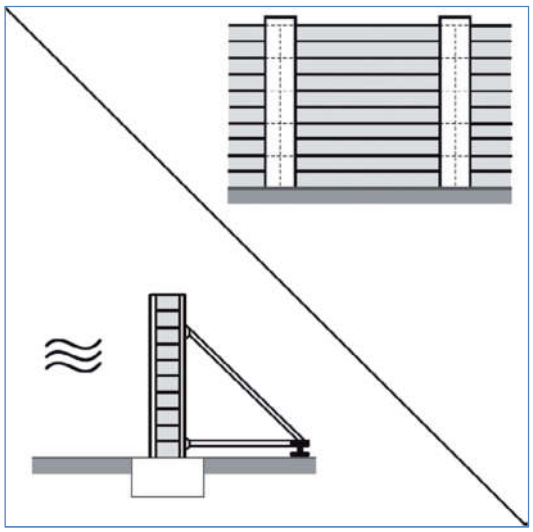

Figure 2 Dam beams or dam board stop log systems

Area of application: These systems are suitable both as area flood control systems in the open spaces as well as for use in the passages between buildings or other stationary flood control facilities. With such systems, a level of protection of several meters can be realized. The distance between columns is usually a number of meters. To increase the level of protection, additional supports may be required.

Logistics and Maintenance: Before and after the use, adequate storage for the columns and stop log elements and seals are required. When in use, it is essential to ensure that the right elements are used in the right place by well organised logistics for the removal from storage, transport, and installation on site (integration in an alarm plan).

- Folding systems (possibly with impact protection)
  Basic structure: These systems consist of individual plate-shaped segments joined by rigid foot parts or connected by plastic tarpaulins. They either swing open when in use at the site or lift themselves with the incoming water. A tear-resistant and watertight blanket at the edges of the segments forms a flexible joint and seals the joints between the neighbouring segments. They may need to be fixed in the ground by earth screws or anchors. In permeable substrates, preinstalled concrete aprons with connection profiles and plastic sheeting that incorporated into the soil may be necessary to prevent any undercurrent through the ground.

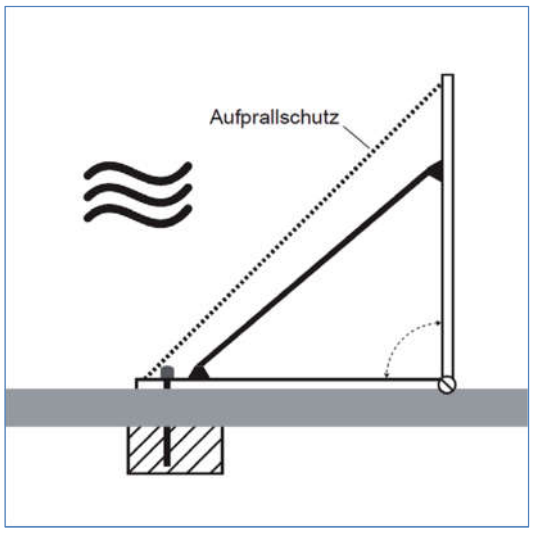

Figure 3 Example of folding systems

Area of application: Folding systems require substantially flat mounting surfaces; terrain slopes are tolerable to some degree. Individual barrier elements can be joined together to longer wall sections, or individual passages between buildings, or stationary facilities can be sealed.

Logistics and Maintenance: Regarding the logistics and maintenance, preinstalled folding systems are comparable with floating barrier systems and systems with partly or entirely mobile components with dam beams or board stop log systems.

- Sandbag systems
  Basic structure: Sandbags are made of jute or plastic and can either be filled with sand or grit. When using, note that the bags are filled only to ⅔, and the filling opening are placed opposite the side where the water might be . Filled sandbags can have a weight of about 12 to 20 kg. To improve the seal on the waterside, plastic sheets can also be used.

