

# IMPROVER

IMPROVED RISK EVALUATION AND IMPLEMENTATION OF RESILIENCE CONCEPTS  
TO CRITICAL INFRASTRUCTURE

## Training and educational material

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# 1 Executive Summary

The IMPROVER project is focusing on how to improve European critical infrastructure (CI) resilience to crises and disasters through the implementation of resilience concepts to real life examples of pan-European significance, including cross-border examples.

In order to facilitate the knowledge gained within the project to critical infrastructure operators and other stakeholders with interest in critical infrastructure resilience, the project partners have developed training and educational materials.

The training materials are presented as a course with four knowledge lessons on different, but interlinked topics associated with critical infrastructure resilience. Moreover, supporting material of a more visual nature is provided to expand the knowledge gain.

The topics covered by the training material are the following:

- Lesson 1: Critical infrastructure resilience
- Lesson 2: How to manage resilience
- Lesson 3: Resilience analysis
- Lesson 4: AESOP communication guidelines
- Supporting materials

These topics reflect the overall objectives of the IMPROVER project:

1. Improve our understanding of the application and interaction of different resilience concepts.
2. Evaluate the baseline requirement of critical infrastructure in the event of a crisis.
3. Development of a resilience management guideline including a methodology for implementation of resilience concepts to critical infrastructure.
4. Pilot implementation of the proposed methodology in application to critical infrastructure of European significance.

This deliverable describes the structure and design of the training material and how the material is intended to be used. Furthermore, learning objectives for each lesson is provided as well as a specification of target groups.

## 2 The training material as a whole

### 2.1 Objectives

The overall objective of the IMPROVER project is to improve European critical infrastructure resilience to crises and disasters through the implementation of combinations of societal, organisational and technological resilience concepts to real life examples of pan-European significance. The implementation is enabled through the development of a methodology based on risk evaluation techniques and informed by a review of the positive impact of different resilience concepts on critical infrastructures.

The objective of creating the training and educational material, presented in this report, is to facilitate the transfer of knowledge gained within the IMPROVER project to critical infrastructure operators and other stakeholders concerned with critical infrastructure resilience. The objective of the training material design is to give critical infrastructure operators and other stakeholders an overview of the project findings, as well as the possibility to study topics of special interest more thoroughly.

The topics covered in the training material reflect the overall objectives of the IMPROVER project as follows:

**OBJECTIVE 1:** Improve our understanding of the application and interaction of different resilience concepts. *This objective is reflected in Lesson 1 – Critical Infrastructure Resilience by providing an overview of the resilience concept, and its different domains, with a focus on critical infrastructure.*

**OBJECTIVE 2:** Evaluate the baseline requirement of critical infrastructure in the event of a crisis. *This objective is reflected in Lesson 3 – Resilience analysis, by presenting and explaining four different methodologies for resilience analysis within a critical infrastructure.*

**OBJECTIVE 3:** Development of a resilience management guideline including a methodology for implementation of resilience concepts to critical infrastructure. *This objective is reflected in Lesson 2 – How to manage resilience, by describing the resilience management frameworks developed within the project, and how to use them.*

**OBJECTIVE 4:** Pilot implementation of the proposed methodology in application to critical infrastructure of European significance. *This objective is reflected in Lessons 2-4 by providing examples from real-life pilot implementations.*

