
# 1ST WORKSHOP PROCEEDINGS

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| Contributors | All partners |

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# PROJECT CONTEXT

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|---|---|
| Workpackage | WP7: Dissemination |
| Task | T7.2 |
| Dependencies | This deliverable influences the whole project work. |

## Contributors and Reviewers

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|---|---|
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## Version History

| Version | Date | Authors | Sections Affected |
|---|---|---|---|
| 1 | 18/12/15 | L. Mendoza | All |
| 2 | 20/01/16 | E. Bellini, L. Mendoza | All |
| 3 | 25/01/15 | L. Mendoza | All, implementation of comments |
| 4 | 28/01/16 | L. Mendoza | Implementation of Quality Review comments |
| 6.1 | 29/01/16 | P.Nesi | All, Closed and finalized |

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# 1 EXECUTIVE SUMMARY

Increasing Europe's resilience to crises and disasters is a topic of highest political concern in the EU and its Member States and Associated Countries. Regarding the specific case of transport systems, it can be said that those have developed a prominent safety and business critical nature, in view of which current management practices have shown evidence of important limitations in terms of resilience management.

Furthermore, enhancing resilience in transport systems is considered imperative for two main reasons: such systems provide critical support to every socio-economic activity and are currently themselves one of the most important economic sectors and secondly, the paths that convey people, goods and information, are the same through which risks are propagated.

RESOLUTE is based on the vision of achieving higher sustainability of operations in European UTS. The project recognises foremost the ongoing profound transformation of urban environments in view of ecological, human and overall safety and security needs, as well as the growing importance of mobility within every human activity. Sustainability is rapidly becoming an imperative need across all economic and social domains. Among many things, this requires overall heightened operational efficiency, mainly by optimising the allocation and utilisation of available resources (organisational technical and human), whilst striving to continuously minimise any source of waste, namely incidents, accidents and other operational failures.

Within this context, RESOLUTE considers resilience as a useful management paradigm, within which adaptability capacities are considered paramount. Rather than targeting continuous economic and financial growth of businesses and market shares, organisations must generate the ability to continuously adjust to ever-changing operational environments.

The final goal of RESOLUTE is to adapt and adopt the identified concepts and methods from the guidelines defined within the project for their operationalization and evaluation when addressing Critical Infrastructure (CI) of the Urban Transport System (UTS), through the implementation of the RESOLUTE Collaborative Resilience Assessment and Management Support System (CRAMSS), that adopts a highly synergic approach towards the definition of a resilience model for the next-generation of collaborative emergency services and decision making process.

In order to achieve this, the project consortium planned to organise workshops that would ease the reflection on the guidelines preparation and on their implementation.

The first workshop on "European Resilience Management Guidelines (ERMG)" was therefore held on December 15th , 2015 in Florence, Italy.

The aims of the project first event are firstly to present RESOLUTE and its objectives, as well as to gather the project community around the specific issue of European Resilience Management Guidelines and to ease exchanges on this issue both between project participants and with external stakeholders such as researchers from European and Associated countries or Critical Infrastructure providers.

According to the RESOLUTE project objectives, the workshop was organized around operational scenarios and disaster resilience in Florence and Athens and aimed to:

- Collect inputs from stakeholders around the proposed scenarios
- Share on-going initiatives in Florence and Athens for mapping and protection of land with particular reference to the resilience of the transport systems and traffic information
- Engaging stakeholders in providing their ideal perspective on the urban transport system resilience
- Highlighting the main drivers and preparing the ground for the European Resilience Management Guidelines.

In order to meet these objectives, the part of the workshop was organized around the tables of discussion between experiment with multidisciplinary composition so as to stimulate the identification of issues, development and formalization of procedures and solutions.

To this end transport operators, cultural heritage, energy, telecommunications, water, environment; civil protection; fire dept.; local societies; hospitals, Post, River Basin Authority, research organisations, national city council organization representatives were invited.

This deliverable presents workshop and the work done in this frame.

# 2 INTRODUCTION

The RESOLUTE project aims at creating the European Resilience Management Guidelines (ERMG) as well as the Collaborative Resilience Assessment and Management Support System (CRAMSS).

In the view of having these tools promoted and well known by Member States, Associated Countries and Critical Infrastructure Providers, a number of dissemination actions will have to be conducted during the whole project lifetime. The aims of dissemination actions will be:

- Create awareness about the project and its results towards the EU and Associated Members policy makers and EU citizens
- Create a project community
- Set out an overall dissemination plan

Organize workshops as well as the final event in order to ensure a proper project results presentation.This deliverable provides a description of the first project workshop and its outcomes. The workshop served for gathering information from the various Stakeholders, collecting inputs from stakeholders around the proposed scenarios, sharing on-going initiatives in Florence and Athens for mapping and protection of land with particular reference to the resilience of the transport systems and traffic information Engaging stakeholders in providing their ideal perspective on the urban transport system resilience and highlighting the main drivers and preparing the ground for the European Resilience Management Guidelines.

All conclusions will serve for finalizing the work mainly in WP2.

The workshop was organized on 15 December 2015 in Florence, Italy. It was held in the historic seat of Florence Tribunal, down town, near Palazzo Vecchio, the Badia Fiorentina, the Bargello. The place was offered by the Commune of Florence's courtesy. The area is traditionally home to central public institutions. In this way the event RESOLUTE has enjoyed considerable visibility and public resonance.

# 3 WORKSHOP PREPARATION

Each of the following elements was previously defined for the organization of the workshop:

- General objective of the workshop in the dissemination plan
- Definition of the target communities and auditors to be reached/engaged
    - First workshop will target scientific community and stakeholders to be involved in the RESOLUTE User Forum
- Definition of the workshop program according to the objectives, and target goals/topics to be reached. The program elaboration includes:
    - Presentations by the Project representative, including an overview on RESOLUTE
    - Invited speaker

  - Collaborative and workshop sections according to the goals, to be specifically prepared by the project partners.
  - Conclusion and questionnaire collection
  - Production of the workshop proceedings
- According to the program, a preliminary list of invited speakers with CVs and related motivation aligned with the event objectives was produced and contained:
  - Identification and selection of keynote speakers
  - Choice of relevant international experts
  - Contacts with these potential speakers
- Initial promotion plan, use of
  - Management of the workshop announcement
  - the mailing list elaborated for the Newsletter dissemination to also disseminate information
  - project and partners websites
  - partners contacts and mailing lists
  - contact the specific targets for each workshop
- Logistical organization:
  - Management of registrations
  - Management and support of keynotes
  - Collection and publication of accommodations information, etc.
  - Founding of the adequate place to organize the conference
  - Organization of all the necessary logistics for the conference (i.e. computer and other materials, breaks and lunches, official dinner…)

# 4 AGENDA OF THE WORKSHOP

The agenda with all the presentation connected is accessible at: http://www.resolute-eu.org/index.php/2015-07-16-15-29-23/resolute-1st-workshop

| | |
|---|---|
| 9.00 - 9.15 | Welcome |
| 9.15 - 10.00 | Resilience in transport system – Keynote [Pedro Fereira] |
| 10.00 - 10.20 | RESOLUTE Project: Concepts and approach [UNIFI, DISIT] |
| 10.20 - 10.40 | Coffee break |
| 10.40 - 11.30 | Florence Urban Transport System overview [CDF, mobility and civil protection]<br>Florence Transportation System [CDF]<br>Implementing resilient mobility [CDF]<br>Tools and data available for traffic management [Mobility dept./ Swarco]<br>Tools and data available for Tramvia [Thales] |
| 11.30 - 12.00 | Athens Metro System Overview [Attiko]<br>System description, practices and interdependencies [Attiko]<br>Tools and operational data available [Attiko] |
| 12.00 - 13.00 | RESOLUTE Risk Scenarios introduction [UNIFI disit] |
| 13.00 - 14.00 | Lunch |
| 14.00 - 15.30 | Working groups: Prepare, Absorb, Recovery, Adapt analysis of Scenarios [UNIFI] |
| 15.30 - 16.00 | Coffee break |
| 16.00 - 17.00 | Working groups summary [Working Group Rapporteur] |
| 17.00 - 17.30 | Open discussions |

# 5 FORMAT & OBJECTIVES OF THE WORKSHOP

The first workshop on "European Resilience Management Guidelines (ERMG)" was organized in the framework of the RESOLUTE project on 15 December 2015 in Florence, Italy.

The aims of the project first event are firstly to present RESOLUTE and its objectives, as well as to gather the project community around the specific issue of European Resilience Management Guidelines and to ease exchanges on this issue both between project participants and with external stakeholders such as researchers from European and Associated countries or Critical Infrastructure providers.

More particularly, the workshop focused on:

- The Resilience concept applied to urban transport
- Safety management in highly complex systems such as urban transport
- The existing limitations in terms of resilience management in urban transport
- Experience from other transport modes

The RESOLUTE workshop, bringing together main stakeholders such as: Critical Infrastructure managers, decision makers, first responders as well as scientists active resilience and risk analysis from various disciplines, aims at:

- Understanding the Transport Systems, practices, tools and interdependencies in Florence and Athens
- Engaging stakeholders in providing their ideal perspective on the urban transport system resilience
- Highlighting the main drivers and preparing the ground for the European Resilience Management Guidelines

This workshop ended with a round table gathering the presenting experts as well as RESOLUTE partners and external audience and the results and conclusions of this workshop will serve as a basis for the development of European Resilience Management Guidelines, engaging at the same time a number of external stakeholders in the RESOLUTE User Forum.

# 6 PRESENTATIONS

## 6.1 – Resilience in Transport Systems

First presentation has been decided to be a generic presentation on "Resilience in Transport Systems", more precisely entitled "Modelling transport systems with Functional Resonance Analysis Method (FRAM): Flows or functions?" by Erik Hollnagel, Professor at University of Southern Denmark & Chief Consultant Center for Quality, RSD (DK). The presentation was orally given by Pedro Ferreira in replacement of Erik Hollnagel who could not join the workshop.