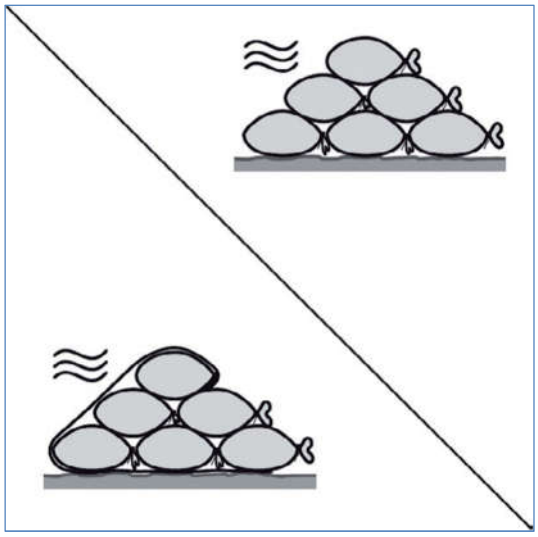

Figure 4 Example of sandbag systems

Area of application: Sandbags can be stacked mound-like without further assistance by hand. Their applications are many, e. g. door or window openings, light wells, driveways, but also entire streets can be protected through dams of any length. In addition, sandbags are used to secure dykes, to increase the protection level of existing levees or walls, or in combination with other protection systems, such as the block systems.

Logistics and Maintenance: Sandbag systems extensively used as the construction of dams, requires a large number of workers for filling and subsequent distribution to the dam construction area is necessary. For faster filling of sandbags filling-aid, e. g. sandbag hopper and other filling machines have proven very useful.

After a flood event, it must be decided on the basis of pollution levels. What happens to the sandbags? If they are contaminated with oil or chemicals, for example, they must be professionally cleaned or disposed of. Otherwise, pre-filled sandbags should be stored dry and protected from the weather.

- Container systems (filled with water or sand)
  Basic structure: Open container systems strung together to form a protective barrier. They can be filled with water or sand. The outer sheath for systems filled with sand can consist of tear-resistant geotextile fabric and for systems filled with water from reinforced PVC. In addition, there are also systems made of fiberglass reinforced plastic panels with a plastic sheet that be rolled into cylinders and closed with a simple system.

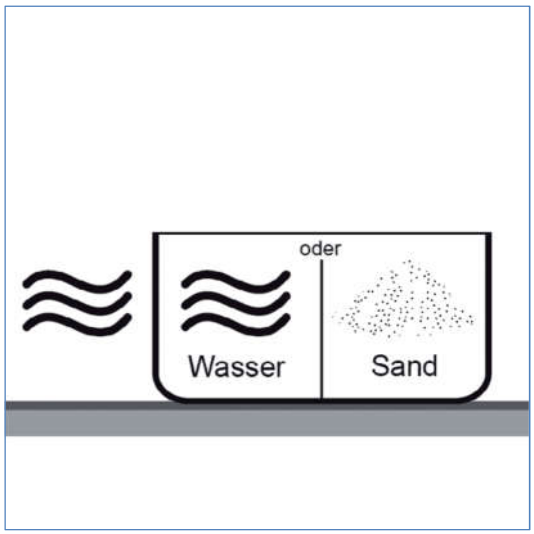

Figure 5 Example of container systems

Area of application: With container systems, dams of any length can be constructed. In general, the tightness in the coupling areas between containers is already given by the pressure of the filled containers, or they may need to connect each other in the site, e. g. by screw. If the dimension fits, gateways or wall openings can be locally sealed with the container systems. With container systems, a protection level of about 0.5 to 2 m can usually be achieved. Container systems can possibly be used in rough terrain since no heavy tools are required for their construction and transport.

Logistics and Maintenance: Depending on the type of system, e. g., with or without a frame, the required space for storage is very different. Also depending on the type of container

systems and their parts can be reused. When reusing the system, its elements must be emptied, cleaned, if necessary, and dried.

- Bock systems
  Basic structure: These systems are essentially composed of three components: Support construction, wall elements (e. g. Euro pallets or metal plates.), and plastic seal sheets. To fix the support structure on the ground, nails or anchor bolts are used. On the support structure, the wall elements are assembled and fixed to the ground with sandbags; the seal sheets are placed on the waterside of the wall elements.