### 2.2 Structure and design

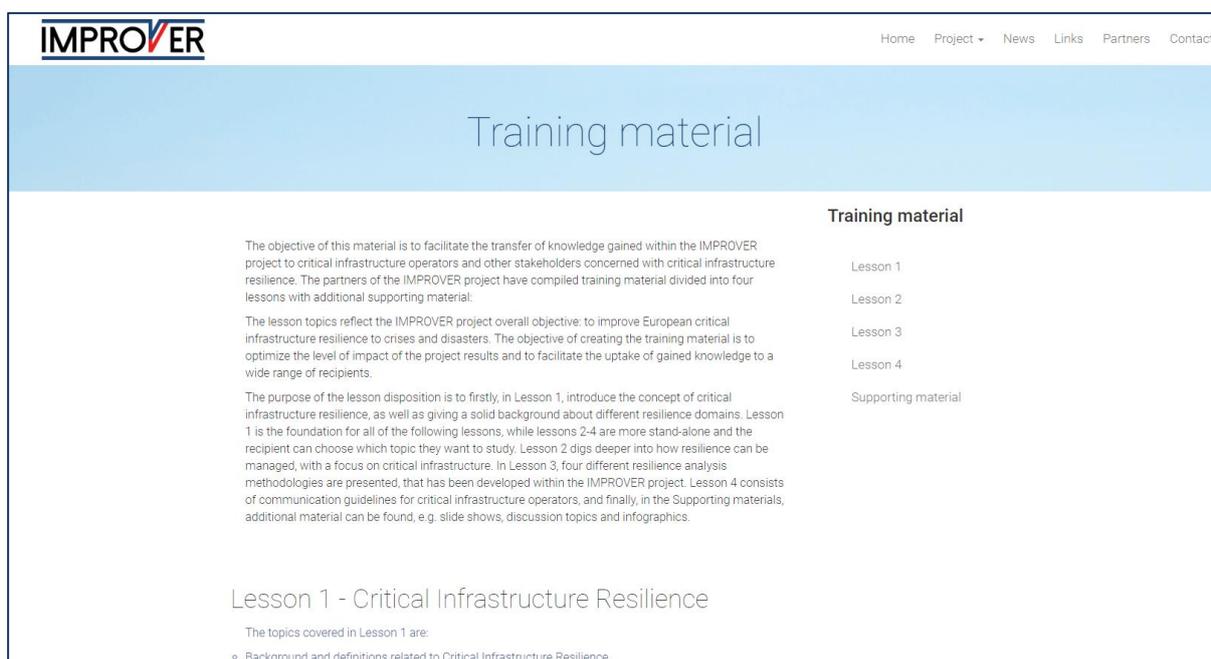
The project outputs were evaluated from the perspective of a critical infrastructure operator, and based on that the content was reviewed to fit the audience. The evaluation resulted in a course structure with five parts:

- Lesson 1: Critical infrastructure resilience
- Lesson 2: How to manage resilience
- Lesson 3: Resilience analysis
- Lesson 4: AESOP communication guidelines
- Supporting materials

## Training and educational material

Lesson 1 is designed to serve as an introduction to critical infrastructure resilience and is thus serving as a foundation for the other lessons. The following lessons are interlinked but can be studied separately depending on the purpose of the learning. Lessons 1-4 consists of knowledge document in text form that instructs the reader on the specific topic. Moreover, there are suggestions for discussion topics and learning activities that supplement each knowledge document. Lastly, supporting materials are provided, which are designed to complement the lessons. In addition to questions for discussion and learning activities, there can be found supporting slide shows for some of the topics as well as an infographic.

To guarantee accessibility, all training materials are accessible for free on the project website [www.improverproject.eu](http://www.improverproject.eu). The training and educational material are aimed both for self-studies and at instructors, with supporting visual material as well as suggestions for discussion topics and learning activities.



The screenshot shows the IMPROVER project website. The header includes the IMPROVER logo and navigation links: Home, Project, News, Links, Partners, Contact. The main heading is 'Training material'. Below this, there is a detailed description of the training material's objectives and structure. The text states: 'The objective of this material is to facilitate the transfer of knowledge gained within the IMPROVER project to critical infrastructure operators and other stakeholders concerned with critical infrastructure resilience. The partners of the IMPROVER project have compiled training material divided into four lessons with additional supporting material.' It further explains that the lesson topics reflect the IMPROVER project overall objective: to improve European critical infrastructure resilience to crises and disasters. The objective of creating the training material is to optimize the level of impact of the project results and to facilitate the uptake of gained knowledge to a wide range of recipients. The purpose of the lesson disposition is to first, in Lesson 1, introduce the concept of critical infrastructure resilience, as well as giving a solid background about different resilience domains. Lesson 1 is the foundation for all of the following lessons, while lessons 2-4 are more stand-alone and the recipient can choose which topic they want to study. Lesson 2 digs deeper into how resilience can be managed, with a focus on critical infrastructure. In Lesson 3, four different resilience analysis methodologies are presented, that has been developed within the IMPROVER project. Lesson 4 consists of communication guidelines for critical infrastructure operators, and finally, in the Supporting materials, additional material can be found, e.g. slide shows, discussion topics and infographics.