Methods, models, the four principles of the FRAM & the FRAM functions were presented. Conclusions of the presentation were that the FRAM is a method to build a model. It provides the basics for building a model of an activity (functions, aspects) but makes no assumptions about the activity or the model. A FRAM model represents the potential couplings among functions in a system – the functions needed to carry out a given activity. The model is built by defining functions and their aspects, rather than by drawing them. A FRAM model can be used to produce specific instantiations. The instantiations will show which of the potential couplings become actual couplings under given conditions. A FRAM model can be used to support: Investigation of events (accident analysis), Consequences of changes (risk assessment), Analyses of work-as-done (representations of work-as-done), etc…

The full presentation is available at:

http://www.resolute-eu.org/images/media_centre/1st_workshop/EH_Firenze_DEC15-ferreira.pdf

## 6.2 – Florence Urban Transport System Overview

Five presentations were given on this subject.

The first presentation was on "Florence Urban Transport Systems Resilience Planning & Pilot design" made by Gianluca Vannuccini from the IT Department of CDF. Since its beginning, the RESOLUTE project has been calling for intensive cross-sectional cooperation, research, insights, within the Municipality. The IT division has established a closer relationship and an effective synergy with Civil Protection (the local Emergency Management authority is operated by a Municipality of Florence department), and the City Mobility Office (which is also a Municipality of Florence department). Together with the Metropolitan City of Florence (co-managing infomobility for the City), they have been engaged in a deep revision of digital and geographical data, operating rules and procedures, and communication channels. Vannuccini presented the RESOLUTE Integrated approach, including OpenData & GIS data management, Traffic Supervising technologies, Civil Protection tools and initiatives, along with constant, increasing cooperation with all public and private transport utilities in Florence – both in the municipal and in the metropolitan area. A significant effort is devoted in Florence to collect strategic dataset from the different actors of the city resilience and mobility, in order to provide to the RESOLUTE CRAMMS and tools the suitable data sources and to allow proper decision-making in case of emergency.

The second presentation, given by Chiara Lorenzini, was about the Florence Transportation System. The full city transportation system as well as risks factors were presented. In particular, Chiara outlined the metropolitan area of Florence public and private transport overview, its main numbers and assets, together with the main risk factors that affect the city population with respect to mobility. The main recent natural disasters were presented, then Chiara showed the approach of the City to manage transport modelling with respect to such disasters and their effects on the metropolitan transport network.

The third presentation was entitled „Implementing resilient mobility", held by Jürgen Assfalg from Città Metropolitana di Firenze, IT & Innovation Dept. This presentation intruduced the audience to the first scenarios for the group work of the afternoon. Jurgen outlined the details of the Traffic Supervisor of Florence, and he described the selected emergency scenarios for the Florence pilot.

Scenarios include the following aspects, which need to be analysed and modelled:

- Events triggering changes in the traffic setting of the City (calendar, changes in offer/demand, traffic events)
- Actions to be taken accordingly (VMS, UTC, traffic events)
- Information to users in the different available digital channelsFour representative scenarios were identified in the Florence pilot:
- Flood - 200 years
- Flood - 30 years
- Downburst in the south-east area of the City
- Local flooding next to Opera theatre

The fourth presentation was done by SWARCO MIZAR S.p.A about „Strategy Management Towards Resilient Transport Systems" and it went through Challenges and needs, Evolutions in Traffic Management, Strategy Management, Best practices and how to go Towards Resilient Transport Systems.

The fifth presentation was more specifically about the Florence Tramway and was given by Andrea Grifoni from Thales Italia SpA. He presented the Florence Tramway technology systems and ist operation control room centre.

All five presentations are available on the project website:

http://www.resolute-eu.org/images/media_centre/1st_workshop/Resolute_Florence_201512151-vannuccini.pdf

http://www.resolute-eu.org/images/media_centre/1st_workshop/Florence-Transport-System_Lorenzini_2.pdf

http://www.resolute-eu.org/images/media_centre/1st_workshop/Resolute-Assfalg.pdf

http://www.resolute-eu.org/images/media_centre/1st_workshop/20151215RESOLUTE_Workshop_SWARCO.pdf

http://www.resolute-eu.org/images/media_centre/1st_workshop/RESOLUTE_Tramway_Presentation_grifoni.pdf

## 6.3 – Athens Metro System Overview

One presentation was given on this subject.

The first presentation was made by Dr. Alexandros Deloukas, Attiko Metro S.A.& Evangelos Karagkounis, Metro Operations Expert and presented an overview on the Athens Metro System with a system description, detailing the practices and interdependenciesn as well as the tools and operational data available.

The presentation (in two parts) is available on the project website:

http://www.resolute-eu.org/images/media_centre/1st_workshop/RESOLUTE-Florence-Workshop-15_12_2015_ATTIKO_1.pdf

http://www.resolute-eu.org/images/media_centre/1st_workshop/RESOLUTE-Florence-Workshop-15_12_2015_ATTIKO_2.pdf

# 7 INTERACTIVE SESSION ORGANISATION

## 7.1 STEP 1 12.00 - 13.00 RESOLUTE Risk Scenarios introduction

Risk Scenarios were introduced

Climate

1) Water bomb (localized extreme event) - Florence
2) 30 year flood (periodic climate event) - Florence
3) 200 year flood (extreme climate event) – Florence

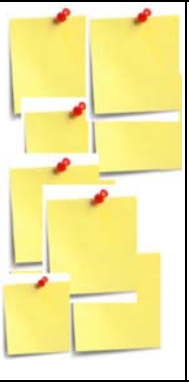
Man made

4) Vehicle accident (unexpected common operational event) - Florence
5) Bomb attack (man made extreme event) – Florence/Athens
6) Large yard critical event (interdependent CI failure) -Florence

Then each participant was asked to write a post-it with:

- *Back*: Name. Surname, affiliation

- *Front*: the most important action/topics to be addressed

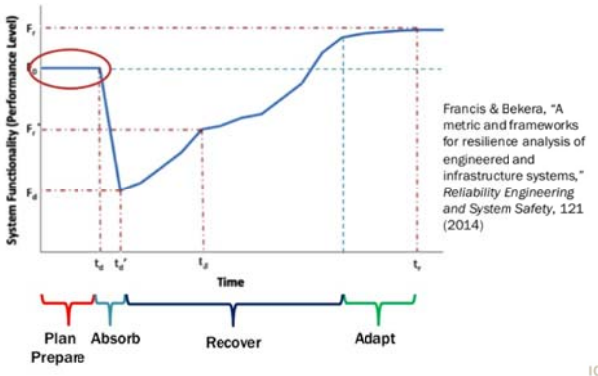
| Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 | Scenario 5 | Scenario 6 |
|---|---|---|---|---|---|
|  |  |  |  |  |  |

Outcome: Identify the scenario and the topic of interest of each attendee for grouping them properly.

- In case some scenarios did not receive any post, they were to be aggregated to others
- In case a scenario received too many posts they would be split in 2 or 3 taking care of not having all people with the same background in one group.

## 7.2 STEP2 14.00 - 15.30 Working groups: Prepare, Absorb, Recovery, Adapt analysis of Scenarios

Once the groups were defined, a coordinator of each group was nominated. Then each group was asked to fill out a table (see the Appendix 2), identifying which are the best and feasible elements necessary to manage the resilience step properly. The information collected has been accommodated in the following table structure (see Section 9 of the present document). Such table is structured around the adaptive cycle / event management cycle principles composed by the four phases: Plan/Prepare, Absorb, Recovery and Adapt. This approach has been considered appropriate for the velocity with which it is possible to communicate the resilience concept to people that are not used to think about it. The following picture has been used to frame the context before starting the interactive session of the workshop.




Moreover, we identified in advance at least three categories of information that we consider needed for driving the ERMG development and the related operationalization tools: Processes, Data and Responsibilities. While the concept of processes and responsibilities are aspects quite familiar for the stakeholders, the definition of the data needed for the four phases represents a change a way of thinking about the resilience. In particular, the objective is to increase the stakeholder awareness about the huge value of the data generated within their own organizations for the resilience management at city/community level. In fact, only recognizing and aggregating data streams coming from different sources, it is possible to obtain a real (dynamic) picture of a complex system as the UTS. The final aim it to support ERMG development moving towards a more quantitative and evidence driven approach.

| Subcase x.x | Prepare processes | Absorb processes | Recovery processes (in temporal order) | Adapt process | Counter or critical Example |
|---|---|---|---|---|---|
| | | | | | . |
| | Data for Prepare | Data for Absorb | Data for Recovery | Data for Adapt | |
| | | | | | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | | | | | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | | | | | |

Create evocative figures of entities-actors relationships (e.g. oriented charts) for each Resilience step (Prepare, Absorb, Recovery, Adapt)

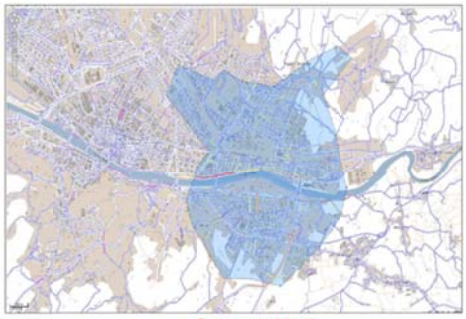
## 7.3 STEP 316.00 - 17.00 Working groups summary

Finally each WG leader was asked to produce 4 slides (one for each step of the resilience: Prepare, Absorb, Recovery, Adapt).

Overlaps from the different groups were expected and are the signal of a convergence towards specific elements that will be driven in the guidelines productions.

# 8 RISK SCENARIOS PRESENTATION

## 8.1 Scenario 1: Water bomb




The water bomb is an extreme event related to climate change. The phenomenon is characterized by high spatial and temporal variability: high quantity of water on a limited surface and time duration.

