

Examples of structural failure

Origin	Design 20%	Execution 50%	Use 15%	Other 15%
Causes	Gross errors 80%		Actions 20%	



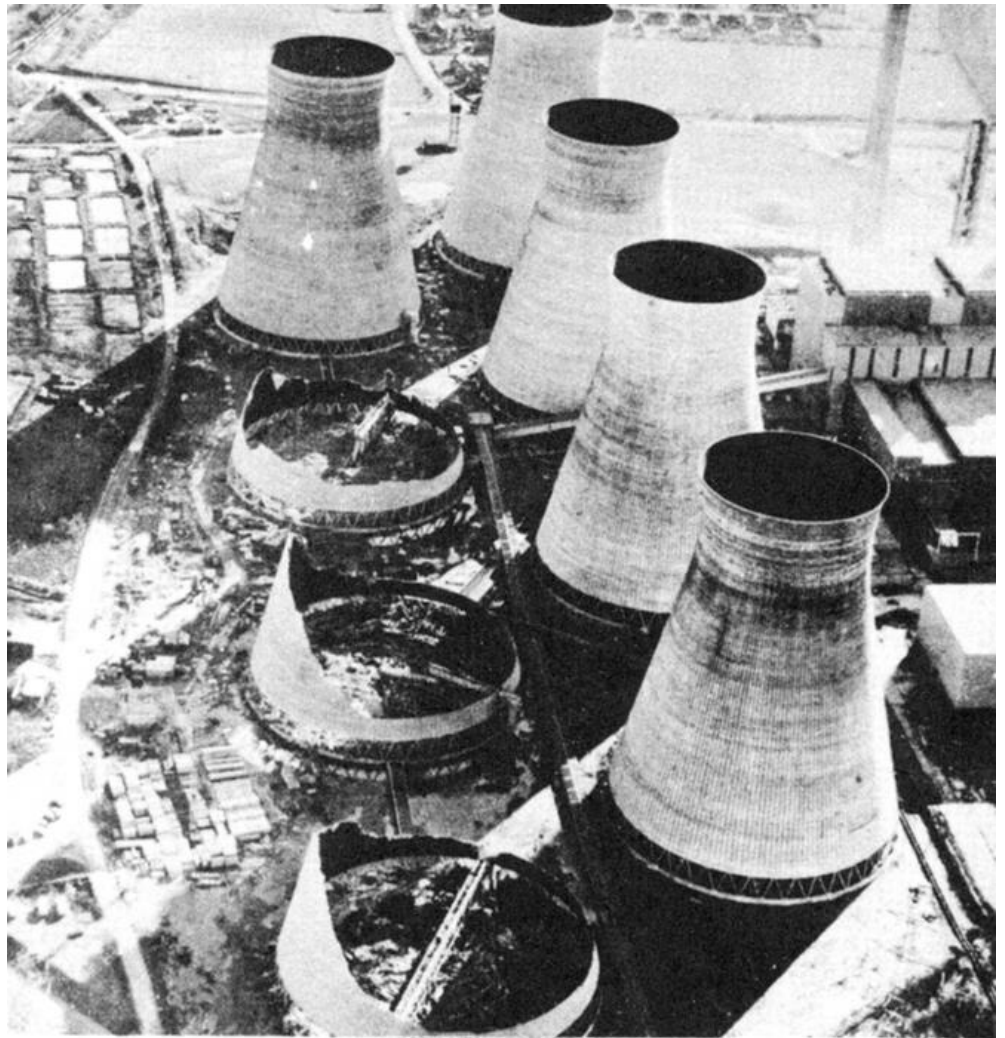
Historical cases
Airport in Paris
Shear punching
Serviceability failure
Environmental influences

