

*“The airport cannot operate without fuel, power, communications, and water. The reliability and restoration of these systems are also the greatest unknown for the airport”.*

*- San Francisco Lifelines Report*

# Infrastructure Resilience Framework

**Prepared for 2024 Review**

# Definitions: Hazards, Shocks & Stressors



- **Resiliency:** preparation to adapt, respond and recover due to adversity caused by the impacts of Acute Hazards, Shocks and Stressors



- **Acute Hazards:** potential for injury or damage to occur as a result of an instantaneous or short duration exposure to the effects of sudden shock to physical assets



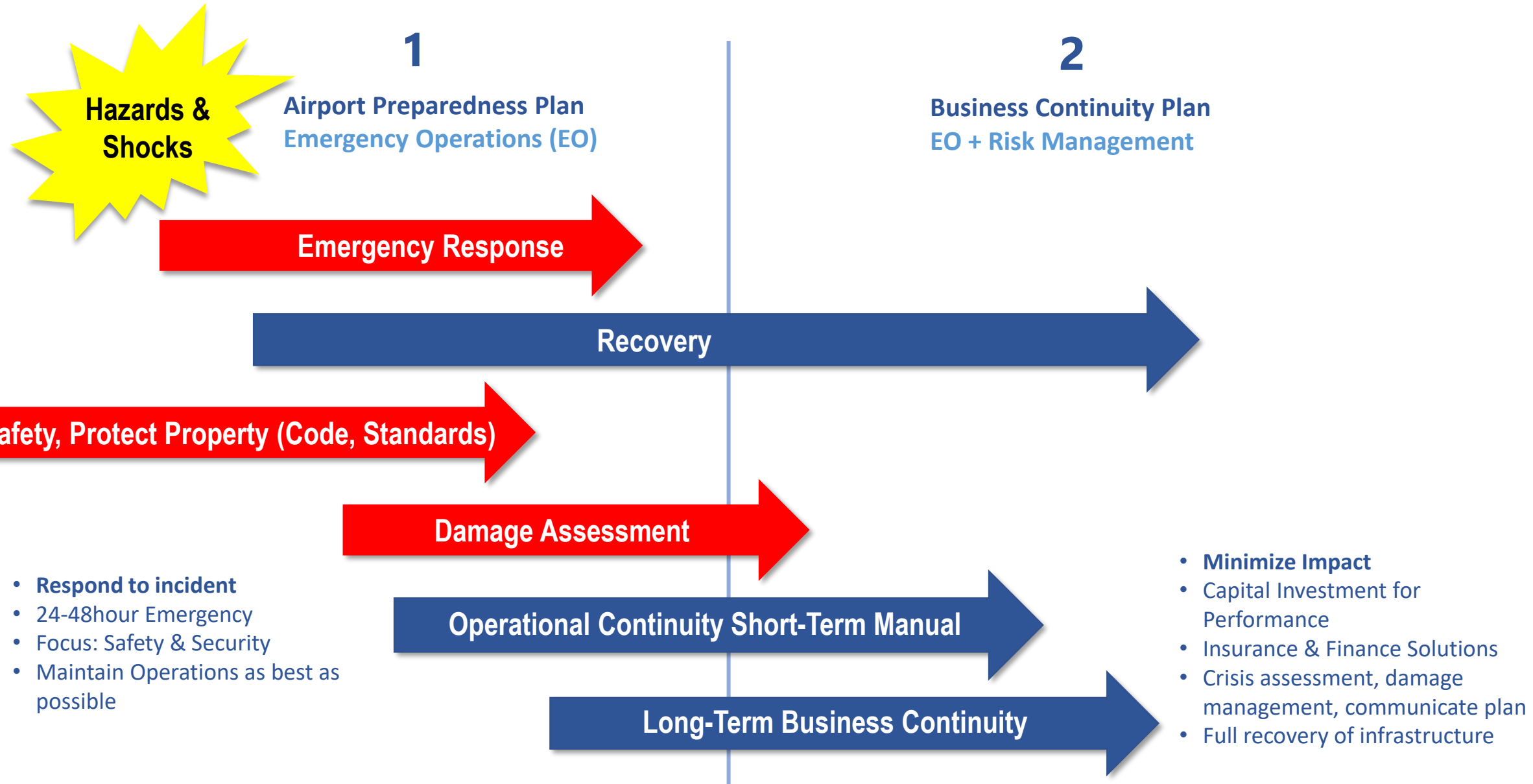
- **Shocks:** external short-term deviations from long-term trends that have substantial negative effects on people's current state of well being, level of assets, livelihood, safety or their ability to withstand shocks