There are difficulties to precisely localize the boundaries of the phenomenon with the existing tools (e.g. weather forecasts, satellite images, monitoring network, etc.). The temporal dimension can be measured in minutes. The phenomenon requires innovative methodologies of analysis at an urban scale.

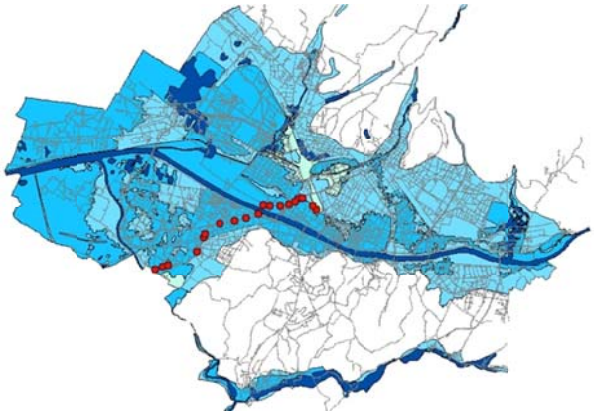
Even the ground effects are difficult to predict because the response of the affected area can vary depending on the type of the impacted elements (e.g. urban distribution, preservation status and level of functionality of the protection mechanisms, fixity or mobility of the urban elements) and the population reaction.

In fact, one of the current issues related to such events is the citizens' awareness about their frequency and dangerousness. In particular, such events are perceived as unique (or extremely rare) with a so high degree of fatalism that, after the most critical time, the memory tends to vanish very quickly. This leads the citizens to maintain behaviours that do not take into account the extreme events as a possibility (e.g. mobile installations on the roof of the houses). Such extreme events affect parts of the city that might have different social value in relation to their usage and capacity of aggregation and community identity representation. Such social value of the places should be taken into account during the vulnerability assessment

List of Sub cases reported as table in Section 9:

- 1.1 Underpass with water and no power energy
- 1.2 Underpass with water and power

## 8.2 Scenario 2/3: 30/200 year flood



The two phenomena are characterized by spatial and temporal prediction that are translated into the risk maps. One of the major differences between the 30 and the 200 years flood event is the magnitude and the area of the affected city. In fact, the two events share similar processes and benefit of the same investigation methods and output products (analytic data and maps) even if the resources needed to manage such kind of events are different.

The 200 years flood can be identified as an event with a magnitude able to seriously affect the biggest part of the city. It has been estimated that if an event similar to what happened during the 1966 floods happened today, the level of the water could be 2 meters higher (from 4 to 6 meters in some parts of the city) due to changes in the urban structure and its land use. The expected damage has been estimated around of 20 billion euros. This means that the impact is not only at local or regional level, but also at national level.

In the 200 years event, the timing is crucial. In fact, from the first signals detected upriver to the flooding in the Florence downtown in the 1966, ca. 15 hours passed. Thus, the dynamic of the event gives a time window that needs to be exploited in a more effective manner. In fact, the entire population was not aware about the imminent risk and the authority took the wrong decision of not advising the citizens considering the panic more critical with respect to the possibility of flooding. Finally, the national authorities were not able to understand the magnitude of the event, which lead to not fully complying with the request of help coming from the city authorities. In case of the 200 years event, all the infrastructures are expected to be affected.

The 30 years event affects a limited part of the city while the rest of the city can continue life as usual. This event affects underpasses, basements, garages, the viability of the area propagating the issues also in other parts of

the city. It is necessary to inform the residents living in the area at risk to do specific actions while the other citizens should be advised to restrict their personal mobility.

List of Sub cases reported as table in Section 9; :

- 2-3.1 30 years flood
- 2-3.2 200 years flood

## 8.3 Scenario 4: Vehicle accident


The car crash is one of the most “common” event that affects the UTS operation. Of course the seriousness of the event may affect CI differently. In fact the rescuers may decide to close one lane, two lanes or the whole carriageway, and the impact of such decisions might be very different if it is taken at noon or midnight, etc.

The car crash is a good representative of the class of “expected” events that affect the operation of the UTS, However the magnitude of the loss of the operation of the UTS might be “unexpected” because of the numbers of variables involved like traffic status, whether conditions, presence of injuries/victims, type and number of vehicles involved, etc.

General case: generic vehicle accident

This scenario is divided into a set of sub cases, basin on the type of the vehicles involved.

List of Sub cases reported as table in Section 9:

- 4.1 Cars /Train
- 4.2 Dangerous goods
- 4.3 Motorcycles

## 8.4 Scenario 5: Bomb attack

The underground network is one of the most important "soft target" in urban scenario since the effects of a terrorist attack affect several aspects of the urban system in short, medium and long term. In fact, striking such kind of infrastructure, the following impacts and cascade effects are usually observed:

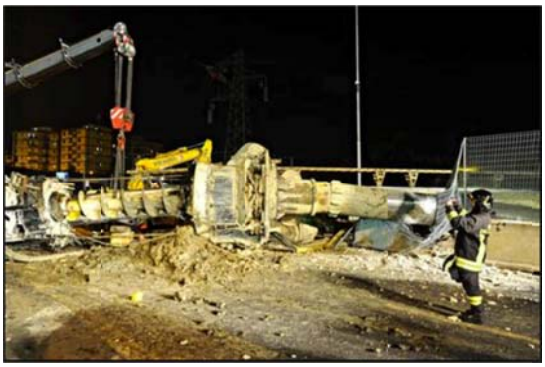
a) Metro infrastructure damage
- ➢ Full or partial closure of lines for a period of time
- ➢ Event. power substation failure (blast impact)

b) Victims in situ
c) Unpredictable people behaviors due to the panic
d) Socio-psychological damage (stress/anxiety/worry/fear) of the wider Athens population
- Event. telecom break down -> emergency response delays
- Road traffic congestion due to sudden modal diversion
- Economic and business losses

List of Sub cases reported as table in Section 9:

- 5.1 Closure of stations along a line after a bomb attack

## 8.5 Scenario 6: Large yard critical event



The scenario described is related to what happens in case of a relevant accident man made or not, in closed areas (e.g. Yards, Stations, Airports, Stadium, etc.) occurs. In a city, there are a number of yards (public or private) that are daily operative. The problem is that facilities like cranes, drills, scaffoldings, etc. are usually close to the streets and critical events like windstorms or human errors can be a cause of an accident. If this event affect the streets nearby as represented in the pictures, such event triggers several cascade effects in the UTS as rapid increment of traffic congestions and difficulties to solve the case due to the need of specialized/dedicated machines that are not usually available as means for the emergency.

List of Sub cases reported as table in Section 9:

- 6.1 Large yard critical event

# 9 RESULTS FROM THE SCENARIOS

## 9.1 Results from scenario 1: Water bomb

| Subcase 1.1 | Prepare processes (from the most expensive to the less) | Absorb processes (from the most degraded to the less degraded) | Recovery processes (in temporal order) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| Underpasss rapidly blocked by water<br><br>1.1<br>The underpass was not technically equipped<br>…..<br>Was strongly equipped<br><br>Something wrong occurred on the technical equipments,. For example no power. | ■ Installing in the underpass<br>  ■ Level sensors<br>  ■ meter on the wall with QR or SMS<br>  ■ listening twitter<br>■ installing semaphores activated by sensors levels<br>■ planning rerouting of the busses and private traffic<br>■ installing water pump activated by water level, with specific SLAs for maintenance and intervention tile<br>■ informing the city control room<br>■ send alerts to the city traffic management system/supervisor<br>■ plan manual closure in the case of no power<br>■ place local power with solar panels<br>■ verify if no power condition are present with device with battery sending information<br>■ if No telecom connection<br>■ prepare and empower citizens on risks and behaviours to undertake in the eventuality of the water bomb<br>■ organize and sustain citizens networks (scouts, active citizens…) to be efficient and helpful in the event of the water bomb | Faster reaction on the basis of data and information to arrive at blocking the underpass and reduce the risk.<br>Get trained citizens and civil society networks activate | ■ Blocking the underpass<br>■ Informing that the underpass cannot be used<br>■ Traffic re-routing and re-adaptation<br>■ Removing water<br>■ Reactivating the underpass<br>■ Repainting<br>■ Reactivate functioning of technical solutions | Improving signaling effectiveness with higher level sensors.<br><br>Fastening the reaction process of removing water with stronger pumps | <u>Absorb</u><br>■ The level of water can be so high to create a strong risk to the people trapped into cars per hours. |
| | Data for Prepare | Data for Absorb | Data for Recovery | Data for Adapt | |
| | ■ Water level<br>■ Alarm status<br>■ Pump position and status: on/off and | ■ Messages on panels and twitter and on the area info point if any | ■ Inform population of the reactivation time | | |

| | | | | | |
|---|---|---|---|---|---|
| | when<br>■ Underpass position and status: open/closed<br>■ Past data on extreme events and the underpasses blocked by the water<br>■ Lists of civil associations and networks | | | | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | ■ City Council (dep. Of infrastructure)<br>■ FS<br>■ Company in charge of pomp/sensors maintenance | ■ Mobility dept. | | | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | ■ …. | ■ …. | ■ … | ■ … | |

| Subcase 1.2 | Prepare processes (from the most expensive to the less) | Absorb processes (from the most degraded to the less degraded) | Recovery processes (in temporal order) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| Social valuable places damaged (e.g. a square with benches and tables destroyed/unavailable, a garden or cemetery with felled trees), | ■ establish a social dialogue in the city (e.g. hearing marathon)<br>■ identify the most important places related to their social functions in the city<br>■ translate such analysis into digital information<br>■ keep the dataset up to date | ■ Evacuate the place if the safety cannot be guaranteed towards a pre-defined/real time determinated safer area.<br>■ Prevent further accesses to the place/space redirecting people to the safer area<br>■ Close the place/space | ■ recognition and remove the structures and are precarious | Changing the urban plant | <u>Absorb process</u><br>■ The level of water can be so high to create a strong risk to the people trapped into cars and blocked in the traffic jam |
| | Data for Prepare | Data for Absorb | Data for Recovery | Data for Adapt | |
| | ■ Map of places related to Social vulnerability<br>■ Social dialogue results collection | ■ Messages on panels and twitter and on the area info point if any<br>■<br>■ . | ■ Inform population of the reactivation time<br>■ ..<br>■ . | ■ data collections of the<br>■ ..<br>■ . | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | ■ City council<br>■ Citizen associations<br>■ . | ■ owners/managers of the locations (private space)<br>■ . | ■ owners/managers of the locations<br>■ ..<br>■ . | ■ Civil Protection<br>■ City Councils<br>■ Universities<br>■ Business<br>■ Citizens | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | ■ …<br>■ .. | ■ Rapid people movement towers covered public spaces (shops, bar, | ■ …<br>■ .. | ■ …<br>■ .. | |