Car supporting a house



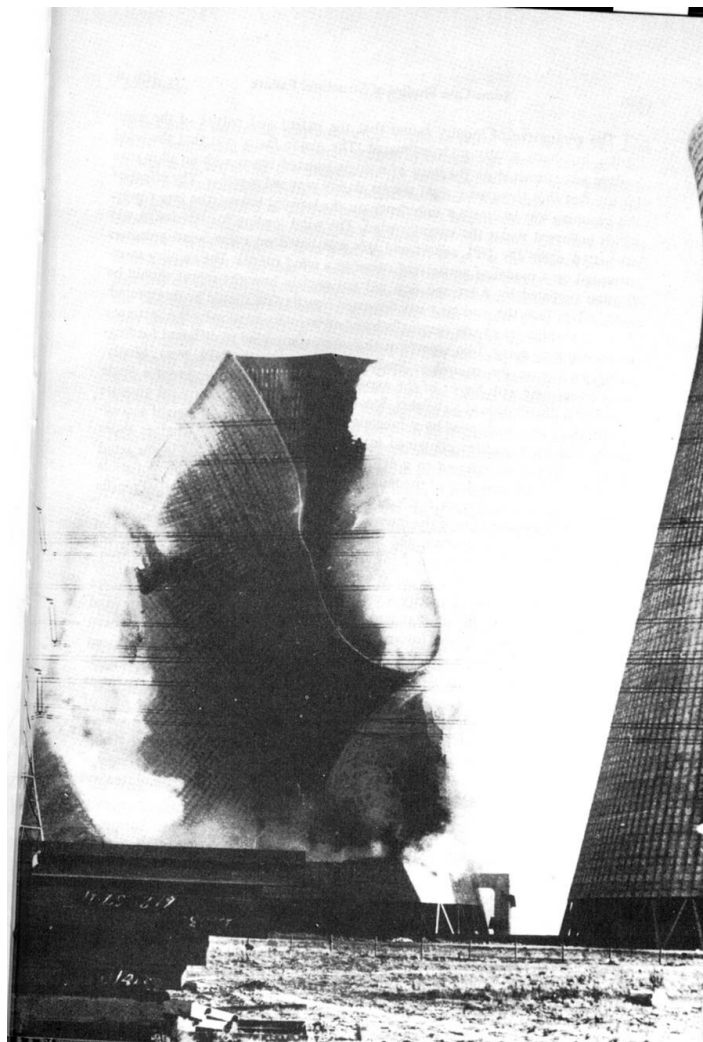
Cooling Towers

at
Ferrybridge
in
Yorkshire,
1965



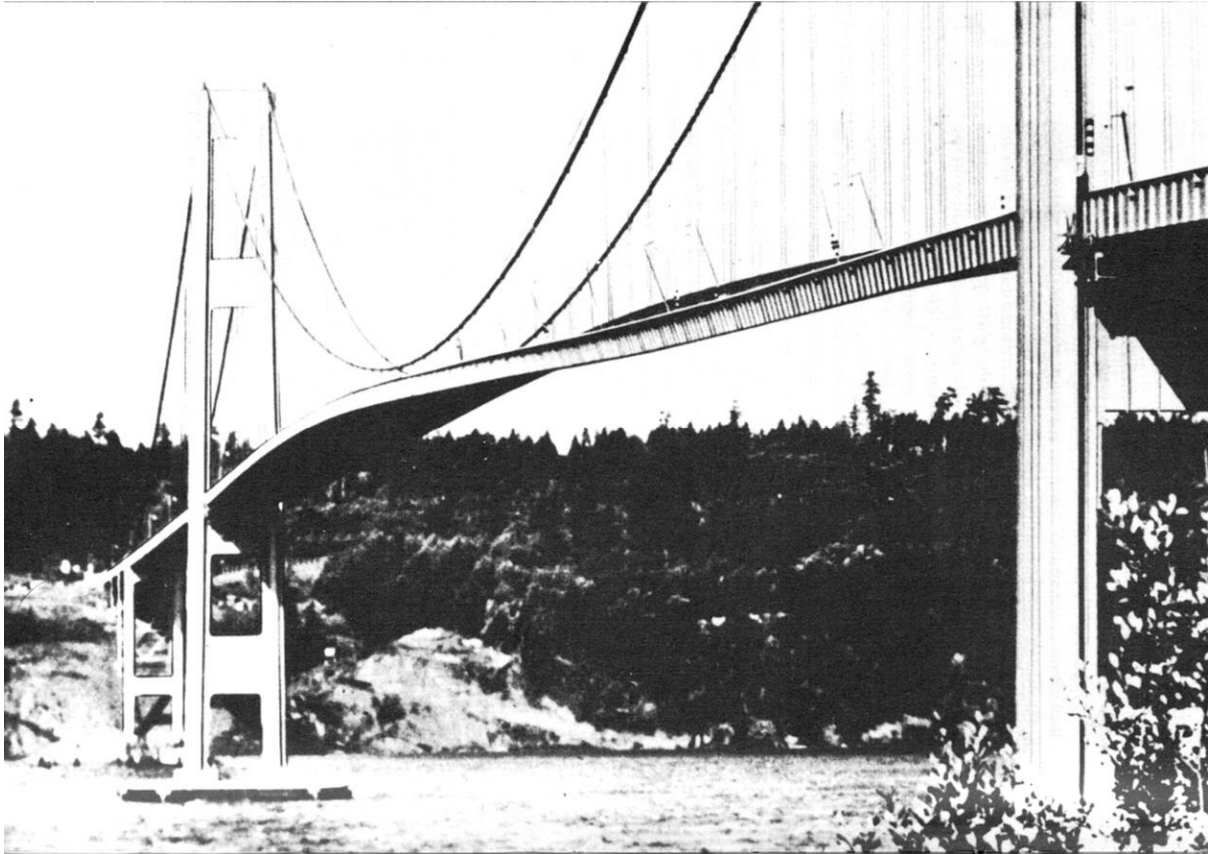