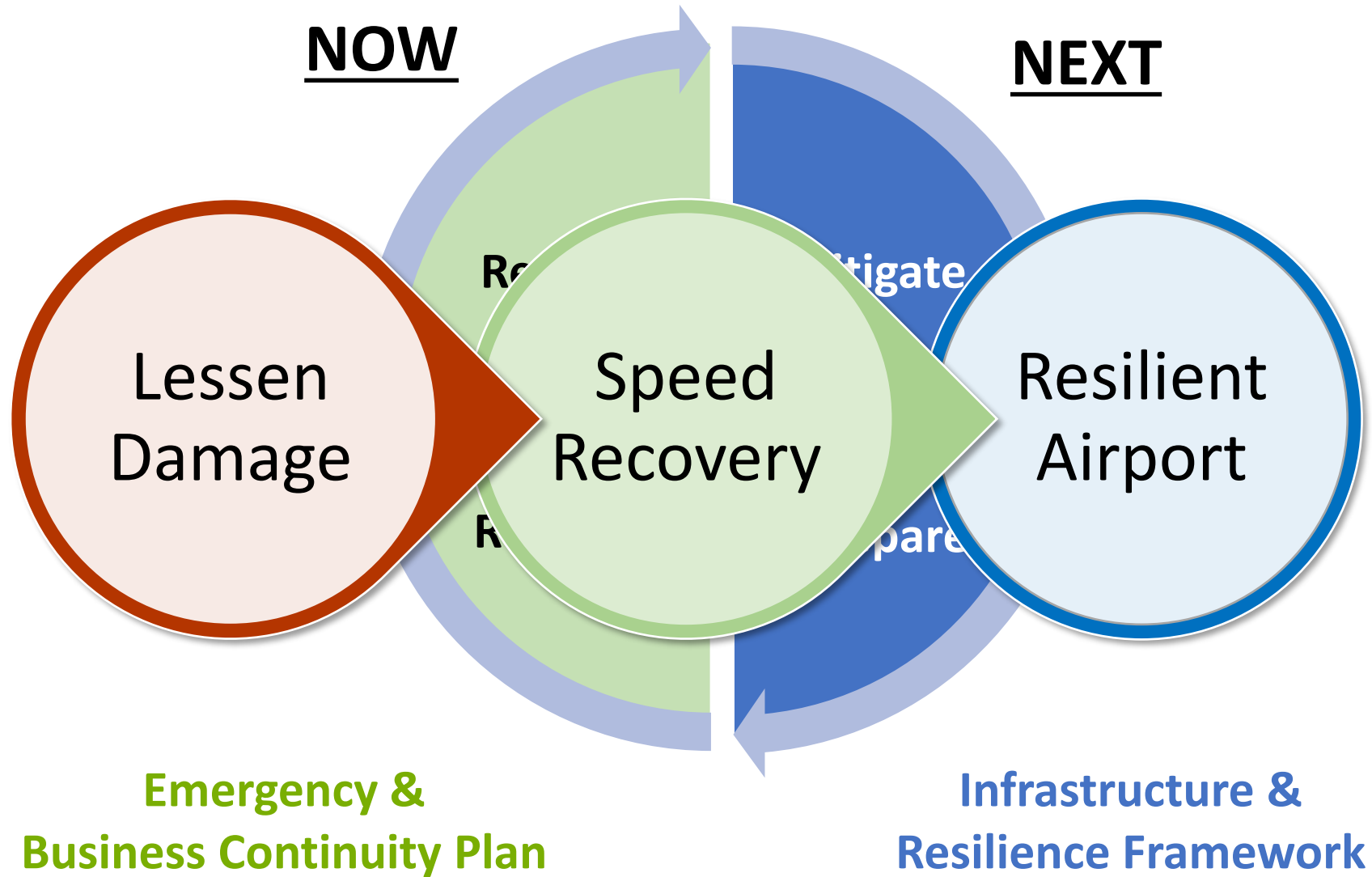
- **Stressors:** long-term trends or pressures that undermine the stability of a system and increase vulnerability within it