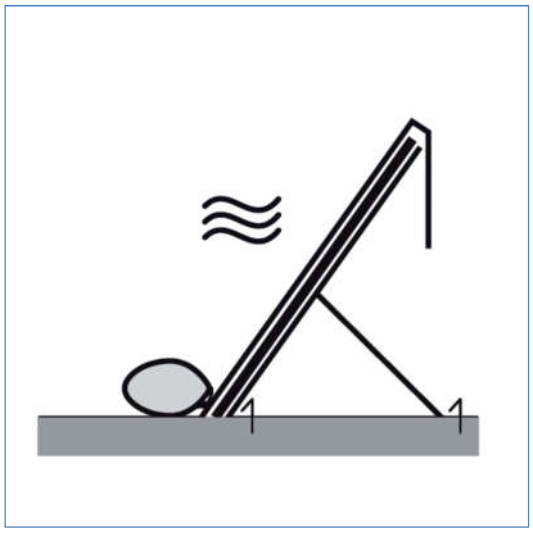

Figure 6 Example of Bock systems

Area of application: Bock systems can be used for the protection of area, or objects. With Bock systems dams of any length and, depending on the type of system, a protection level of up to 1.5 m can be achieved. Systems with Euro pallets are quite inflexible in length due to the unit width of each palette. To ensure the stability of Bock systems, the ground must be stable and relatively flat; using on soft ground is not recommended.

Logistics and Maintenance: To ensure a rapid installation of bock systems, systematic logistics with orderly storage is necessary. After using, bock systems must be controlled, cleaned, dried, and can be reused subsequently.

- Hose systems (filled with water, sand, or air)
  Basic structure: Hose systems are based on the same principle: tubular or trapezoidal plastic containers are filled with water, sand, or air. They get their stability through the ground plane on the waterside. By water-filled systems with a circular cross-section two hoses shall be laid side by side in parallel and interconnected, so they do not roll away by the water pressure of the floods. Their use is, however, problematical in frost. The freezing of the water body in the tubing creates problems of stability.

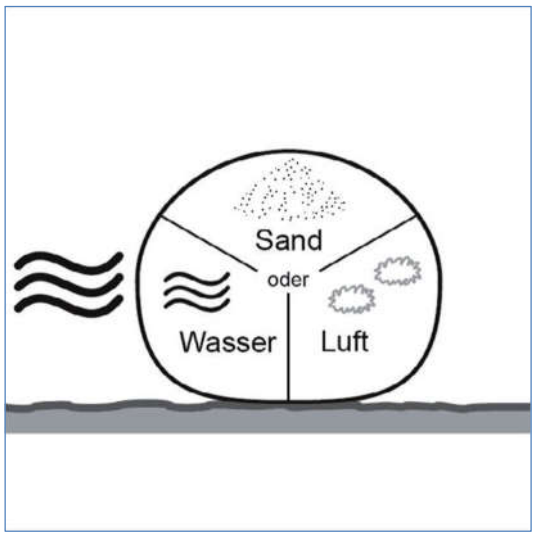

Figure 7 Hose systems

Area of application: Hose systems are able to fit the topography due to their flexibility and can be used under different ground conditions. With hose elements coupled to each other with cuffs, dams of any length for protection of area and protection level of up to 1.5 m in height can be achieved. Furthermore, the protection level of existing dykes can be increased by hose systems. The flexible outer shell of the hose also allows the local sealing of passages for driveways or wall openings.

Logistics and Maintenance: After using, the hoses must be emptied and dried, and examined for cracks and abrasions and repaired if necessary. Subsequently, hose systems can be reused.

- Other systems
  As other systems, , for example, board or precast concrete structures, may be used. These systems can be quickly provided with materials that are available on sites, e.g., on construction sites and building materials storage areas. Provisional systems are not recommended due to the lack of systematic dimensioning and therefore not described further.