Cooling towers

at Ferrybridge
in Yorkshire,
1965



Tacoma Narrows Bridge 1940

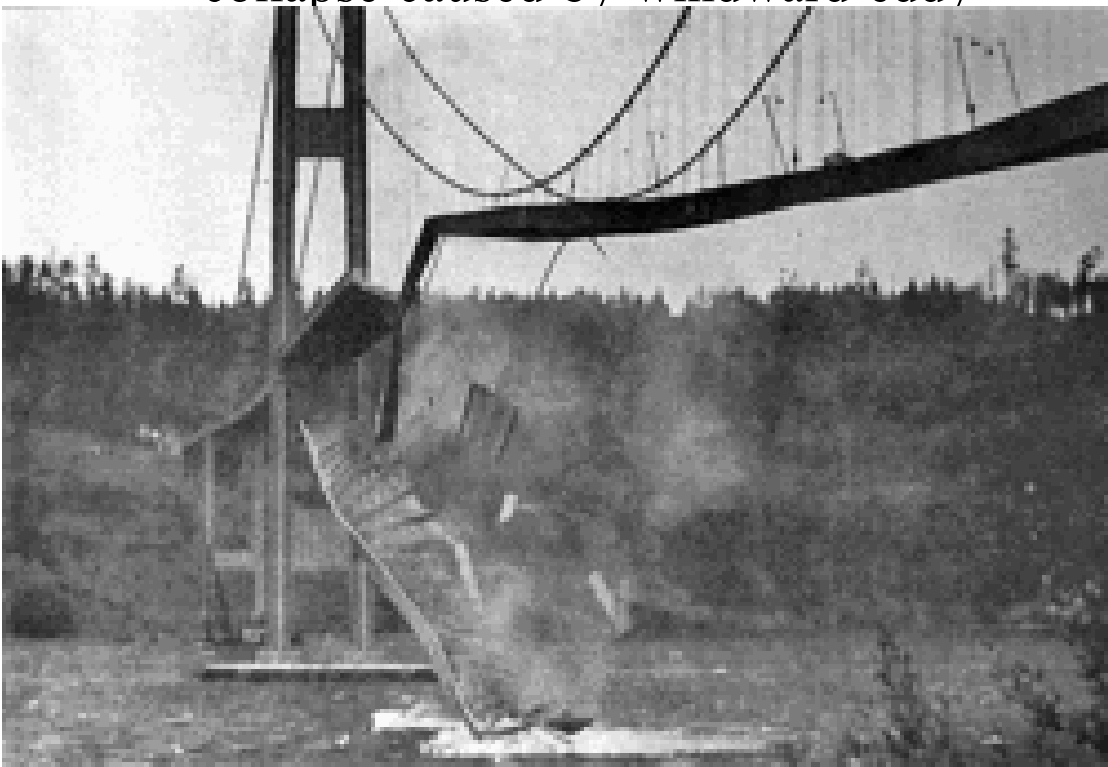
span 853 m, span/width = 72, span/depth = 350