# Connected Cross-Airport Activities



# Where We Are and Where We're Headed



# Phased IRF



# Types of Hazards, Shocks & Stressors

## Environmental / Climate

Earthquakes

Flooding

Wind

Rising Sea Levels

Excessive Heat

Drought

Air Quality

## Human-Caused

Cyber Attack

Terrorism

Active Shooter

Explosions

Security Breach

Political Unrest

## Disruption

Energy Disruption

Water Disruption

Telecommunication  
Disruption

Environmental  
Hazards

Pandemics

## Economic

Recession

Inflation

Increase in  
Passengers

Reduced  
Passengers

Reduced Human  
Resources

Deferred  
Maintenance



# Types of Hazards, Shocks & Stressors

## Acute Hazards

Earthquakes

Flooding

Wind

Cyber Attack

Explosions

Energy Disruption

Water Disruption

Telecommunication  
Disruption

Internal Fire

## Shock Events

Terrorism

Active Shooter

Pandemics

Security Breach /  
Failure

Political Unrest

Aircraft Grounding  
/ Emergencies

External Fire  
(Smoke)

Extreme  
Precipitation

Storm Surge

Excessive Heat

## Chronic Stressors

Recession /  
Inflation

Deferred  
Maintenance

Passenger Volume  
Changes / Capacity

Capacity  
Constraints

Loss of Human  
Resources

Pandemics

Air Quality

Drought

Climate Impacts /  
Severe Weather

Rising Sea Levels

# Operations and Services at Risk (*Sample – not all*)

## 1. Passenger Operations / Services

- Processing (Airport operational database, apron management system)
- Passenger Screening
- Passenger boarding bridge (PBB) operation
- (Flight) Information displays

## 2. Airline / Aircraft Operations Services

- Advanced Visual Docking Guidance System (AVDGS)
- Administration / PAX Services – Ticketing Office, Baggage Service Office, Flight Ops
- 400 Hz aircraft power supply system and PCA provided air supply. (Alt - Aircraft could stay on APS)
- GSE / Airside EV charging

## 3. Security Operations / Services

- Airline radio systems in flight operations (Loss of contact with aircraft)
- Systems – Doors, Cameras
- AIOC

## 4. Facility Operations / Services

- Stationary & Mobile Generators
- Baggage handling systems (BHSs)
- Recycling compactors
- Special Systems Rooms (SSRs)



# Systems at Risk (*Sample – not all*)

## 1. Utilities

- Power Supply: lighting/lighting controls, sensor technology, sewage ejector pumps, etc.
- Water: supply pumps, hot water heaters, restrooms, pumped water from central plant, radiant heating/cooling
- Fuel supply – Aircraft, ground fleet, generators (Av Fuel, RD, Gasoline)
- Telecommunications: fiber