| | | | | | |
|---|---|---|---|---|---|
| | ■ . | etc.)<br>■ Rapid De installation/reinforcement of temporary infrastructures at risk (e.g. scaffoldings, gazebo) | ■ . | ■ . | |

| Subcase 1.3 | Prepare processes (from the most expensive to the less) | Absorb processes (from the most degraded to the less degraded) | Recovery processes (in temporal order) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| Flooded roads in traffic intensive intersection and strong wind | ■ Citizen training<br>■ Sewage system analysis<br>■ Sensors maintenance check<br>■ Risk Analysis | ■ Immediate traffic light cycle changed<br>■ Immediate traffic wardens out to control critical areas<br>■ Multichannel warnings to the citizens/tourist<br>■ public service in degraded operational mode (re-routing) | ■ Floaded roads identified and damage check<br>■ Urgency ranking<br>■ Fire Fighters and civil protection operation<br>■ | ■ Redesign the capacity of the sewage<br>■ Redefine of maintenance frequency<br>■ Redefining of parking allocation<br>■ Redefiing of viability | |
| | Data for Prepare | Data for Absorb | Data for Recovery | Data for Adapt | |
| | ■ Map of the sewage system<br>■ Dependencies analysis with roads infrastructures and traffic flows<br>■ Multisource Data Integration<br>■ Adaptive Traffic Plan preparation<br>■ Real time traffic flow<br>■ Predictive Models development<br>■ Sensors network | ■ Messages on panels and twitter and on the area info point if any<br>■ Info about the extension and intensity of the event from sensors and users<br>■ Traffic Flows<br>■ People movement Tracking<br>■ | ■ Inform population of the reactivation time<br>■ Traffic jam<br>■ People concentration | ■ Damage evaluation data<br>■ Extreme event dynamics data<br>■ User generated content and security cam information analysis for ex post assessment and learning<br>■ | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | ■ City Council (maintenance dept, mobility dept. ICT dept., etc.)<br>■ Citizens<br>■ | ■ Traffic wardens<br>■ Fire fighters<br>■ Civil protection<br>■ Citizens | ■ Fire fighters<br>■ City Council<br>■ Citizens | ■ City Council<br>■ ..<br>■ Citizens | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | ■ City Council (dept. of infrastructure)<br>■ Company in charge of cleaning manholes<br>■ City council<br>■ Periodical risk assessment/brain storming exercise with several stakeholders | ■ Rapid people movement towers covered public spaces (shops, bar, etc.)<br>■ Rapid De installation/reinforcement of temporary infrastructures at risk (e.g. scaffoldings, gazebo)<br>■ | | ■ damage assessment | |

## 9.2 Results from scenario 2: 30/200 year flood

| Subcase 2-3.1 | Prepare processes | Absorb processes (from the most degraded to the less degraded) | Recovery processes (in temporal order) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| 30 years Flooding | ■ Communication message preparation<br>■ Evacuation/rescue exercises involving the population<br>■ Obstacles removal<br>■ Parking organization<br>■ Periodic river maintenance<br>■ Dedicated mobility plan definition to react to the event<br>■ Evacuation plan definition<br>■ Minimum service level of CIs defined in the contracts<br>■ Reinforcement of community relationships<br>■ Prepare and empower citizens on risks and behaviours to undertake in the eventuality of the water bomb<br>■ Organize and sustain citizens (scouts, active citizens…) to be efficient and helpful in the event | ■ Citizen information with not resident included<br>■ Old-style alarm (e.g. bells)<br>■ Proactive and effective event monitoring<br>■ Alert authorities and set up the emergency coordination room with the CI managers<br>■ Advise citizens with right messages<br>■ Close access to the affected and at risk areas and redirect people and traffic towards safety areas (according to their current position and place of residence)<br>■ Mobilize resources to Rescue and evacuate people<br>■ Mobilize resources to Rescue valuable goods<br>■ Activate countermeasures to preserve areas and CIs not already affected<br>■ Streets obstacles removal | ■ Activate Short term Recovery plan with responsibility, goods, and data needed<br>■ Restore UTS and the other CIs at the Minimum Service Level (MSL) in parallel in the area<br>■ Detect self-recovering areas/communities to allocate resource efficiently<br>■ Estimation of the damage | ■ audit ex-post<br>■ proactive investments and policy decisions for disaster risk reduction (create safe temporal parking areas)<br>■ Relocation of services and goods<br>■ Citizen training | <u>Prepare process:</u><br>■ Prompt notify the population to climb to the upper floors and prevent people of moving towards the affected area with vehicles |
| | Data for Prepare | Data for Absorb | Data for Recovery | Data for Adapt | |
| | ■ safe waiting/collection areas map<br>■ risk map<br>■ exercise assessment results<br>■ urban entities map<br>■ plan/procedures to remove obstacles/vehicles<br>■ obtain a representation of the existing community relationships<br>■ CIs real time operation data<br>■ UTS real time operation data | ■ content/message ready to use for multichannel communication<br>■ resilient social network (word of mouth)<br>■ predefined scenarios<br>■ event dynamics tracking<br>■ damage description | ■ priority list dynamically built<br>■ resource available<br>■ status of the CIs | ■ disaster costs quantification<br>■ disaster extension definition<br>■ failures/drawbacks identification all phases: planning, during the rescue, during the recovery) | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | ■ Civil Protection<br>■ City council | ■ Civil protection<br>■ Community | ■ Civil protection<br>■ mobility | ■ Communities<br>■ Public body | |

| | | | | | |
|---|---|---|---|---|---|
| | ■ Category/civic associations<br>■ School/universities<br>■ Mobility<br>■ Utility | ■ Mobility dept. | | | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | | . | | | |

| Subcase 2-3.2 | Prepare processes (from the most expensive to the less) | Absorb processes (from the most degraded to the less degraded) | Recovery processes (in temporal order) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| 200 Years<br>(70% of urban areas affected by 4 meters of water, historical area affected) | ■ Data collection Mapping good at risk<br>■ Population training<br>■ Structural and not-structural interventions<br>■ CI periodical maintenance<br>■ Early warnings system<br>■ Analysis of the city as a system of systems<br>■ Reinforce community relationships<br>■ Evacuation plan<br>■ Early warnings system<br>■ Interdependencies analysis | ■ Event monitoring<br>■ Advise authorities and set up the emergency coordination room with the CI managers<br>■ Advise citizens with right messages<br>■ Close access to the affected and at risk areas and redirect people and traffic towards safety areas (according to their current position and place of residence)<br>■ Public transport service suspended<br>■ Mobilize resources to Rescue and evacuate people<br>■ Mobilize resources to Rescue valuable goods<br>■ Activate countermeasures to preserve areas and CIs not already affected<br>■ Old-style alarm (bells)<br>■ traffic laws suspended | ■ Activate Short term Recovery plan with responsibility, goods, and data needed<br>■ Restore UTS and the other CIs at the Minimum Service Level (MSL) in parallel.<br>■ Detect self-recovering areas/communities to allocate resource efficiently<br>■ Estimation of the damage<br>■ Traffic laws partially reactivated and viability reshaped to speed up the recovery<br>■ Public transport service partially recovered in the areas with less damages<br>■ coordinate spontaneous volunteers | ■ Long term recovery plan<br>■ Procedure Re-design<br>■ Public spaces, urban shape re-design (functions, services, usage, etc.)<br>■ Relocation analysis of services, goods, masterpieces, etc.<br>■ Economical resource allocation strategy<br>■ proactive investments and policy decisions for disaster risk reduction | <u>Absorb process:</u><br>■ If the population are not timely informed with right and reliable information about how the critical event is evolving around them (e.g. informing where the water is flooding behind a group of neighboring buildings that prevent the visibility) , they could take wrong decision on the direction of the escape. |
| | Data for Prepare | Data for Absorb | Data for Recovery | Data for Adapt | |
| | ■ Exposures map<br>■ Vulnerability map(buildings, goods, population)<br>■ Data needs to be up to date<br>■ Integrated emergency procedures able to overcome the administrative boundaries | ■ Multi source Real time data as: river levels, weathers dynamics, people locations and concentrations, UTS status, Social network data<br>■ CIs Loss of operation dynamics (UTS, Energy, Communications, | ■ precise damage evaluation (geographically and economically)<br>■ Priority list<br>■ resource needed evaluation (people,means, etc.) estimation<br>■ georeferencing of the resources | ■ disaster costs quantification<br>■ disaster extension definition<br>■ failures/drawbacks identification all phases: planning, during the rescue, during the recovery) | |

| | | | | | |
|---|---|---|---|---|---|
| | ■ CIs real time operation data<br>■ UTS real time operation data<br>■ | Healthcare, etc.)<br>■ Real time resource monitoring (first responders available, emergency means available, etc.) | in action | | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | ■ Patrimony dept.<br>■ Community/citizens<br>■ City council<br>■ Civil Protection<br>■ Category/civic associations<br>■ School/universities<br>■ Mobility<br>■ Utility | ■ Civil Protection<br>■ Firefighters<br>■ Health emergency<br>■ Security corps<br>■ City Council<br>■ Citizens | ■ Civil Protection<br>■ Military corps<br>■ Public authorities<br>■ Population/Community<br>■ Citizens | ■ City Council<br>■ Citizen associations | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | | | | | |

## 9.3 Results from scenario 4: Vehicle accident

The sub classes 4.2 and 4.3 inherits the entire observations related to 4.1, described in a more general form.

| subcase 4.1 | Prepare processes (from the most expensive to the less) | Absorb processes (from the most degraded to the less degraded) | Recovery processes (in temporal order) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| Cars / Train | ■ Improve existent information/knowledge instruments (e.g. ontologies)<br>■ Create general guidelines (who is responsible for? Who have to be advised and in what cases? When and under what conditions a procedure has to be activated? …)<br>■ Establish a methodology/ procedures, through vehicle infrastructure technologies, to improve, automate and fasten accident registration and prevention<br>■ Monitoring (Dynamically): traffic levels, normality sensors, critical | ■ Inform the people of the accident<br>■ Separate the Affected areas (rerouting, suggest alternative paths, etc.)<br>■ Block the Area (a train station, a road, etc.)<br>■ Collect information on how to avoid the next accident in the same area | ■ Accident registration<br>■ Advise the emergency units<br>■ Use correctly the equipment and use of the correct technologies<br>■ Reestablish the main functionalities<br>■ Reestablish the initial condition (in a long time period) | ■ Rebuild, put new infrastructures to avoid similar accident: speed cameras, traffic island, decontamination systems at the entrance of the galleries to avoid potentially inflammable material transport (in a long time period)<br>■ Make previsions on the restoration time<br>■ Update the guidelines and methodologies created in the Prepare process in order to avoid similar accident (How we can prevent other accidents?) | <u>Adapt process:</u><br>■ In dangeorus crossroards in order to reduce the number of critical events the follwong a different traffic intervations are applied:<br>■ different signaling light cycle - specific road signs<br>■ replacing the asphalt with |

| | | | | | |
|---|---|---|---|---|---|
| | situations, etc.<br>■ Send information to the other road users around the accident<br>■ Mapping of Critical Infrastructures<br>■ Data Classification (& statistical analysis) on:<br>■ Areas/node/situations (in terms of their criticity, etc.),<br>■ Possible damages (What can happen? What is the probability of that happening?)<br>■ Alternative flows for each area<br>■ Establish the possible responsibles (Police, road Police, Traffic managers, Industries, Civil protection, …. ),<br>■ etc.<br><br>■ Share and update the data (establish what kind of data, the IPR on them, etc.), maps and protocols. Maintain the rescue systems aligned with the road management operators and aligned with the accident revealing<br><br>■ Use Support Decision tool<br><br>■ Establish possible alternative paths (also using simulator tools)<br><br>■ Maintenance of dedicated recovery plan (basing on the data classification and the information managed)<br><br>■ Automatic scaling up (on the base of the severity of the accident) of management procedure and different operators involved | | | | stone leveraging the psychology of materials |
| | Data for Prepare | Data for Absorb | Data for Recovery | Data for Adapt | |
| | ■ Tools for aggregating and analyse | ■ Number of vehicles involved | ■ Photos, sms, videos, etc. | ■ | |

| | | | | | |
|---|---|---|---|---|---|
| | metadata (capable to aggregate different type of data in terms of formats, kind of description, etc.)<br>■ Equal data ???<br>■ Measures of accident<br>■ Technologies for establish the positioning of vehicles and people (traffic sensors, etc.)<br>■ Dynamic information on the accident<br>■ Real Time Monitoring, Flow analysis<br>■ Knowledge base (ontology) | ■ Number of people involved<br>■ Position of the accident<br>■ Position of all the vehicles blocked (in order to calculate the entity of the queue, vehicle distance from the accident, etc.)<br>■ Percentage of the road closed<br>■ Data coming from traffic sensors<br>■ … | ■ E-call information<br>■ Responsibles' communications | ■ . | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | ■ Road Police<br>■ Traffic managers<br>■ Industries<br>■ Civil Protection | ■ Traffic managers | ■ Traffic managers<br>■ Medical emergency units<br>■ Police department<br>■ Civil Protection | | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | | | | | |

| Subcase 4.2 Dangerous goods | Prepare processes (from the most expensive to the less) | Absorb processes (from the most degraded to the less degraded) | Recovery processes (in temporal order) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| NOTE:<br>All the actions described in the subcase 1.1 are valid also for the accidents involving dangerous goods | ■ Classify the different kinds of goods and the possible damages and procedures to be adopted in case of accidents: who have to be advised, what are the risks for the people involved, what can be the radius of danger, etc.<br>■ Mapping of Critical Infrastructures | ■ Establish what kind of good are present | ■ Advise special responsibles<br>■ Evaluation of the situation before leave the area | | |
| | Data for Prepare | Data for Absorb | Data for Recovery | Data for Adapt | |
| | | ■ Data related to the goods: it is something that can explode? chemical goods dangerous for people or for the environment, etc.)..<br>■ Percentage of the goods present in the vehicles | ■ Fuel level of the vehicles<br>■ Quantity and position of the goods scattered | | |

| | | | | | |
|---|---|---|---|---|---|
| | | ■ How the vehicles are powered (gas, petrol, etc.)<br>■ … | | | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | | ■ Industries<br>■ Civil protection<br>■ Traffic Managers... | ■ Traffic managers | | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | | | | | |

| Subcase 4.3 Motorcycles | Prepare processes (from the most expensive to the less) | Absorb processes (from the most degraded to the less degraded) | Recovery processes (in temporal order) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| NOTE:<br>All the actions described in the subcase 1.1 are valid also for the accidents involving dangerous goods | ■ Collaborate with industries producing the new technologies to recover a motorcycle accident (data interoperability, responsible traceability)<br>■ Update the traffic management systems (with real time new data, motorcycles specific data, medical data, etc.)<br>■ Use of sensors (e.g. in the helmets or on the motorcycle) | | ■ Automatic advise of the emergency units (using the helmets' sensors) and the possibility to follow in real time the emergency units' suggestions | | |
| | Prepare Data | Absorb Data | Recovery Data | Adapt Data | |
| | ■ Kind of data that can come from helmets or motorbikes | ■ Data coming from helmets or motorbikes in real time.. | ■ What is the point on the head, that the person has beaten during the accident | | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | ■ Industries | | ■ Industries<br>■ Drivers<br>■ Medical emergency units<br>■ Traffic managers | | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | | | | | |

## 9.4 Results from scenario 5: Bomb attack

| General case | Prepare processes (from the most expensive to the less) | Absorb processes (from the most degraded to the less degraded in chronological order) | Recovery processes (in temporal order)<br>Empirical referents of ERMG (Guidelines) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| Closure of stations along a line after a bomb attack | ■ Emergency rules and procedures<br>■ Trained staff through drills<br>■ Agreement with bus operators<br>■ Signages (static signs) empty to be filled with alternative routes in each station [evacuation procedures]<br>■ General Emergency Plans<br>■ Local Emergency Plan (per station)<br>■ Assignment of an authorized person to communicate with the media<br>■ … | ■ Local Incident Manager takes the lead. Only one speaks with OCC<br>■ The staff shall apply the rules and procedures to the case<br>■ Immediate information from OCC to the first responders (emergencies services)<br>■ Immediate information from the OCC to the hierarchy of STASY<br>■ OCC communicates with OASA the bus company<br>■ One authorized person from the metro company communicates with the media<br>■ Bus company proceeds according to the pre-agreed plan<br>■ Establish a call center for information | ■ Immediate medical help of severely injured persons<br>■ Immediate investigation by police and fire services<br>■ Proper communication with the media key actors<br>■ Psychological support to affected person<br>■ Proper media coverage<br>■ Social media monitoring<br>■ Immediate, phased technical recovery of the infrastructre | ■ Adaptation of insufficient rules and procedures<br>■ Adaptation of training materials and drills<br>■ Adaptation of surveillance equipment (CCTV)<br>■ Adaptation of emergency plans (general and local) in phases<br>■ Update of recall procedures for personnel<br>■ Updating of communications protocols<br>■ Adaptation of any agreement between metro and bus companies or others (e.g. Police) | <u>Prepare process:</u><br>■ Casualties in case of missing of evacuation procedures<br>■ Road congestion in case of missing agreement with bus companies<br>■ Reduction of public transport level of service<br>■ Chaotic situations if no proper information channels planned in advance<br><u>Recovery process:</u><br>■ A delay of recovery leads to economic and business losses<br>■ Road congestion<br>■ Many frightened people to stay at home<br><u>Adapt process:</u><br>■ No adaptation at the minds of |
| | Prepare Data | Absorb Data | Recovery Data | Adapt Data | |
| | ■ Geographical extension of the damage<br>■ Direct communication with the metro OCC, bus OCC and OASA (transit authority)<br>■ Duration of the disruption<br>■ Proximity of the bus depots<br>■ Availability of busses and drivers | ■ Extend and severity of the damage and disruption<br>■ Information about the road traffic<br>■ . | ■ Evidence in situ (e.g. DNA footprints)<br>■ Reports from staff as witnesses<br>■ Camera CCTV displaying<br>■ Social media analysis | ■ Weak points (vulnerabilities) of the system security after an analysis of the incident<br>■ Weak points of the agreements between metro and others (gap with best practices)<br>■ Evaluation of the proper communication | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | ■ STASY (metro operator)<br>■ OASA (supervisioning and planning | ■ Local Incident Manager gives immediate as accurate as | ■ Police and fire services<br>■ Medical services (hospitals) | ■ Top management responsibility of the proven | |

| | | | | | |
|---|---|---|---|---|---|
| | of bus scheduling)<br>■ OSY (bus operator)<br>■ Traffic management centre for roads<br>■ Traffic Police | possible information to OCC<br>■ OCC turns the information to the Emergencies Services<br>■ OCC gives instructions and coordinates with the assistance of the Local Incident Manager<br>■ Bus company guarantees replacement service<br>■ Communication manager informs media according to the info coming from the highest hierarchy (GM, Minister, etc.) | ■ Technical services of STSY to immediately contact the constructors (award bonus for early repairs) | or not proven organizational effectiveness<br>■ Reorganization of the company after the incident, if needed | travelers means no use of alternatives modes of transportation<br>■ If no external auditing perhaps the same malpractices in the future |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | Interdependencies with first responders:<br>■ Fire Brigade<br>■ Emergency Medical Aid<br>■ Police<br>■ Civil Protection | ■ Emergency Services must have a unified system of command and response | ■ Single Occupancy: Vehicles should not circulate for a short period (only High Occupancy vehicles with more than 1 passenger)<br>■ Extent exclusive bus lanes<br>■ Communication with the experts<br>■ State that public workers change to a flexible work schedule | ■ External auditing of bad and best practices of the actual response | |