Tacoma Narrows Bridge 1940

span 853 m, span/width = 72, span/depth = 350

collapse caused by windward eddy



Earthquake in Mexico City, 1985



Earthquake in Mexico City, 1985



Damage
caused by
an overloaded
lorry
on a bridge



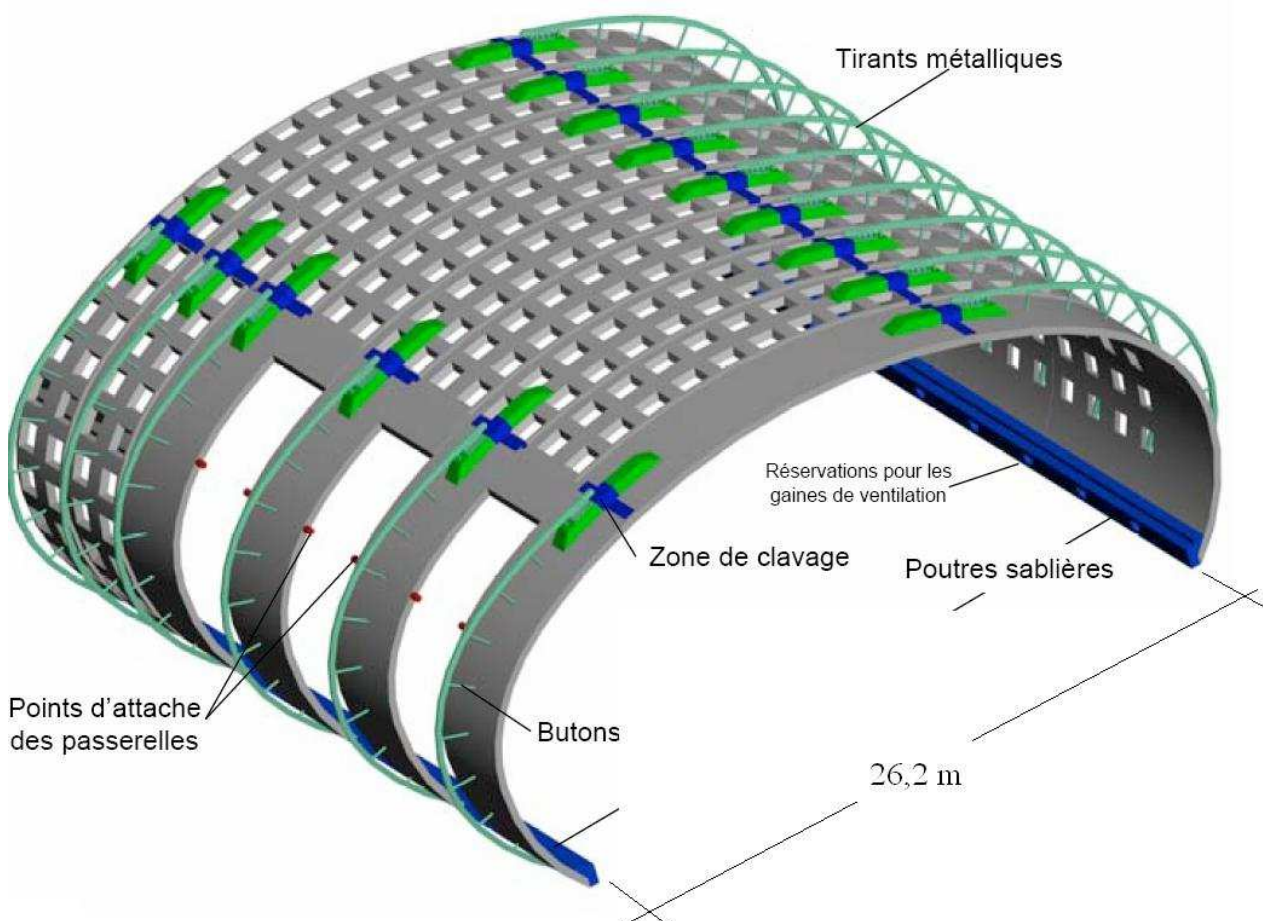
