SEPHRA

SEcurity

Protection and

Hardening

Risk

Analysis

Presented by:

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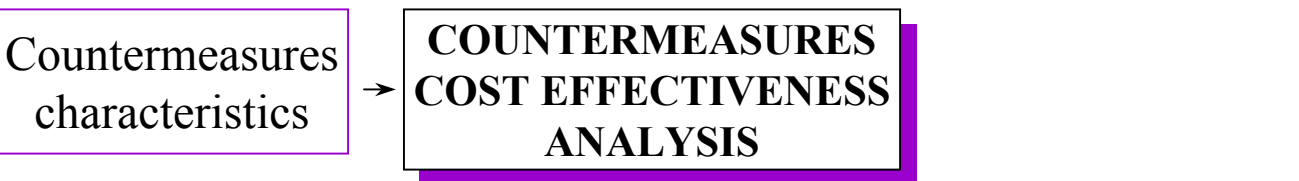
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SEPHRA

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| Defined threats | → | **THREAT ANALYSIS** | → | Probabilistic threats |

| Installation characteristics | → | | | |

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| **DAMAGE ANALYSIS** | → | Expected damage/injuries |

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| **RISK ASSESSMENT** | → | Risk level |

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| Countermeasures characteristics | → | **COUNTERMEASURES COST EFFECTIVENESS ANALYSIS** |

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| **COUNTERMEASURES OPTIMIZATION** | → | Optimal countermeasures |

Protective Hardening Consultancy Using SEPHRA

Stage 1 - Threat Analysis

- Defining various envisaged threats including external and internal placing of explosives, vehicle bombs on adjacent streets/public areas, shooting,etc.

- Compiling a suggested list of threats with their respective probability of occurrence, to be considered in the design/retrofit of the structure.

Stage 2 - Damage Analysis

- Calculating the blast and contact explosion effects of the defined threats on the structural elements in various locations, sensitive to terrorist attacks.

- Assessing the structural damage expected from the explosion effects, based on practical experience (EBD's unique database on terrorist attacks effects) and on engineering judgement.

- Expressing the expected damage in terms of the number of injured people as well as damage levels to systems and equipment, throughout the building .
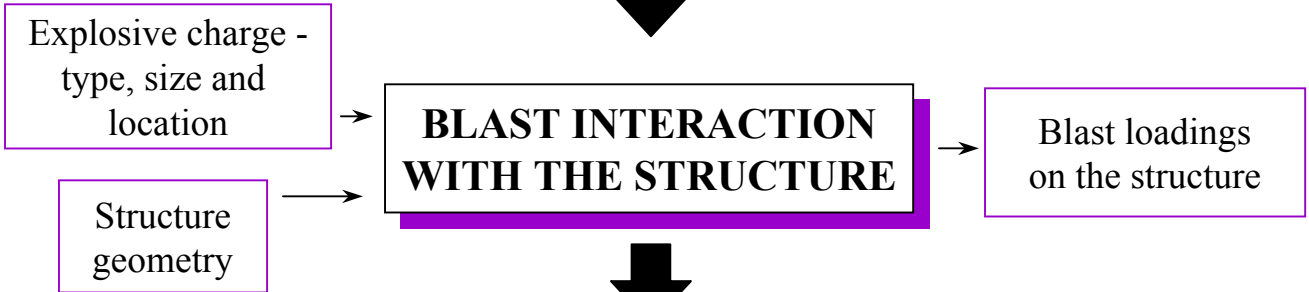
DAMAGE ANALYSIS BLAST EFFECTS

Explosive charge - type, size and location

Structure geometry

BLAST INTERACTION WITH THE STRUCTURE

Blast loadings on the structure

Structural elements characteristics

ASSESSMENT OF DAMAGE TO THE STRUCTURAL ELEMENTS

Displacements

Accelerations, Velocities

ASSESSMENT OF INTERNAL DAMAGING EFFECTS

Spalling

Flying objects/ debris

Shock effects

Equipment characteristics

Density of people

ASSESSMENT OF DAMAGE TO INTERNAL EQUIPMENT/PEOPLE

Equipment survivability

Number of expected injuries

The damage assessment is based on:

- Observed weapons/destructive devices effects on real structures.