- Mobile backflow protection
  Basic structure: These systems are, type 1, inflatable sealing elements that are introduced and inflated into existing sewer openings, and Type 2, prefabricated, adjusted sheets or plates in customized degrees.

  Inflatable sealing elements are available as:
  - shut-off disks
  - shut-off bubbles
  - sealing bags
  - shaft sealing bags and
  - inflatable plug for pipelines.

  The elements are a combination of rubber balloons with metallic lines or valves for inflation. They are available in different sizes. It is recommended to pre-determine the required sizes and quantity of the needed systems and to procure and provide these.

For shafts, there are prefabricated panels with screws and fasteners. These are available for purchase in certain sizes or are individually made, usually of metal.

Area of application: Mobile backflow protection systems are used to seal manhole covers, processes, pipes, and opening of shafts.
Logistics and Maintenance: All mobile backflow protection systems are prefabricated elements and delivered as planned. Only the plug for sealing pipes is an emergency measure. When creating protection concepts, stationary backflow protection systems are to be preferred. This is definitely required when wastewater must be discharged during the flood.

5 Functional characteristics as criteria for selection of systems

Apart from the costs for acquisition and operation, mobile flood protection systems differ with respect to the structure, permissible application areas, and the need and expense for the logistics and maintenance. Simplified, these functional characteristics used as evaluation criteria are divided into the following topics:

- Type of System
- Scope of application: Applications or system limitations according to the testing and approval, e. g. maximum water level
- Material: Susceptibility to frost, resistance to saltwater, and UV-radiation
- Statics: Integrity and load capacity, stability (e.g., resistance against flotsam or mechanical effects, susceptibility to vandalism)
- Tightness: Test methods and allowable leakage, compensate for uneven surfaces and soil bearing capacity
- Costs (Reference base L x H = 100 m x 1 m): life, reuse or disposal, necessary structural conditions, and additional costs for these
- Operation expense (Reference base L x H = 100 m x 1 m): time, devices, people, and manual, and training for installation
- Expenses for maintenance after use: needed time, devices, and number of people
- The expense for periodic maintenance: Time, devices, number of people, and other, e. g. additional measures to protect against feeding animals
- Logistics: the weight of typical individual elements, maximum dimensions of the standard system, necessary capacity required for storage (e. g. per 100 m), storage outdoor or protected indoor, necessary transport capacity
- References (e. g. practical assignments and also in the sense of product liability protection).

In the appendix of this publication, there is a comparative review of sandbags. The choice of the example sandbags because they have been tested for many years in mobile flood protection and are also independent of the manufacturer.

6 Operational experiences

The preparation and explanation of the functional characteristics as criteria for selection have clearly shown that the use of mobile flood protection systems should be practiced regularly because the participating institutions and operation personnel must plan and train together. This also applies to the heads of operations, ensuring the communication system works even if the mobile networks fail or the logistics chain is broken. The timely and proper set up of the mobile protection systems requires the following planning:

- The application site, e.g. the access road, is shut off over a wider area as possible and clearly visible properly signposted.
- Entrances to the operational site are guarded during the duration of operation, e. g., by trained security personnel.
- The traffic should be redirected via large-scale route diversion, and redirection is clearly visible
- The required capacity of logistics should be at constant readiness, if necessary, by having contracts in place with suppliers
- The required material and the corresponding storage are clearly labelled
- Drive and walkways in the storage are also marked clearly and visibly
- The Tools to be provided are stored with all the tools parts and accessories that are required for their deployment
- The operation personnel must be properly trained and exercised
- The operational personnel should also be trained and aware of the exercise water levels
- The operation personnel should carry necessary protective equipment, such as helmets, safety vests.
- Teams must be able to be supplied for the duration of the operation. The supply chain y should be as short as possible.

Experience demonstrates that, it is useful for the training exercises to define a realistic scenario and to inform residents in good time, using signage and the media.

7 Quality assurance measures

The protective functions of mobile flood protection systems in case of use will be determined by 1. the systems' properties and 2.correct assembly.