Paris Airport Terminal, 05-2004



Internal view



Structural system



Failure zone



Collapsed zone



Cracks of the outer surface of the shell



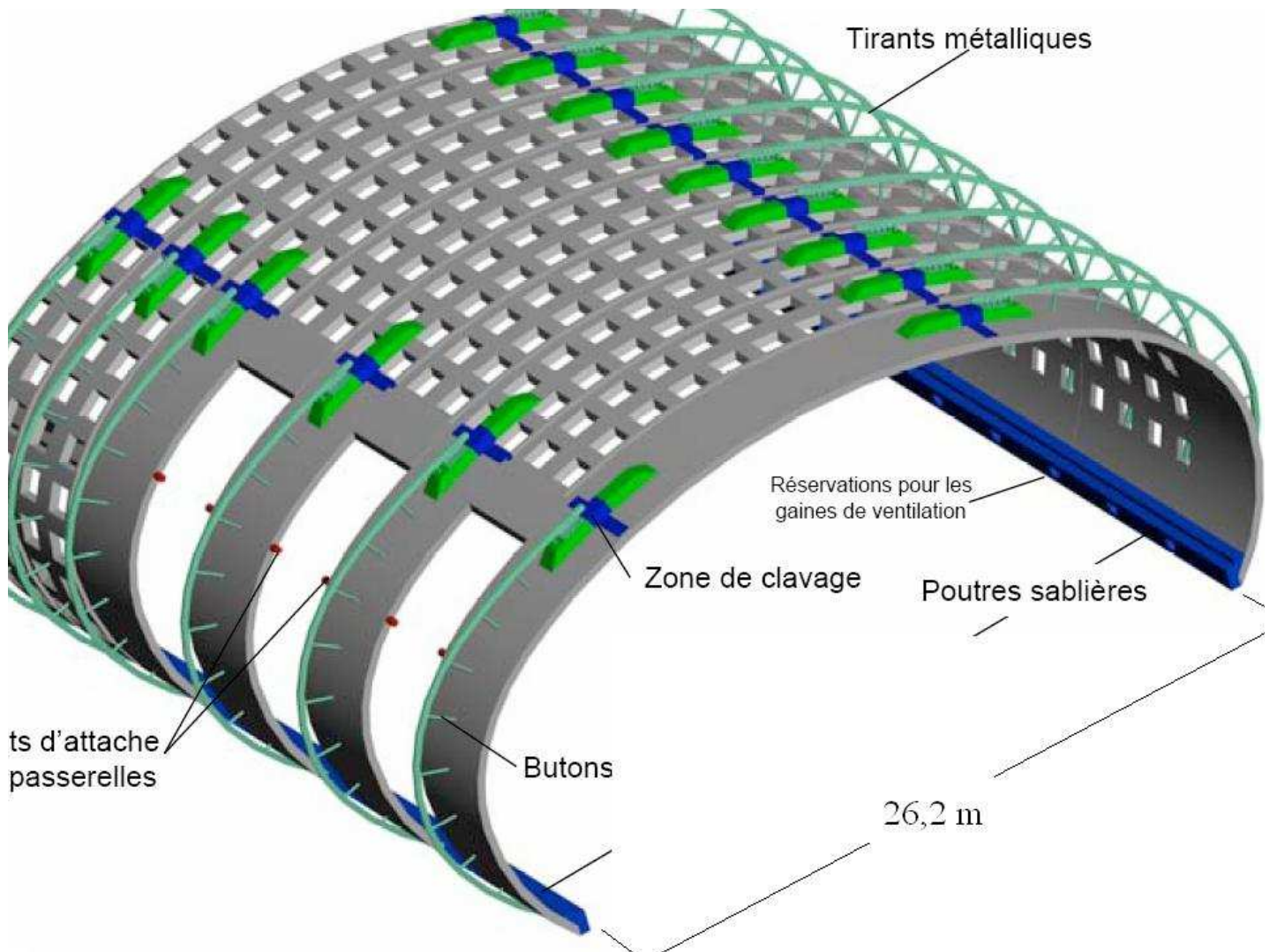
La fissuration est dense et profonde sur cet élément de coque entre les passerelles.