Below the description, there is a list of training materials:

- Lesson 1
- Lesson 2
- Lesson 3
- Lesson 4
- Supporting material

The page also includes a section for 'Lesson 1 - Critical Infrastructure Resilience' with a list of topics covered:

- The topics covered in Lesson 1 are:
  - Background and definitions related to Critical Infrastructure Resilience

**Figure 1. Training material on the project website [www.improverproject.eu](http://www.improverproject.eu).**

### 2.3 Target groups

The general target groups for the training material are critical infrastructure operators and other stakeholders concerned with critical infrastructure resilience, for example emergency managers. However, the different lessons might attract different audience. For example, Lesson 1 is also likely to be of interest to a more general audience such as interested citizens and researchers and students from another field. Lesson 2 is targeted to critical infrastructure operators on a management level, and Lesson 3 is likely of interest to specific roles within an infrastructure, e.g. those involved in organizational or technological aspects. Lesson 4 is aimed primarily at communications teams within a critical infrastructure but can also be of interest to e.g. emergency managers.

Furthermore, the supporting materials could be of interest to teachers and instructors to incite discussion about the course material. In general, recipients with a good understanding of risk management, emergency response planning and preparation are expected to find the material useful.

### 2.4 How to use the training material

The training material consists of four lessons covering different topics relating to managing critical infrastructure resilience, with an additional lesson primarily aimed at discussion and learning

activities. Our suggestion is to start reading Lesson 1, which will provide background and an overview of the resilience field, with a focus on critical infrastructures. This lesson will work as a solid ground when moving forward to the other lessons. Lesson 2 and 3 are focused on practical solutions and tools and the background given in Lesson 1 will enhance the understanding. Lesson 4 can to a greater extent be studied stand-alone.

For instructors, we recommend using the supporting materials that can be found on the project website. For self-studies we recommend starting off by reading the knowledge documents (Lesson 1-4), and then move on to the associated discussion topics and activities.

In the following chapters, each lesson will be described in greater detail.

## **3 Lesson 1 – Critical Infrastructure Resilience**

### **3.1 About the lesson**

The first lesson focuses on explaining what critical infrastructure resilience is about, the change from protection to resilience, and how critical infrastructure resilience is used in European policies. Furthermore, the lesson introduces different resilience domains, and explains the technological, organizational and societal resilience domains in greater detail. This introduction is important as a basis for understanding how resilience can be implemented as a management tool to cope with crises and disasters in a critical infrastructure.

In summary, Lesson 1 covers the following topics:

- Critical Infrastructure Resilience – background and definitions
- Resilience domains
  - Technological resilience
  - Organisational resilience
  - Societal resilience

The lesson is composed of a knowledge document in text form. In addition, there are suggestions for discussion topics that are recommended to discuss in small groups after studying the knowledge document. Estimated time required for this lesson is 1.5 hours for the text document, and 30 minutes for the discussion activities.

This lesson is based on results from Work Package 1 and Work Package 2 of the IMPROVER project. The lesson is developed by Dr Marianthi Theocharidou (Joint Research Centre, Belgium), Staffan Bram (RISE, Sweden), Emma Lundin (RISE, Sweden) and Hannah Rosenqvist (DBI, Denmark).

### **3.2 Learning objectives**

The overall objective of this lesson is to provide a basic understanding of the resilience concept and the relating resilience domains. By the end of this lesson, participants should be able to:

- Understand the concept of critical infrastructure resilience in contrast to critical infrastructure protection.
- Explain the differences between the three resilience domains; technological, organizational and societal.
- Identify examples of resilience in their surroundings.

### **3.3 Lesson target group**

This lesson is targeted to a broad audience, since it is an introductory lesson and does not require any previous knowledge on the subject. The lesson is specifically recommended for critical infrastructure operators that are interested in learning how to manage and analyze resilience, but it is equally valuable for anyone, from any professional or educational field, who wants to learn more about the topic.