## 9.5 Results from scenario 6: Large yard critical event

| General case | Prepare processes (from the most expensive to the less) | Absorb processes (from the most degraded to the less degraded) | Recovery processes (in temporal order) | Adapt process (from the most expensive to the less) | Counter or critical Example |
|---|---|---|---|---|---|
| Closed areas and in case of BIG accidents man made or not (e.g. Stations, Airports, Stadium, etc.) | ■ Use a resilient sensor network (data server, intelligent sensors, topology networks, etc.)<br>■ Tools for managing the resilient sensor network<br>■ Monitor the people behavior in real time<br>■ Determine a set of guidelines/plan to guide the people in case of problems: what the people can do? Where the people can go? Where are the near exit?<br>■ Update the guidelines in real time (e.g. exit/way xxx is closed, the monitor yy is broken, etc.)<br>■ Base the guidelines on the user profile and on the specific areas | ■ Detect in real time the event<br>■ Guide the people: to find the near exit, to choose the correct path basing on their profile (e.g. people with mobility problems) and using both the public (monitor, visualization and earing systems, speakers, etc.) and the personal devices (e.g. mobiles) | ■ Advise/Send the emergency units using both the sensor network and the simulator systems | ■ Rebuilding, reestablish the main functionalities<br>■ Identifying and Mapping the existence and availability of specific facilities/machine (of public and private organization) that can be used in a extraordinary emergency context like mobile crane of big dimension | <u>Prepare process:</u><br>■ Victims in case of safety countermeasure s against extreme events are not in place<br>■ Huge delay in recovering the UTS operation if the needed machine for removing the |

| | | | | | |
|---|---|---|---|---|---|
| | ■ Identify main interdependency chains and create maps of the more probable evolution scenarios (collect historical data; register, store, analyze new events data)<br>■ Use of more traditional technologies and integrate all the data for example in a common ontology (cameras, speakers, etc.)<br>■ Create and update a map of probability for a certain number of potential risks<br>■ Use of simulators and Decision Support systems | | | | working machineries are not identified in advance |
| | Prepare Data | Absorb Data | Recovery Data | Adapt Data | |
| | ■ Sensor network realized with different technologies<br>■ Simulator and managing tools<br>■ Knowledge base (ontology) | ■ How many people are present in the area<br>■ What kind of people is present and in what measure (children, people with mobility/ hearing/sight problems, etc.)<br>■ Data coming from social networks | ■ Required dedicated Facilities/machines availailability data | | |
| | Prepare Responsibility | Absorb Responsibility | Recovery Responsibility | Adapt Responsibility | |
| | ■ Infrastructure operators<br>■ Industries<br>■ Tools' developers | ■ First responders<br>■ Yard operators | ■ Yard Operators | ■ | |
| | Prepare other | Absorb other | Recovery other | Adapt other | |
| | | | | | |

# 10 CONCLUSIONS

The data gathered during RESOLUTE 1st workshop constitutes an important contact with transport operators and stakeholders, in particular those involved in the preparation of the testing and validation scenarios, for the ERMG preparation. The development of the ERMG starting with a bottom-up approach, allows to frame the work within the real life stakeholder expectations and requirements, paving the way for a future effective and wider adoption. Workshop data is structured around the adaptive cycle / event management cycle principles in order to collect needs and requirements for the operational point of view from the stakeholders. In particular 6 threat scenarios have been identified: water bomb, 30/200 years flooding, street accidents, bomb attack in the tube, large yard critical event. These scenarios have been used to harvest processes, data and responsibilities for each step of the adaptive cycle (prepare, absorb, recover, and adapt) in order to drive the guidelines definition and the development of the tools. According to the workshop results the scenarios (Florence City and Athens metro) can be characterised by:

a) Multi-decision-makers (civil protection, public administration, infrastructure managers, etc.),

b) Actors with conflicting micro-opportunistic behaviours, different risk perceptions, beliefs, skills, etc.

c) Heterogeneous data sources (environmental sensors, traffic flows, social network, etc. ) with different data delivery rate (raining from real-time to static), quality, reliability and semantics.

d) Fragmented and sometimes not clearly defined responsibilities and processes

e) Local and general vulnerabilities with complex interdependencies aiming the system (ICs, People, Organizations, Business, etc.) composing the urban sociotechnical system of systems.

f) Needs to optimally manage the scarcity of resources in term of first responders, goods, and tools available during an emergency

g) Needs of an authoritative multi-channel communication strategy and a situation-aware communication delivery tools (e.g. localised and personalized early warnings, installation of variable messaging panels, etc.)

h) Common attitude of the authorities to neglect the preparing and adapting phases in favour of the absorbing and reacting phases.

i) Weak population preparedness against unusual extreme events and wrong perception about their recurrence probability and potential effects

j) Needs to consider place/space with a recognised social value, as one of the critical functions to be recovered with a due priority in order to maintain social cohesion and the related community resilience.

These characteristics will further serve during the current phase of RESOLUTE in order to begin the demonstration and validation of the planned integrated system of mobility management which, besides forecasting, will involve a corrective strategy actuation for restoring of safety condition for system users and of effectiveness of the public transport network in case of emergency event. At the end of the workshop, RESOLUTE consortium fully reached the aim that was fixed for the workshop in terms of gathering data for next project phases. In order to enlarge the consortium data useful for the ERMG production, and taking into account the success of the method applied during Florence workshop, the consortium decided to keep this way of working

for the next planned workshop. In this view, new scenarios will be developed in order to be presented to the audience, so that complementary data will be able to be gathered.

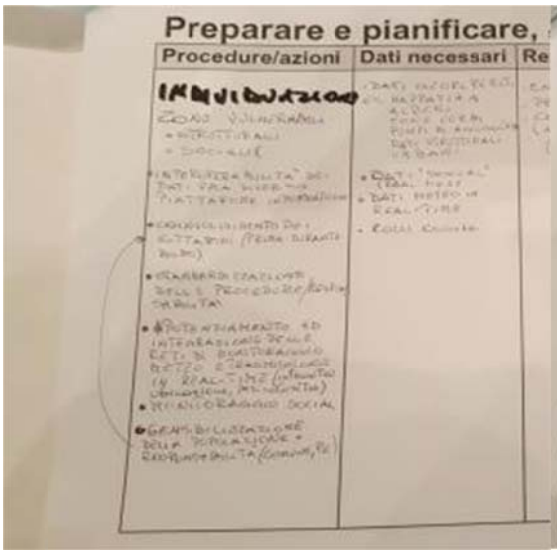
# APPENDIX 1: ATTENDANCE LIST

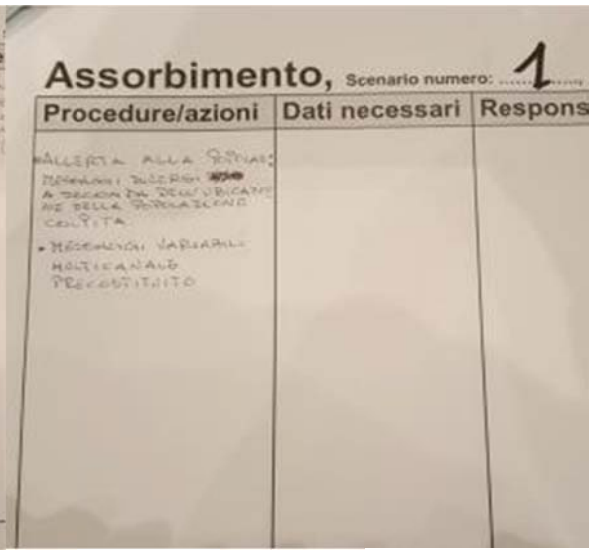
| Family Name | First Name | Affiliation | Category | Family Name | First Name | Affiliation | Category |
|---|---|---|---|---|---|---|---|
| Antonini | Andrea | LAMMA | Climate/ Environment | Morelli | Stefano | UNIFI-DST | Geology |
| Assfalg | Jurgen | Citta' Metrop. | Mobility | Nesi | Paolo | UNIFI-DISIT | Information Engineering |
| Azzari | Margherita | UNIFI | Geography | Niccolai | Fabio | ESTRACOM spa | Energy |
| Bartalesi | Giacomo | CDF | Public body Civil Protection | Pagliai | Susanna | ASF Toscana | Public Health |
| Basta | Michele | CDF-MOB | Mobility | Pauzié | Annie | IFSTTAR/LESCOT | Transport |
| Battistini | Alessandro | UNIFI | | Pazzi | Veronica | UNIFI | |
| Bavazzano | Maddalena | ARPAT | Environment | Piccini | Leonardo | IRPET | Economy |
| Bekiaris | Evangelos | CERTH | Transport | Pierini | Valentina | CDF | Pubic body |
| Bellini | Pierfrancesco | UNIFI – DISIT | Information Engineering | Rossi | Roberto | THALES | Transport |
| Bellini | Emanuele | UNIFI – DISIT | Information Engineering | Salvadori | Andrea | Comune Montelupo Fiorentiino - ANCI | National Association of City Council - Resilience |
| Benelli | Giuliano | UNISI | Information Engineering | Taverniti | Manuela | CDF | Public body |
| Candelieri | Antonio | CMR | Resilience research | Vaiani | Mauro | CDF | Pubic body |
| Coconea | Elena | SWARCO | Transport | Vallario | Guiseppe | CO Firenze 2016 | Public body |
| Crisci | Alfonso | UNIFI-DMSC | Environment | Vannuccini | Gianluca | CDF-SI | Information System |
| De Filippis | Tiziana | CNR-IBIMET | Environment | Zamperlin | Paola | UNIFI | Geography |
| Deloukas | Alexandros | ATTIKO | Transport Research | | | | |
| Drosou | Anastasios | CERTH | Information System | Marianini | Martina | CDF | Economy |
| Fanti | Riccardo | UNIFI-DST | Geology | Di Consto | Mariano | UNIFI DISIT | Information Engineering |
| Ferreira | Pedro | COFAC | Resilience | Martelli | Giacomo | UNIFI | Information Engineering |
| Forte | Ivan | VALDERA | City Concils Association | Badli | Claudio | UNIFI | Information Engineering |

