

Seismic Protection of Industrial Facilities

Beyond the Structural System

STRUCTURAL SAFETY + EQUIPMENT PROTECTION + OPERATIONAL CONTINUITY

Executive Summary

A building may remain standing after an earthquake while the facility becomes unusable. Industrial resilience requires structural safety, equipment protection and operational continuity to be addressed together.

1. Beyond Life Safety

Performance objectives may include maintaining the operation of critical machinery, process piping, emergency systems and electrical distribution, or restoring them rapidly.

2. Non-Structural Risk

Mechanical equipment, electrical systems, piping, suspended services, storage racks, tanks and control systems may be critical to operations.

3. Equipment Anchorage

The complete load path is Equipment → Base or Plinth → Anchorage → Structural System. Inadequate restraint can lead to sliding, rocking, overturning or connection damage.

4. Piping and Electrical Systems

Supports, relative displacements, flexible connections, cable-tray bracing, electrical panels and interactions with adjacent systems must be assessed.

5. Tanks, Racks and Suspended Systems

Anchorage, overturning, sliding, support-system performance and falling-material hazards should be examined for each project.

6. Structure-Equipment Interaction

Floor accelerations, interstorey drift and relative displacements affect non-structural demands. Structural retrofitting may also change the demands on equipment.

7. Criticality and Dependencies

Systems can be classified by their roles in life safety, production and recovery, or as non-critical. Dependencies such as Power → Cooling → Compressed Air → Control → Process must be mapped.

8. Integrated Facility Assessment

Structural Analysis → Equipment Inventory → Non-Structural Assessment → Dependency Mapping → Risk Prioritisation → Retrofitting → Implementation → Verification.

9. Resilience as an Investment

Production losses, supply-chain impacts, equipment replacement, inventory damage and recovery costs form the economic dimension of the engineering decision.

Conclusion

Protect the building, equipment, utilities, processes and business.