## **4 Lesson 2 – How to manage resilience**

### **4.1 About the lesson**

This lesson focuses on resilience management and the recipient will learn about the main areas of challenges and advantages concerning resilience management. The lesson starts off by describing the recent paradigm shift from risk-based approaches to resilience based approaches. Thereafter, the IMPROVER Critical Infrastructure REsilience management Framework (ICI-REF) is introduced and the concept of resilience management integrated with risk management processes is explained. The lesson continues by introducing a scaled-up framework for societal resilience management, IMPROVER Societal Resilience management Framework (IS-REF), which is based on ICI-REF. The idea of resilience management on a national or regional level is described by referring to IS-REF as an example. Working in a critical infrastructure, it is important to understand the difference between risk management and resilience management. This knowledge will thus facilitate preparedness for, response to and recovery from a crisis situation.

In summary, Lesson 2 covers the following topics:

- From risk management to resilience management
- Enhancing absorptive and adaptive capabilities in a critical infrastructure by presenting IMPROVER Critical Infrastructure Resilience management Framework as an example.
- Resilience management on a national level by presenting IMPROVER Societal Resilience management Framework as an example.

The lesson is composed of a knowledge document in text form. In addition, there are suggestions for discussion topics that are recommended to discuss in small groups after studying the knowledge document. Estimated time required for this lesson is 1 hour for the text document, and 30 minutes for the discussion activities. Additional material on this topic, in the form of a slide show, can be found in Supporting Materials.

This lesson is based on results from Work Package 5 and Deliverable 5.1 of the IMPROVER project. The lesson is developed by Dr David Lange (RISE, Sweden).

### **4.2 Learning objectives**

The overall objective of this lesson is to introduce the recipient to resilience management in practice, and how resilience management can be integrated in existing risk management processes. By the end of this lesson, participants should be able to:

- Understand and explain the difference between risk management and resilience management.
- Identify and present the different stages of risk management and resilience management and account for differences and interconnections between them.
- Understand the link between societal resilience and infrastructure resilience.

### 4.3 Lesson target group

This lesson is primarily targeted to critical infrastructure operators in general, and positions on a management level and risk managers, in particular. The content of this lesson can also be of interest to risk/crisis/safety managers of any organization that is interested in developing their risk management process.

## 5 Lesson 3 – Resilience analysis

### 5.1 About the lesson

In this lesson, recipients will be introduced to resilience analysis and how one can measure resilience in different ways depending on required level of detail and analysis domain. As an operator of critical infrastructure, one would like to know if one's organization has the ability to cope with, adapt to, and recover from the effects of a hazard. Resilience analysis is a way of indicating to what extent an organization, or a part of an organization, possesses these abilities. The lesson will present four different resilience analysis methodologies in order to illustrate the concept of resilience analysis.

This lesson is valuable because it provides an understanding of resilience metrics and how they can be used. This is an important part of any resilience management process, since it offers an indication on strengths and weaknesses within an organization or infrastructure.

In summary, Lesson 3 covers the following topics:

- Introduction to resilience analysis
- Indicator based resilience analysis by presenting the Critical Infrastructure Resilience Index as an example.
- Technological resilience analysis by presenting IMPROVER Technological Resilience Analysis as an example.
- Organisational resilience analysis by presenting IMPROVER Organisational Resilience Analysis as an example.
- Societal resilience analysis by presenting the IMPROVER Societal Resilience Analysis as an example.

The lesson is composed of a knowledge document in text form. In addition, there are suggestions for discussion topics that are recommended to discuss in small groups after studying the knowledge document. Estimated time required for this lesson is 2 hours for the text document, and 90 minutes for the discussion activities. Additional material on this topic, in the form of slide shows, can be found in Supporting Materials.

This lesson is based on results from Work Package 2, 3 and 4 of the IMPROVER project. The lesson is developed by Staffan Bram (RISE Research Institutes of Sweden), Bjart Rød (The Arctic University of Norway), Hannah Rosenqvist (Danish Institutes of Fire and Security Technology) and Emma Lundin (RISE Research Institutes of Sweden).

## **5.2 Learning objectives**

The overall objective of this lesson is to inform the recipient of methods for analyzing an organisation's ability to cope with, adapt to, and recover from a hazardous event. By the end of this lesson, participants should be able to:

- Understand the purpose of resilience analysis in the context of resilience management.
- Identify suitable resilience analysis methodologies for different resilience domains and level of detail.
- Explain the overall process of four different resilience analysis methodologies.

## **5.3 Lesson target group**

This lesson is primarily targeted to critical infrastructure operators in general, and positions on a management level, and risk managers, in particular. The content of this lesson can also be of interest to risk/crisis/safety managers of any organization that is interested in developing their risk management process. Furthermore, civil protection agencies, emergency management authorities and other public institutions can find the societal resilience analysis useful.