7.1 Verification of suitability and their assessment

The required characteristics of mobile flood protection systems, such as the stability and watertightness which depend on the water pressure and resistance to mechanical impacts, must always be proved by the tests of prototypes related to approved methods and procedures.

7.2 Declaration of the manufacturer

Mobile flood protection systems can have different properties for the area and specific item protection. To support the choice of appropriate protection systems for local conditions in practice, manufacturers should provide all functional characteristics as information.

7.3 Operating precautions for use.

For the use of mobile flood protection systems, sustainable maintenance of the components and solid operational and logistics planning is always required.

The emergency response plan must contain reporting chains, required warning, mobilization times, and define all the necessary personnel, e. g. for set up, and transportation capacity.

Flood protection measures in the public sector, should ensure that the effects of changes in a public area are recognized and considered the related protection system. This might include hydraulic engineering measures on waters (including dams, bridges, and retention areas), or changes in the neighbourhood in terms of surface drainage and development. or changes to flood control measures in public ownership.

8 Literature

Gesamtverband der Deutschen Versicherungswirtschaft e. V. / Hochwasser-Kompetenz-Centrum
"Mobile Hochwasserschutzsysteme; Hinweise für die Beschaffung, den Einsatz und die Bereitstellung " (VdS 6001)
http://vds.de/fileadmin/vds_publikationen/vds_6001_web.pdf

Online-catalogue on flood-resistant ceilings and exterior walls:

https://www.gdv.de/de/themen/politische-positionen/schadenverhuetung/service

Österreichischer Wasser- und Abfallwirtschaftsverband (ÖWAV)
Mobiler Hochwasserschutz (ÖWAV-Arbeitsbehelf 42)
ÖWAV, 1010 Wien, Marc-Aurel-Straße 5, 2013

VdS Loss prevention limited
VdS 3855: VdS-Guideline on flood protecting systems; stationary and mobile flood protecting systems (publication in preparation)

VdS Loss prevention limited, Cologne, Amsterdamer Str. 172-174

Annex: Functional characteristics of sandbag systems (of jute or plastics) - An example of the system assessment