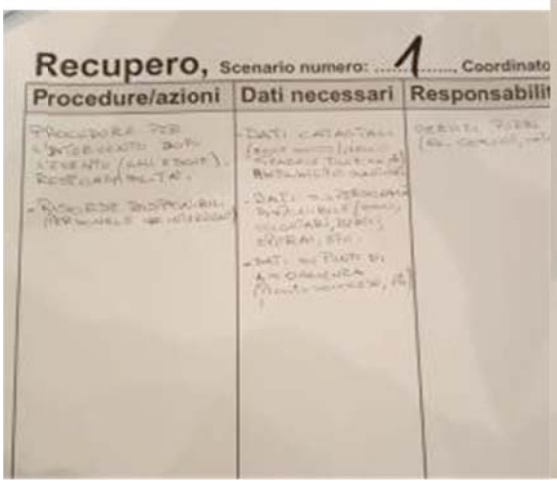
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gaitanidou | Lila | CERTH | Transport Research | Lorenzini | Chara | Citta' Metrop. | Mobility |
| Gigli | Giovanni | UNIFI | UNIFI | Materssi | Marco | CDF | Public Body General Directorate |
| Grifoni | Andrea | THALES | Transport | Campatelli | Federico | ANCI Toscana | National Association of City Council |
| Karagkounis | Evangelos | STASY Urban Rail | Transport research | Maria Flora | Salvatori | UNIFI-DISIA | Statistics |
| Leuteritz | Jan-Paul | FHG-IAO | Human Factor | Paolucci | Michela | UNIFI –DISIT | Information Engineering |
| Martelli | Cristina | UNIFI-DISIA | Statistics | Piccoli | Elisabetta | CDF | Public body |
| Mendoza | Lucile | HUMANIST | Resilience network | Sbandati | Andrea | CISPEL | Critical Infrastructures (water, transport, ecc. |
| Montini | Giovanni | ADB Arno | River Authority | Venturi | Alessandro | UNIFI | Information Engineering |
| Morabito | Marco | CNR-IBIMET | Environment research | | | | |