## 2. Building Equipment / Systems

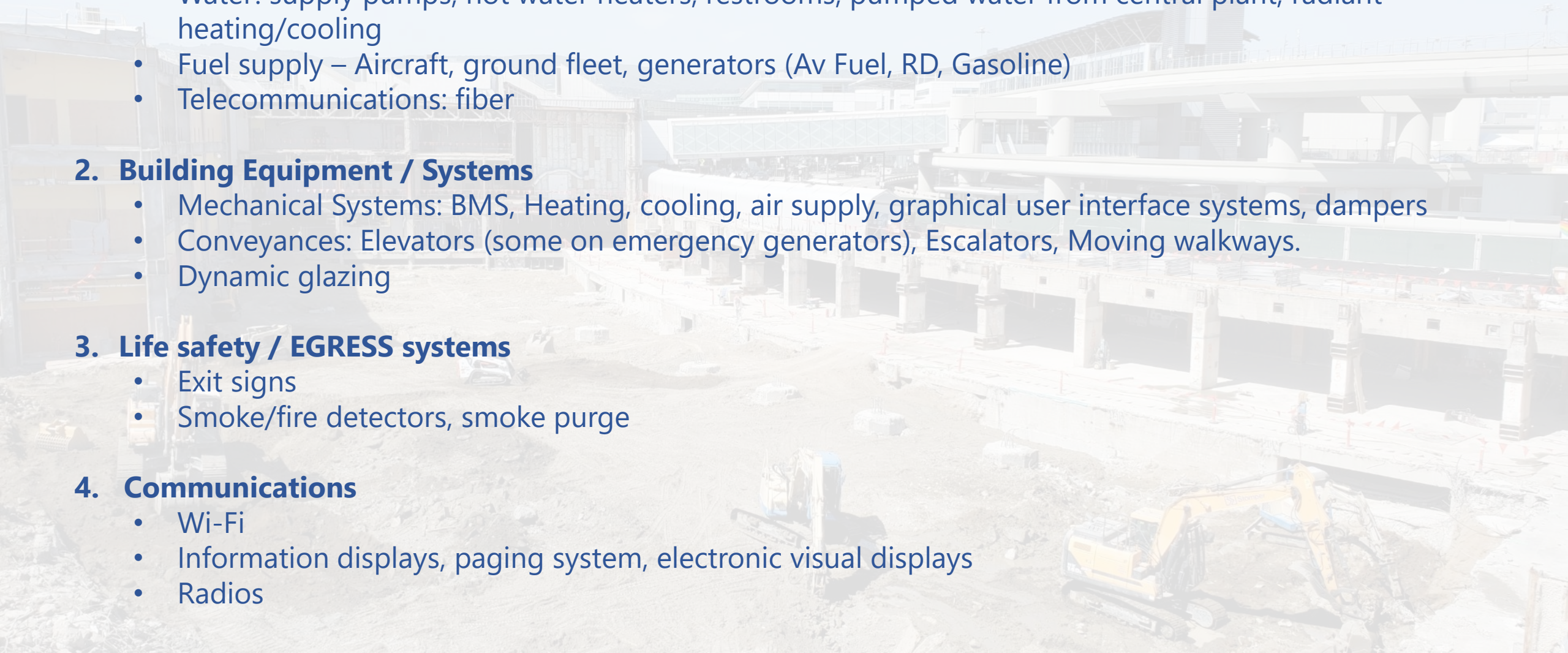
- Mechanical Systems: BMS, Heating, cooling, air supply, graphical user interface systems, dampers
- Conveyances: Elevators (some on emergency generators), Escalators, Moving walkways.
- Dynamic glazing

## 3. Life safety / EGRESS systems

- Exit signs
- Smoke/fire detectors, smoke purge

## 4. Communications

- Wi-Fi
- Information displays, paging system, electronic visual displays
- Radios





# Define Levels of Criticality (Facility) <> Level of Service (Function)

1

**Essential to Maintaining Operations – Must be Fully Operational**  
*Cannot Absorb Damage; Airline, Airport, Passenger Impacts Immediate*

2

"1a"

**Important to Maintaining Operations – Delayed Operation with Minor Repair**  
*Can Accept Absorb Minor Damage; Brief Interruptions or No Disruption*