Systems Characteristics	Sandsack (jute)	Sandsack (plastic)
Company		
Area of application		
(a) Area or property protection	Area and property protection	Area and property protection
(b) Capabilities and system limit	In dikes, a maximum height of about 2 mcan be reached	In dikes, a maximum height of about 2 mcan be reached
Material		
(a)Basic material	Jute, filling material: sand, Split	Plastic, filling material: sand, Split
(b) Susceptibility to frost		
(c) Salt water / UV resistance		UV stabilized or UV-resistant
Permissible water level		
Static		
(a) Stability and bearing capacity (Domino effect)	When applying the correct stacking technique in dike construction may have rather high stability. Jute bags interlock well even when wet.	Lower stability than jute bags as increased hzard of slipping.
(b) Stability (eg resistance to flotsam and mechanical effects)		
(c) Vulnerability to vandalism	Sandbags can be removed from the dam.	Sandbags can be removed from the dam.
Tightness		
(a) Test methods and allowable leakage?	As a result of swelling of jute bags in contact with water tightness is increased, but not 100% tightness.	Not 100% tightness.
(b) Compensetion of uneven ground and soil bearing capacity	Sandbags nestled on uneven ground.	Sandbags nestled on uneven ground.
Costs		
a) Cost (Procurement) per opening or L x H = 100 mx 1 m	Jute bags without filler: 3,600 € (14,000 jute bags (sales promotion, 2004) à € 0.40) Costs filler: € 3,150 (15 kg of sand per sack, 1 t of sand à 15 €) Cost filled jute sacks: € 6750	Plastic bags without filler 2,800 euros (about 14,000 plastic bags (sales promotion, 2004) à € 0.20) Costs filler: € 3,150 (15 kg of sand per sack, 1 t of sand à 15 €) Cost filled plastic bags: € 5,950
(b) Life time	Usually, only mission	Several missions possible.
(c) Reuseablility or disposal	Generally not reusable because wet jute bags rot quickly. When contamination by contact with oil, etc., proper disposal is necessary. Otherwise Jute is a natural material and can easily be disposed of werden.	In general, reusable.
(d) Necessary structural requirements (Addition costs)	No	No
Effort for installation per opening or for length x height = 100 mx 1 m		
(a) Time	3 hours	3 hours
(b) Equipments	48 truck for transport, about 8 forklift truck for loading and unloading.	48 truck for transport, about 8 forklift truck for loading and unloading.
(c) Persons	50	50
(d) Guidance / training for installation	"Please note: - Fill sandbags only 2/3 so they nestle when laying on rough - Filling opening opposite the water side - - Observe the stacking technique depending on the application - Use of foil can also protect against the leakage of water	"Please note: - Fill sandbags only 2/3 so they nestle when laying on rough - Filling opening opposite the water side - - Observe the stacking technique depending on the application - Use of foil can also protect against the leakage of water
Efforts for maintenance after use		
(a) Time	"No maintenance required, since usually only used for one mission. If the sack is to be reused, the sand must be removed and the bag is completely dry. ".	Bags must be dried after use
(b) Equipments		
(c) Number of person		
Regular maintenance		
(a) TIme		
(b) Equipments		
(c) Number of persons		
(d) Other, e. g. additional measures to protect against feeding animals	Jute sandbags can be pre-filled poorly stored, since the moisture of the sand alone can lead to a decay process after a short time. Are the bags once wet, they must be dried. Therefore, regular maintenance is filled and stored bags is necessary.	Plastic bags prefilled can be quite easily stored at proper storage over long periods
Logistic		
(a) Net weight of typical individual elements	Filled sandbag, dry: 15 kg Filled sandbag, wet: 20 kg	Filled sandbag, dry: 15 kg Filled sandbag, wet: 20 kg
(b) Storage place: Outdoors or protected against weather	Protected against weather and light, store away from direct sunlight and dry.	Protected against weather and light, store away from direct sunlight and dry.
(c) Max. Dimensions of standard system	Sandbag empty: 35 x 70 cm Sandbag filled: 25 x 50 x 8 cm	Sandbag empty: 35 x 70 cm Sandbag filled: 25 x 50 x 8 cm
(d) Space for storage per opening protection or L x H = 100 mx 1 m	One euro pallet (1.20 mx 0.80 m): 50-70-filled sacs For dike L x H = 100 m x 1 m: 200-280 euro pallets needed, corresponding to an area of 192-269 square meters.	One euro pallet (1.20 mx 0.80 m): 50-70-filled sacs For dike L x H = 100 m x 1 m: 200-280 euro pallets needed, corresponding to an area of 192-269 square meters.
(d) Transport capacity	One truck respectively 5-ton carry capacity: 300 filled sandbags	One truck respectively 5-ton carry capacity: 300 filled sandbags
Certification		
Practical application	Elbe flood, August 2002 Flood Krems, August 2002 Flood Dresden, April 2006 Oder flood, May 2010	Elbe flood, August 2002 Flood Krems, August 2002 Flood Dresden, April 2006 Oder flood, May 2010

Origin source: VdS 6001

Systems Characteristics	Sandsack (jute)	Sandsack (plastic)
Company		
Area of application		
(a) Area or property protection		
(b) Capabilities and system limit		
Material		
(a)Basic material		
(b) Susceptibility to frost		
(c) Salt water / UV resistance		
Permissible water level		
Static		
(a) Stability and bearing capacity (Domino effect)		
(b) Stability (eg resistance to flotsam and mechanical effects)		
(c) Vulnerability to vandalism		
Tightness		
(a) Test methods and allowable leakage?		
(b) Compensetion of uneven ground and soil bearing capacity		
Costs		
a) Cost (Procurement) per opening or L x H = 100 mx 1 m		
(b) Life time		
(c) Reuseablility or disposal		
(d) Necessary structural requirements (Addition costs)		
Effort for installation per opening or for length x height = 100 mx 1 m		
(a) Time		
(b) Equipments		
(c) Persons		
(d) Guidance / training for installation		
Efforts for maintenance after use		
(a) Time		
(b) Equipments		
(c) Number of person		
Regular maintenance		
(a) TIme		
(b) Equipments		
(c) Number of persons		
(d) Other, e. g. additional measures to protect against feeding animals		
Logistic		
(a) Net weight of typical individual elements		
(b) Storage place: Outdoors or protected against weather		
(c) Max. Dimensions of standard system		
(d) Space for storage per opening protection or L x H = 100 mx 1 m		
(d) Transport capacity		
Certification		
Practical application		