- Full scale tests on real structures.

- Recorded damages to structures during real attacks (summarized in our extensive database ODS - Observed Damages to Structures - including more then 39,000 events).

- Calculations of weapons effects and structural response.

- Engineering judgement based on practical experience.

The damage can be expressed as:

- Costs for repairs of the direct damage.

- Costs for indirect damage.

- Number of people injured.

- Time required to return to normal functioning.

- Relative capability to perform the required functions.

Protective Hardening Consultancy

Using SEPHRA

Stage 3 - Risk Assessment

- Calculating risk levels in various locations by combining the threats probabilities of occurrence with the expected damages.

- Expressing the risk levels in different terms:

  - Structural damage.

  - Number of expected injured people.

  - Damage levels to equipment and systems.

Stage 4 - Hardening Protective Measures
Cost Effectiveness Analysis

- Recommending various hardening protection measures, including their characteristics, configuration, location, materials, etc.

- Relating each hardening protective measure to a respective reduction in the damage/risk level, based on EBD's practical experience and engineering judgement.

- Estimating the cost of the hardening protective measures.

Stage 5 - Optimal Hardening Protective Measures

- Plotting the cost of the hardening protective measures versus their respective levels of damage.

- Graphically, defining the optimal most cost effective set of hardening protective measures.

ESTIMATED
  DAMAGE
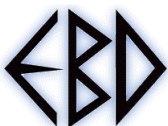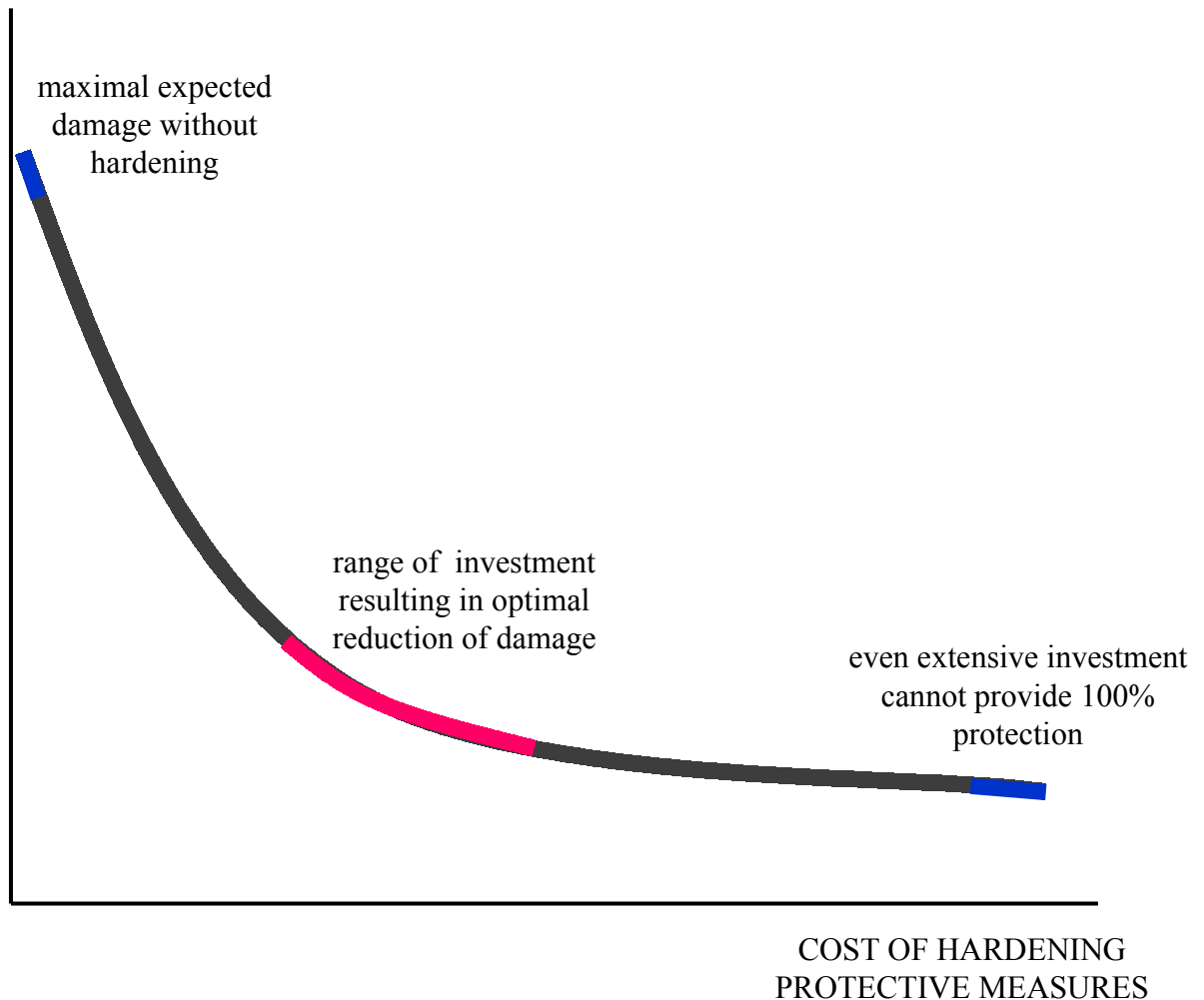
maximal expected
damage without
hardening

