ATTIKO METPO A.E.

STANDARDS FOR SUSTAINABLE AND SMART CITIES

ESYP/NATIONAL QUALITY INFRASTRUCTURE SYSTEM
ELOT/HELLENIC ORGANIZATION FOR STANDARDIZATION

PARTICIPATORY EXPERIENCE IN H2020 PROGRAMMES AND IMPLEMENTATION REQUIREMENTS FOR 'RESOLUTE' RESILIENCE GUIDELINES AND STANDARDS

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RESILIENCE MANAGEMENT GUIDELINES AND OPERATIONALIZATION APPLIED TO URBAN TRANSPORT ENVIRONMENT (RESOLUTE)

- H2020 RESOLUTE is based on the vision of achieving higher resilience of operations in European Urban Transport Systems (UTS)
- ATTIKO METRO (together with the City of Florence) is the basic end user-partner of the RESOLUTE project (www.resolute.eu.org). Athens Metro is a Critical Infrastructure (CI) of national importance.
- RESOLUTE aims :

- Reviewing of the state-of-art of resilience assessment as well as national guidelines in order to develop a conceptual framework for maintaining UTS
- Developing European Resilience Management Guidelines (ERMG)
- Operationalising and validating the ERMG addressing road and urban rail infrastructures
- Enhancing resilience by training emergency personnel and civilians on the ERMG system
- Adopting of the ERMG at EU level

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- Under critical circumstances, public authorities, disaster response services and Traffic Control Centers manage urban traffic by activating emergency rules and procedures to limit private traffic, aiming to mitigate damages and re-establish normal operations as briefly as possible.
- Public stakeholders invest in measures to improve preparedness, response and recovery for specific catastrophic scenarios.
- Problem : fragmented and ill-defined responsibilities and intervention procedures
- Target audience of ERMG guidelines & standards: City and Critical Infrastructures (CI) managers. Using ERMG standards, they should fill the gap between actual and desired status of resilience management.
- ERMG standards refer to system functions that different CIs have in common. The functions are categorized to four (4) stages that a system needs to maintain in order to be resilient :

- Plan/Prepare : set the groundwork to keep assets functioning during a disruptive event
- Absorb : maintain asset function and service availability while setting back the disruption
- Recover : restore asset function and service availability to pre-event level
- Adapt: use experience from the disruptive event to improve standards, personnel training or other aspects to become more resilient

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- The resilience of a critical infrastructure such as the Urban Transport System can be described by its abilities to:

(1) *anticipate* potential threats or opportunities for changes;

(2) *respond* to regular or irregular disruptions by adjusting functioning to existing conditions;

(3) *monitor* both the system and the environment for what could become a threat in the immediate time frame;

(4) *learn* from experiences of both successes and failures.

- In an effort to assess the potential for resilience of the UTS, four capabilities should be considered, i.e. four sets of questions where the answers can be used to construct the system's resilience profile;
  examples of questions for each of the four system abilities follow:
  (Anticipating) How long is the organization willing to look ahead?
  (Responding) For which events is there a response ready? How soon can a response be given?
  (Monitoring) What are the key performance indicators? How, when and why are they revised?
  (Learning) Is learning based both on successes and failures?
- Anticipating functions: This type includes all functions performed when planning for operation of CIs, such as (a) Develop a Strategic Plan, (b) Manage awareness and user behavior, (c) Train staff.
- Responding functions: These are functions performed following a system disruption, such as (a) Restore/repair physical infrastructure, (b) Restore/repair operations, (c) Coordinate emergency actions.
- Monitoring functions: These functions have been defined so that they are flexible enough to increase or relax the data collections according to a potential or ongoing event. Examples of monitoring functions are: (a) Monitor resource availability, (b) Monitor safety and security, (c) Monitor user generated feedback.
- Learning functions: (a) Collect event information, (b) Provide adaptation and improvement insights.