Rupture of concrete shell

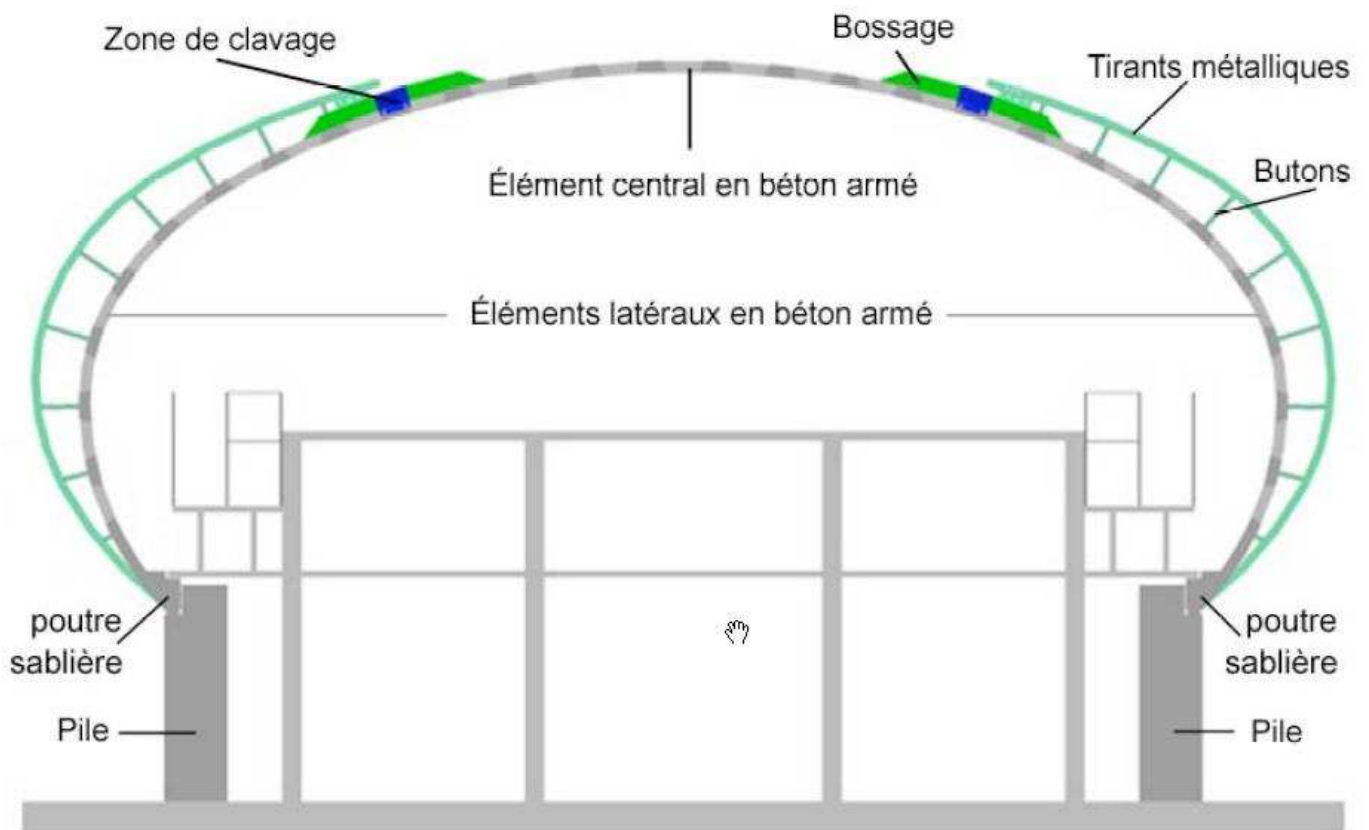
Détail de la surface de rupture