3

**Non-Essential – Major, but Repairable, Damage**  
*Unlikely to Cause Widespread / Noticeable Issues*

4

**No Impact to Operations – Replacement Required**  
*Accept Damage - No Impact to Operations*



Facilities



Assets

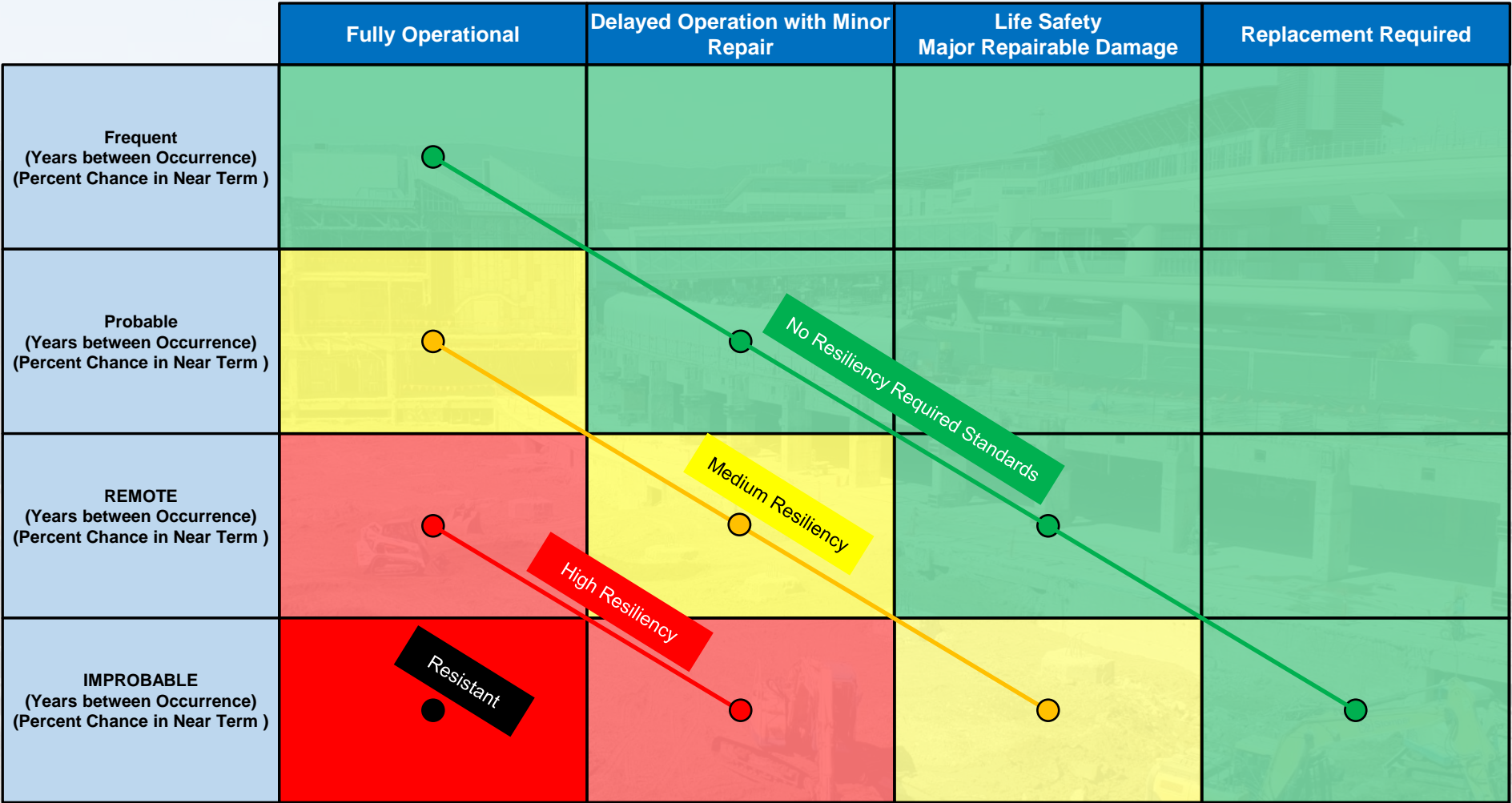


Functions

# Resiliency Level

## Operational Desired Performance / Service Level

Hazard, Shock, Stressor Design Level





# Performance Example

## Modified Mercalli Intensity Scale

Intensity	Shaking	Description/Damage
I	Not Felt	Not felt except by a very few under especially favorable conditions
II	Weak	Felt only by a few persons at rest, especially on upper floors of building
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars many rock slightly. Vibration is like the passing of a truck. Duration estimated
IV	Light	Felt indoors by many, outdoors by a few during the day. At night, some awakened. Dishes, window, doors disturbed, walls make cracking sound, Sensation like heavy truck striking buildings. Standing motor cars rocked noticeably
V	Moderate	Felt by nearly everyone; many awakened. Some Dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structure; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures, considerable damage in ordinary substantial building with partial collapse. Damage great in poorly built structure. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well- designed frame structure thrown out of plumb. Damage great in substantial budlings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooded structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