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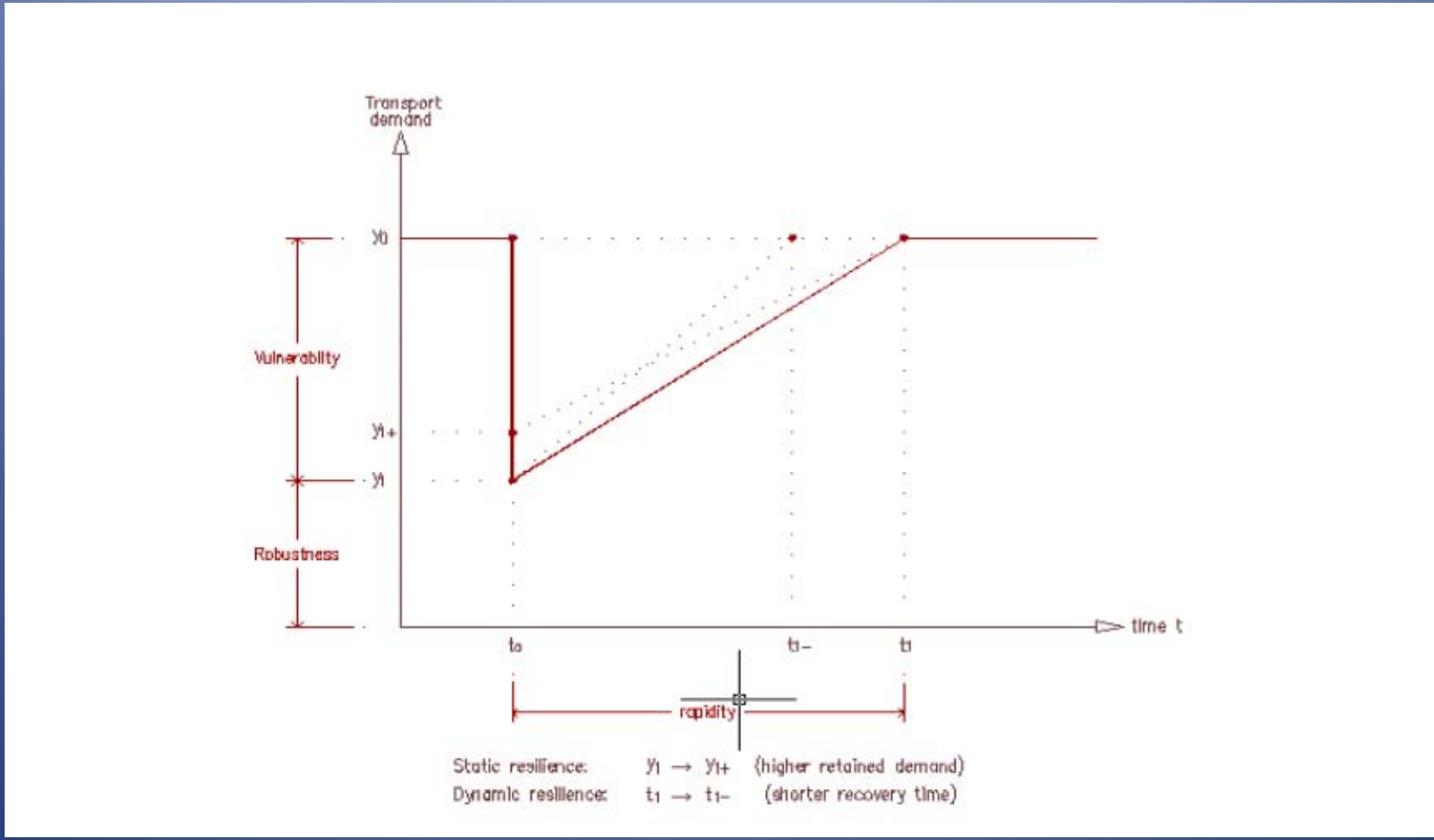

Static and dynamic resilience

(source: A. Deloukas, Tools and operational data available [Attiko], www.resolute-eu.org/index.php/2015-07-16-15-29-23/resolute-1st-workshop)

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***Example:* Metro static resilience**

The *static resilience* of the UTS demand is related to the UTS robustness – i.e. maintaining system function after the shock without immediate metro infrastructure restoration. The corresponding guideline and function describes how to *absorb/respond* to an attack. The staffs recall system and reserve capacities (e.g. spare trains) have to be mobilised. The efficiency of modal substitute strategies (bus bridging, interdiction of Single Occupancy Vehicle use, bus lane extension or lifting road tolls in conjunction with Variable Message Sign re-direction updates) is assessed in advance with the use of a multi-modal transportation model. The retraction of spare buses from proximal depots and scheduled bus lines is a critical strategy component. Effective replacement management mitigates the transport capacity degradation of the UTS during the disruption.

Transportation model runs estimate with static assignments the interplay of disrupted UTS supply and demand. *KPI metric for demand recovery* is a static resilience indicator measuring the transport demand covered by residual metro and alternate carriage capacity as percentage of the transport demand reduction due to an attack.

RESILIENCE MANAGEMENT GUIDELINES AND OPERATIONALIZATION APPLIED TO URBAN TRANSPORT ENVIRONMENT (RESOLUTE)

***Example*: Metro dynamic resilience**

The *dynamic resilience* of metro demand aims to re-establish the initial level of demand as briefly as possible after a disastrous attack. This presupposes fast repair of the infrastructure (*physical layer*) and restoration of the transport operations (*service layer*). The corresponding guidelines and functions describe how to *absorb/respond to and recover* after an attack. Typical is an exponential recovery time path. Aimed is the reduction of downtime and degraded modus operandi. The critical *KPI for the restoration* is the recovery time back to 90% operability of the metro network.

Modelled scenario comparisons estimate the recovery rate of metro demand, the latter KPI being a performance *process* indicator.