Origin source: VdS 6001

European guidelines

Fire

Guideline No 1 F - Internal fire protection control
Guideline No 2 F - Panic & emergency exit devices
Guideline No 3 F - Certification of thermographers
Guideline No 4 F - Introduction to qualitative fire risk assessment
Guideline No 5 F - Guidance signs, emergency lighting and general lighting
Guideline No 6 F - Fire safety in care homes
Guideline No 7 F - Safety distance between waste containers and buildings
Guideline No 8 F - Preventing arson – information to young people
Guideline No 9 F - Fire safety in restaurants
Guideline No 10 F - Smoke alarms in the home
Guideline No 11 F - Recommended numbers of fire protection trained staff
Guideline No 12 F - Fire safety basics for hot work operatives
Guideline No 13 F - Fire protection documentation
Guideline No 14 F - Fire protection in information technology facilities
Guideline No 15 F - Fire safety in guest harbours and marinas
Guideline No 16 F - Fire protection in offices
Guideline No 17 F - Fire safety in farm buildings
Guideline No 18 F - Fire protection on chemical manufacturing sites
Guideline No 19 F - Fire safety engineering concerning evacuation from buildings
Guideline No 20 F - Fire safety in camping sites
Guideline No 21 F - Fire prevention on construction sites
Guideline No 22 F - Wind turbines – Fire protection guideline
Guideline No 23 F - Securing the operational readiness of fire control system
Guideline No 24 F - Fire safe homes
Guideline No 25 F - Emergency plan
Guideline No 26 F - Fire protection of temporary buildings on construction sites
Guideline No 27 F - Fire safety in apartment buildings
Guideline No 28 F - Fire safety in laboratories
Guideline No 29 F - Protection of paintings: transports, exhibition, and storage
Guideline No 30 F - Managing fire safety in historic buildings
Guideline No 31 F - Protection against self-ignition end explosions in handling and storage -of silage and fodder in farms
Guideline No 32 F - Treatment and storage of waste and combustible secondary raw -materials
Guideline No 33 F - Evacuation of people with disabilities
Guideline No 34 F - Fire safety measures with emergency power supply
Guideline No 35 F - Fire safety in warehouses
Guideline No 36 F - Fire prevention in large tents
Guideline No 37 F - Photovoltaic systems: recommendations on loss prevention

Natural hazards

Guideline No 1 N - Protection against flood
Guideline No 2 N - Business resilience – An introduction to protecting your business
Guideline No 3 N - Protection of buildings against wind damage
Guideline No 4 N - Lighting protection
Guideline No 5 N - Managing heavy snow loads on roofs
Guideline No 6 N - Forest fires
Guideline No 7 N - Demountable / Mobile flood protection systems

Security

Guideline No 1 S - Arson document
Guideline No 2 S - Protection of empty buildings
Guideline No 3 S - Security systems for empty buildings
Guideline No 4 S - Guidance on keyholder selections and duties
Guideline No 5 S - Security guidelines for museums and showrooms
Guideline No 6 S - Security guidelines emergency exit doors in non-residential premises
Guideline No 7 S - Developing evacuation and salvage plans for works of art and -heritage buildings
Guideline No 8 S - Security in schools
Guideline No 9 S - Recommendation for the control of metal theft
Guideline No 10 S - Protection of business intelligence
Guideline No 11 S - Cyber security for small and medium-sized enterprises

Comments and corrective actions:

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Fire Safety | Security | Natural Hazards

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