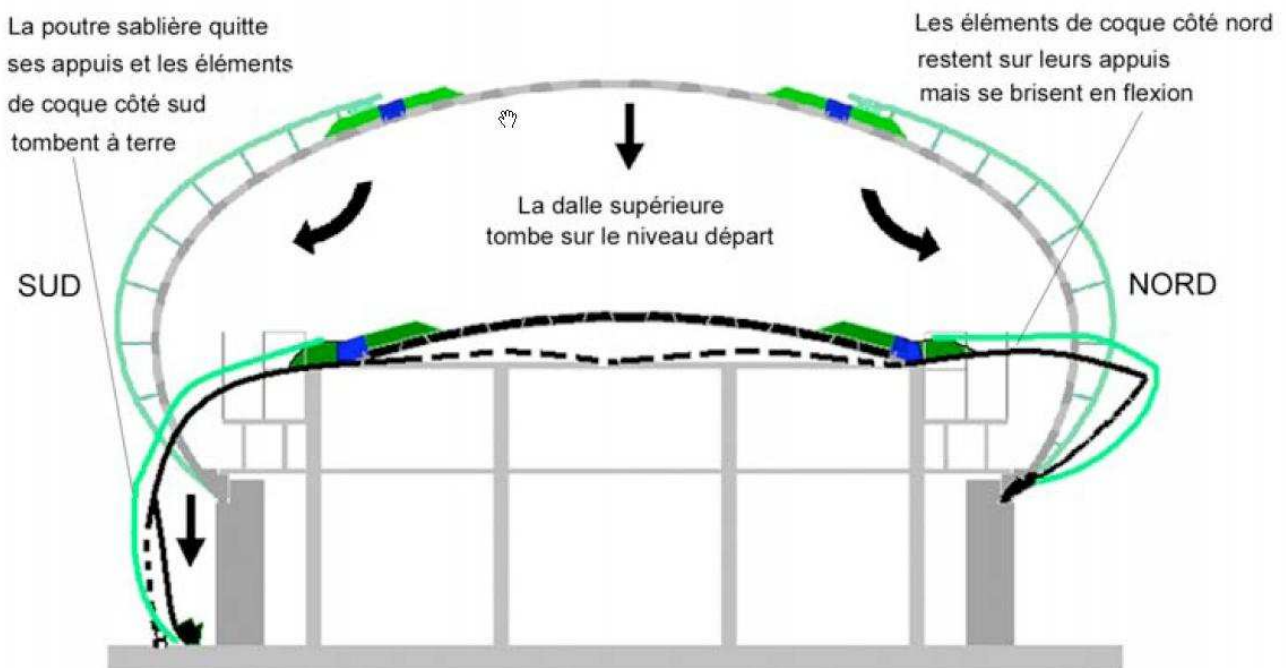
La rupture est franche, elle a dû être brutale.