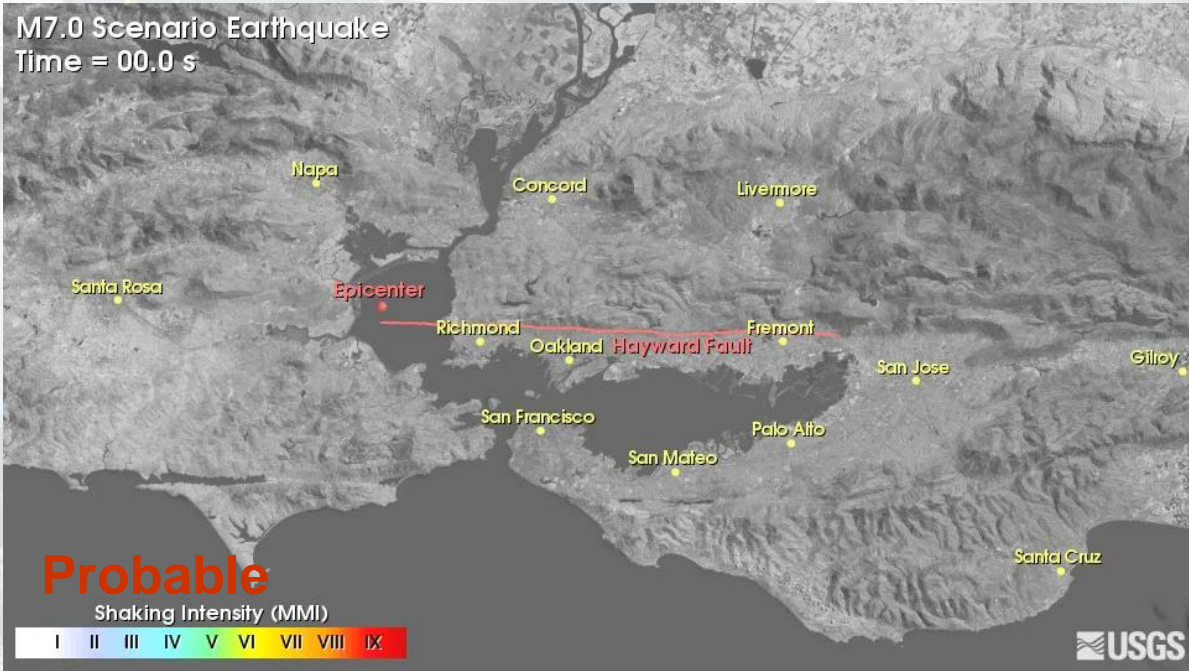




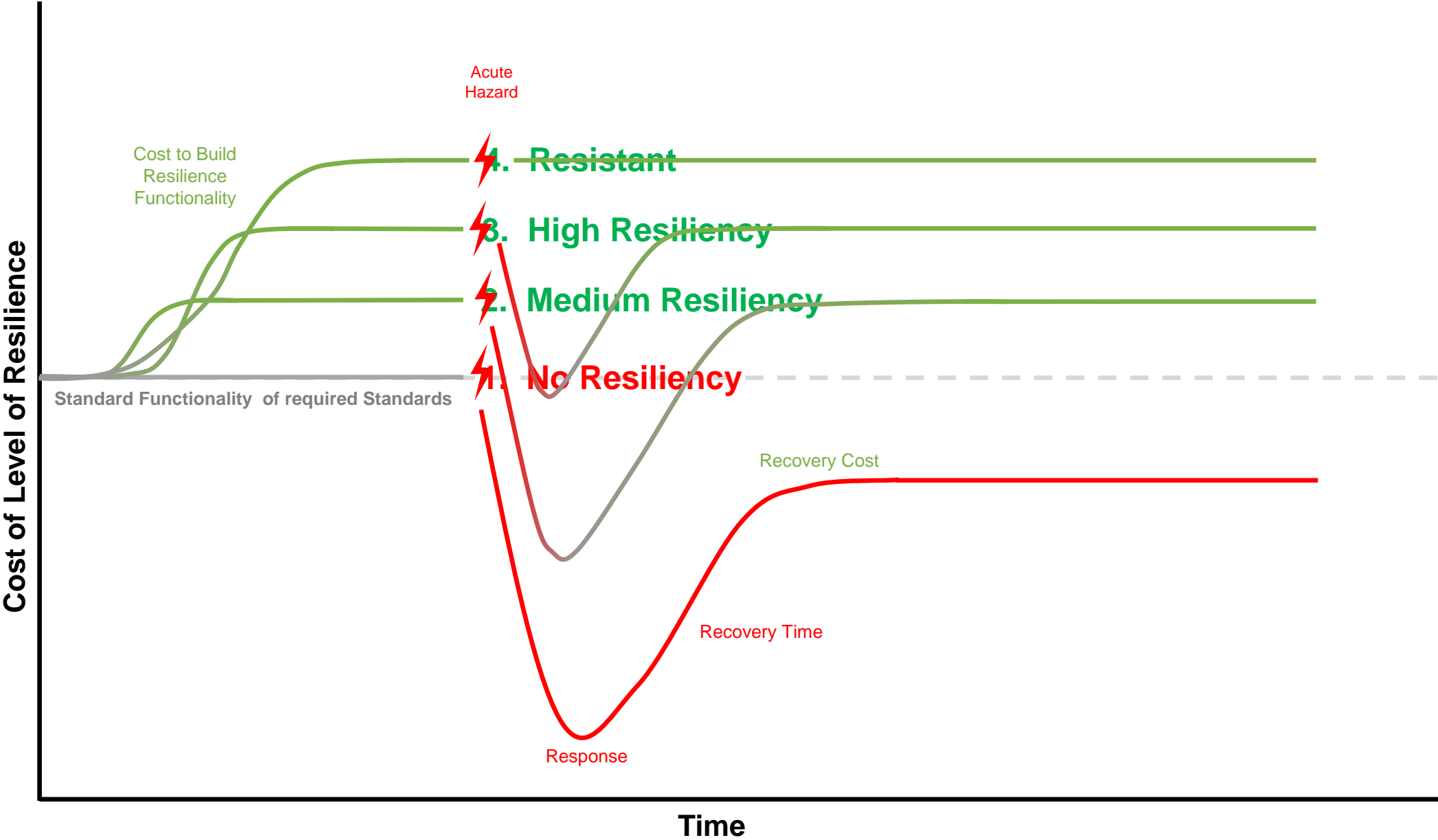