range of investment
resulting in optimal
reduction of damage

even extensive investment
cannot provide 100%
protection

COST OF HARDENING
PROTECTIVE MEASURES

SEPHRA APPLICATIONS

1. THREAT DEFINITION - types of attacks, kind and size of weapons, hit characteristics (direct hit, near miss - distance, single or multiple hits) - now and in the future.

2. QUANTIFY RISK LEVEL to existing/newly designed structures, facilities, installations, sites, etc.

3. FIND OPTIMAL COUNTERMEASURES - security, protection and hardening measures

    A. For existing installations.

    B. For newly designed installations.

4. FIND OPTIMAL UPGRADING - security, protection and hardening measures.

5. DEFINE OPTIMAL MASTER PLAN FOR SECURITY, HARDENING AND PROTECTION including optimal site, optimal facility layout, optimal structures layout, optimal security measures.

6. DAMAGE CONTROL - assessment of all types of damages and the optimal repair measures and procedures.

7. ANALIZE ENVIRONMENTAL HAZARDS - calculate the level of risk to the surroundings.

HOW DOES SEPHRA WORK?

1. It is a computer-aided analysis based on man-machine continuous interface. (no black box - garbage in, garbage out)

2. It is a combination of numerous basic subroutines manually chosen and used by the analyst.

   examples: projectiles hit probability

   blast waves propagation

   fragments penetration into finite concrete elements.

   personnel vulnerability to spalling.

   computer shock tolerance.

   reduction of blast by shielding walls.

(the concept was not to compile a general computer code which can solve particular cases - similar to NASTRAN) (actually we tried, but after 3 years and no satisfaction we gave up and accepted defeat)

3. The concept was proven adequate because:

   a. A PC-computer is sufficient.

   b. The analyst expertise and judgement is fully used.

   c. The intermediate results can be easily checked.

   d. The analysis costs to the client are cheap compared to all other analysis procedures.

SEPHRA SPECIFIC CHARACTERISTICS

1. Can deal with numerous threats simultaneously including considering/calculating the weapons hit probabilities and the relative probabilities of occurrence.

2. Calculates weapons effects, structural response and expected damages/injuries based on extensive practical experience.

3. Correlates all security, hardening and protection measures with the respective reduction in risk, based on extensive practical experience and engineering judgement.

4. Presents the analysis results in a "managerial" format providing an optimal tool for decision making.

PRESENT STATUS OF SEPHRA

- SEPHRA has been and is being used in numerous projects worldwide to the full satisfaction of the clients.

- The SEPHRA subroutines are updated and new ones are compiled constantly.

- The range of installations for which SEPHRA can be used is increasing continuously.

- SEPHRA is updated continuously for new types of threats (newly developed weapons, latest sabotage devices).

- SEPHRA is used also for long-term security, protection and hardening considerations, taking into account possible changes of the threats and the installation characteristics in the future.