# **6 Lesson 4 – AESOP communication guidelines**

## **6.1 About the lesson**

In this lesson, recipients will learn about the main areas of change in communication dynamics and information flows during disasters, and to reflect on how they can approach news media for successful crisis management. The objective is to transfer knowledge in the fields of incident pre-planning and resilience to large scale incidents (e.g. flooding, antagonistic attacks, or highway network collapse). This will help the recipient in their efforts to reduce uncertainty and panic amongst disaster-affected populations at each stage of an incident. Learning to identify and effectively use several communication tactics is a necessary corollary for critical infrastructure operators, in order to build more resilient infrastructures and better manage expectations of affected communities as to when services will be restored. This can in turn enhance crisis management and improve not only the resilience of the critical infrastructure they operate but also that of the communities who rely on their services every day.

This lesson is valuable because it provides information and encourages reflection on inclusive approaches to mediated communication for effective crisis management. Finally, the lesson has been designed in such a way to be easily adaptable to a broader spectrum of crisis management and communication.

In summary, Lesson 4 covers the following topics:

- The role of traditional and social media during crisis situations
- The role of media during different phases of a disaster
- The AESOP communication guidelines

The lesson is composed of a knowledge document in text form. In addition, there are suggestions for activities that can be carried out individually or in small groups, after studying the knowledge

document. Estimated time required for this lesson is 2 hours for the text document, and 1 hour for the learning activities.

This lesson is based on IMPROVER deliverable 4.1 (Petersen et al, 2016) and 4.2 (Serafinelli et al, 2017). The lesson is developed by Dr Ioanna Tantanasi (University of Sheffield) and Dr Paul Reilly (University of Sheffield).

## **6.2 Learning objectives**

The overall objective of this lesson is to inform the recipient of effective communications strategies for managing disasters and large-scale incidents. By the end of this lesson, participants should be able to:

- Explain the role of both social and traditional media in disseminating information during different stages of a disaster;
- Understand how both social and traditional media can be deployed to manage citizen expectations about recovery times during a disaster and to liaise with other key stakeholders such emergency management organisations, and news media.
- Use the AESOP guidelines to identify and develop best practices in crisis communication for CIOs;
- Assess the ethical implications of using information crowdsourced via social media during such incidents.

## **6.3 Lesson target group**

This lesson is primarily targeted to communication teams within critical infrastructure operators. However, the lesson could also be of interest for anyone working with communications, incident pre-planning or crisis management.

# **7 Supporting materials**

## **7.1 About the materials**

The content of the Supporting material is:

- PowerPoint slide shows on the following topics:
  - Critical Infrastructure Resilience
  - Improver Critical Infrastructure Resilience management Framework
  - Critical Infrastructure Resilience Index
  - Organisational Resilience Analysis
  - Societal Resilience Analysis
  - Public expectations and Resilience
- An infographic about Communication and Critical Infrastructure Resilience
- A list of definitions regarding Critical Infrastructure Resilience
- Discussion topics and learning activities
- List of abbreviations used in the lessons

## **7.2 Objectives for using the materials**

The main objective of the Supporting materials is to provide additional information in a different format than the knowledge documents. The Supporting materials are intended to be used as a visual

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aid for transferring the knowledge in the lessons. The materials are not following the same structure as the lessons; consequently, the purpose is to mix-and-match within the Supporting material in order to adapt each lesson for a specific purpose, learning session or target group.

### **7.3 Target group**

The Supporting materials are targeted to any user of the IMPROVER training material, who wants additional information about the lessons. The material could specifically be useful for instructors and educators that want to adapt the lessons into learning sessions. The Supporting material requires previous knowledge of the given topic to be used properly.

## **8 Conclusions**

In conclusion, the training material developed within the IMPROVER project covers a variety of topics, ranging from how to manage resilience to communication strategies in crisis situations. The general target group for the training material is critical infrastructure operators, but parts of the material can be equally valuable for many other groups. This report presents the reasoning behind the design and structure of the training material, as well as learning objectives and target groups for each lesson. Finally, the training material in its whole is openly available at the project website [www.improverproject.eu](http://www.improverproject.eu).