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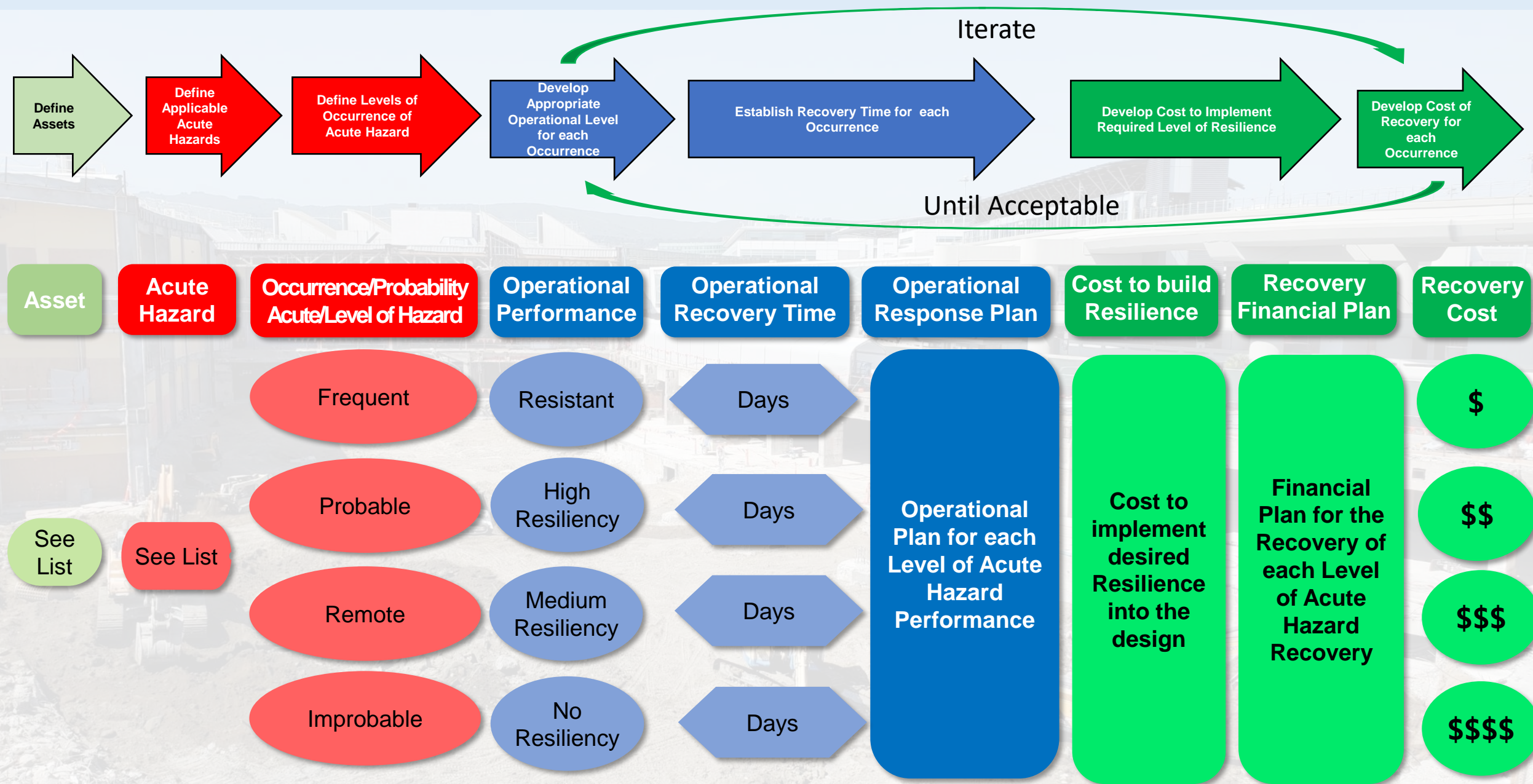


# Cost of Resiliency





# Development of a Resiliency Plan FOR Acute Hazards





Thank you