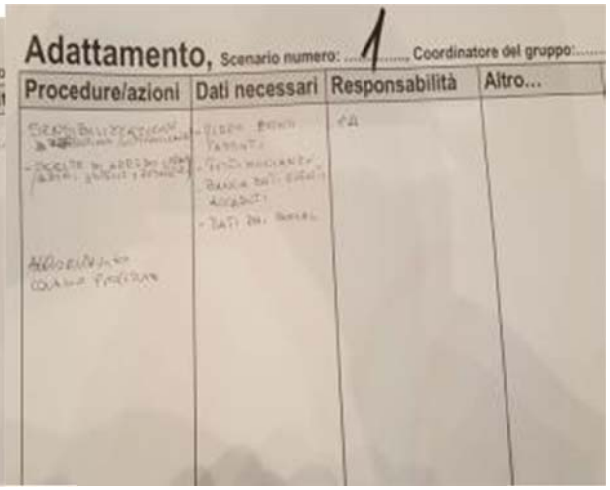
# APPENDIX 2: GROUP WORK PICTURES

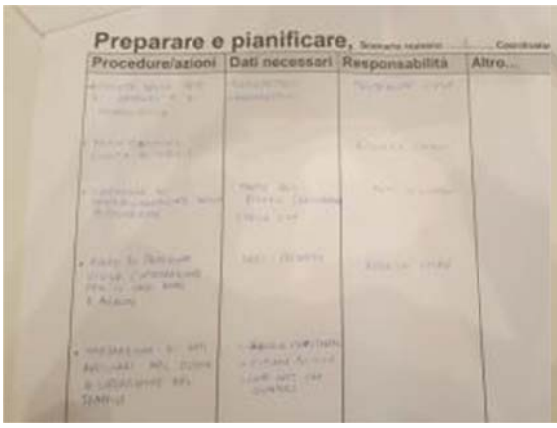
Scenario n. 1

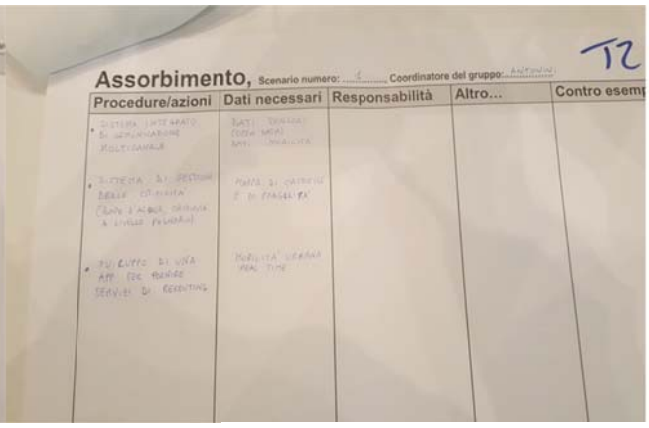


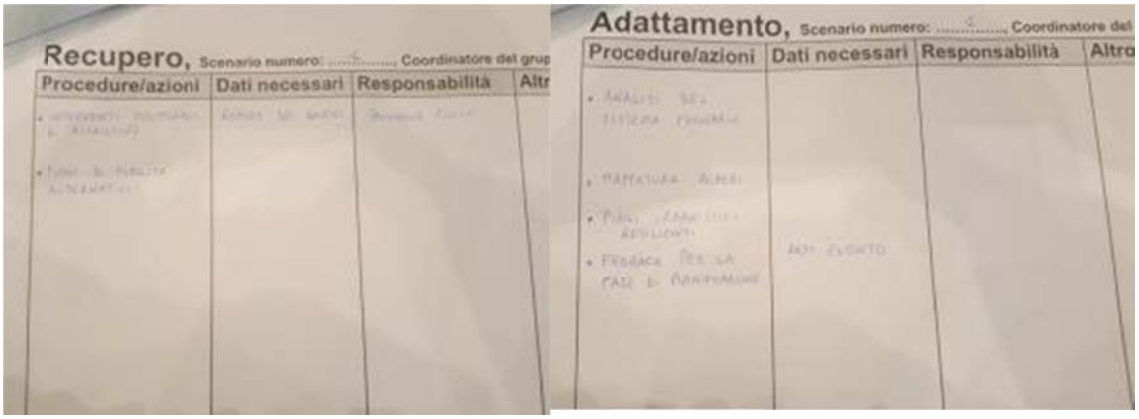



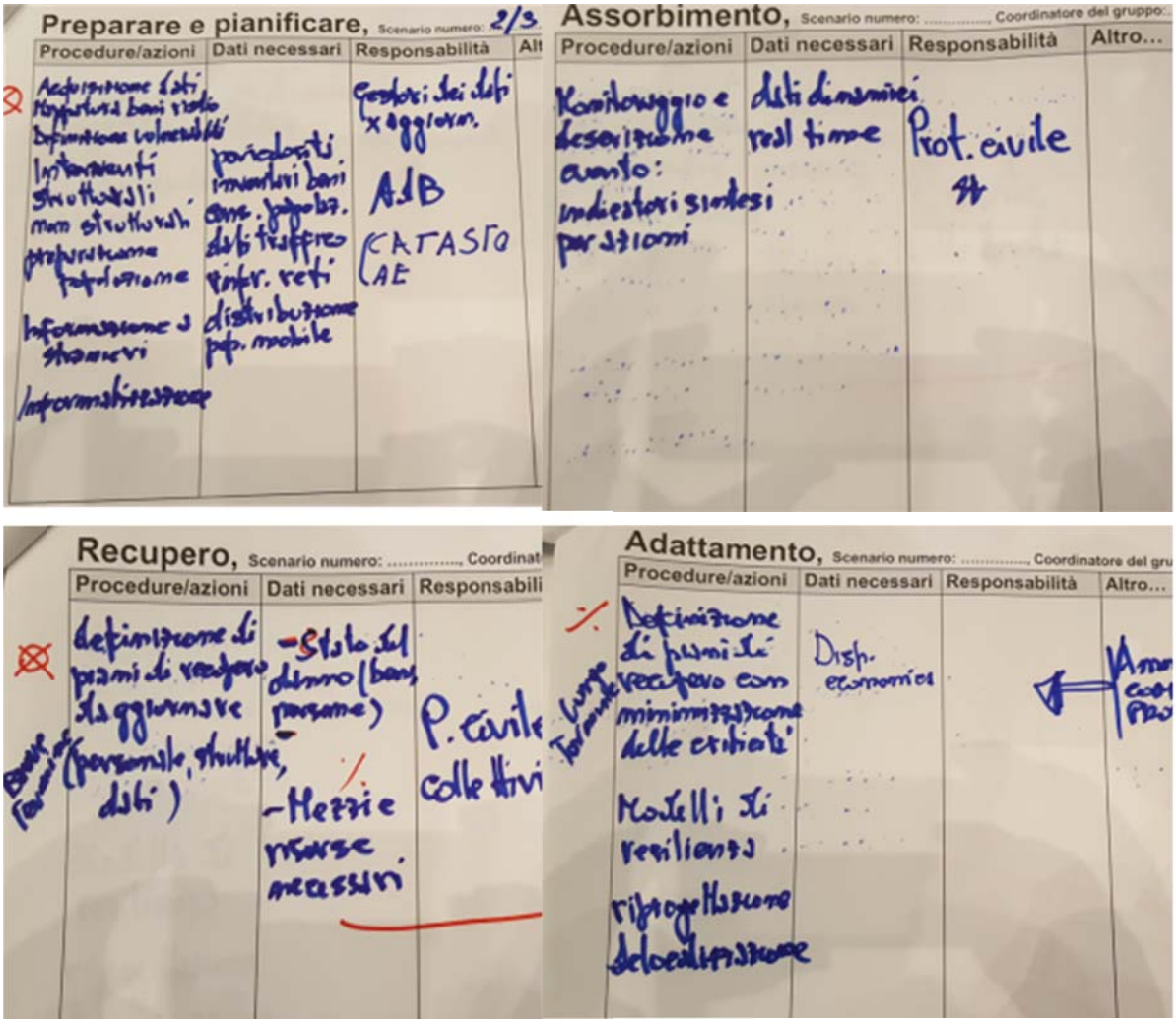



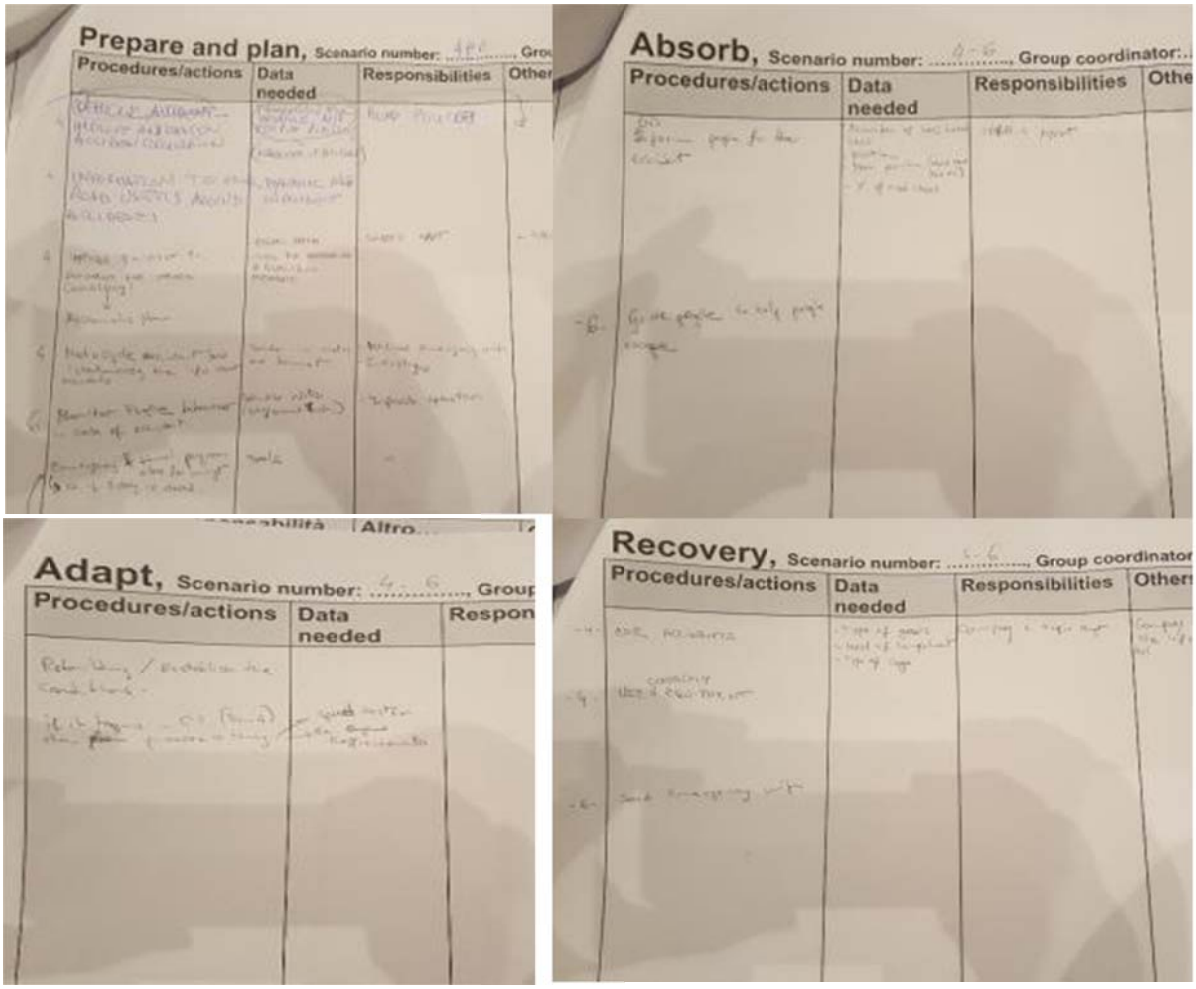



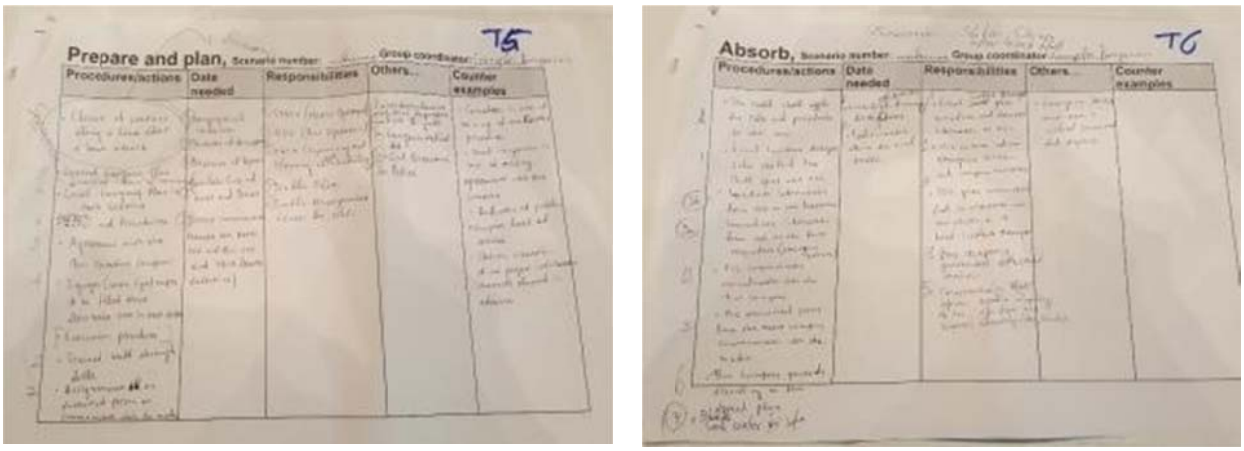


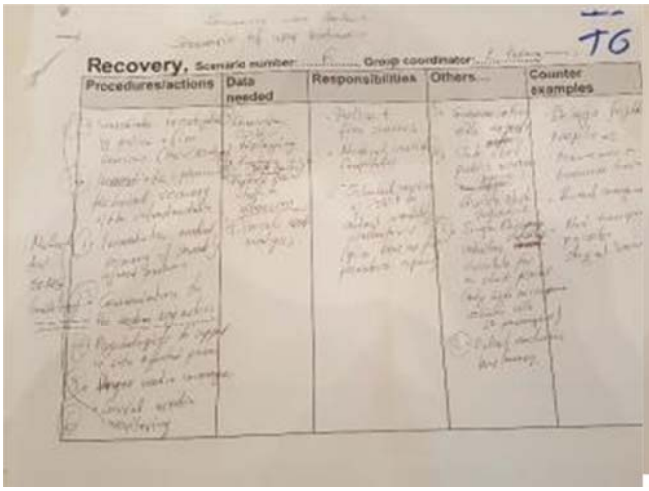

Scenario N. 2-3

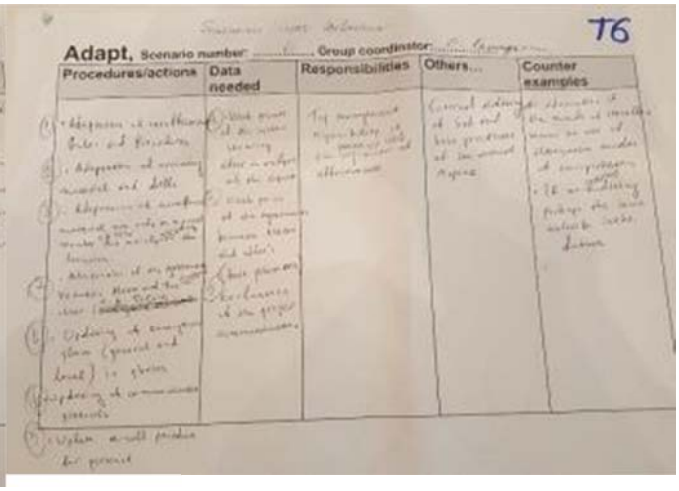



Prepare and plan, Scenario number: ..... Gro
Procedures/actions
Data needed
Responsibilities
Other
Absorb, Scenario number: ..... Group coordinator:..
Procedures/actions
Data needed
Responsibilities
Othe
Adapt, Scenario number: ..... Group
Procedures/actions
Data needed
Respon
Recovery, Scenario number: ..... Group coordinator
Procedures/actions
Data needed
Responsibilities
Other

Scenario n. 5


T5
Prepare and plan, Scenario number: ..... Group coordinator: .....
Procedures/actions
Data needed
Responsibilities
Others...
Counter examples
T6
Absorb, Scenario number ..... Group coordinator .....
Procedures/actions
Data needed
Responsibilities
Others...
Counter examples




Scenario n. 4-6