Transverse section



High flexibility contributes to a collapse



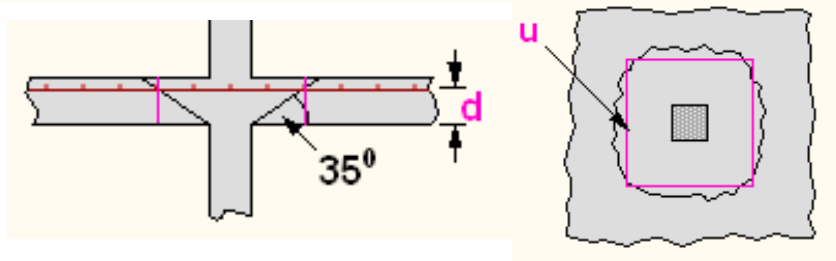
Causes of collapse

Low initial reserve of strength and progressive weakening due to cracking during construction and cycles of stress from differential thermal and moisture movements between concrete shell and curved steel member and struts

The main factors leading to collapse

- the high flexibility was increased by cracking
- a lack of robustness and redundancy
- the high local punching stresses
- weakness of the longitudinal support beam and its horizontal ties to the columns

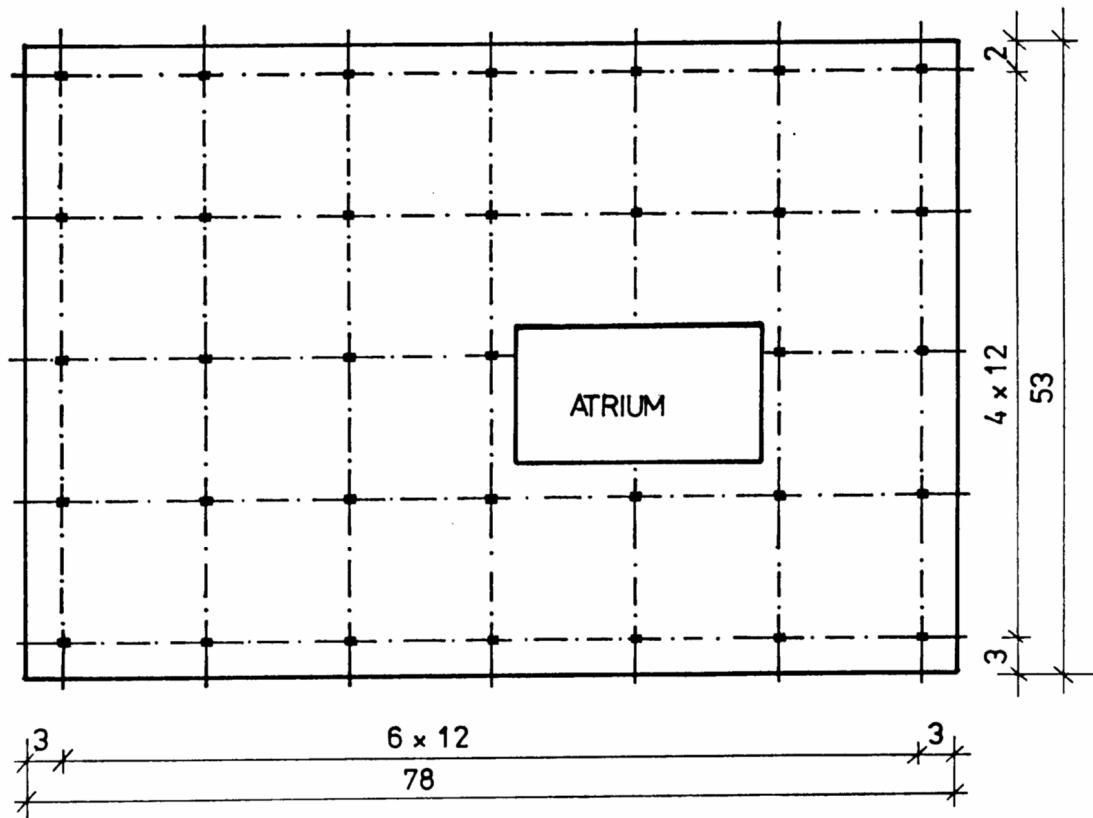
Punching shear



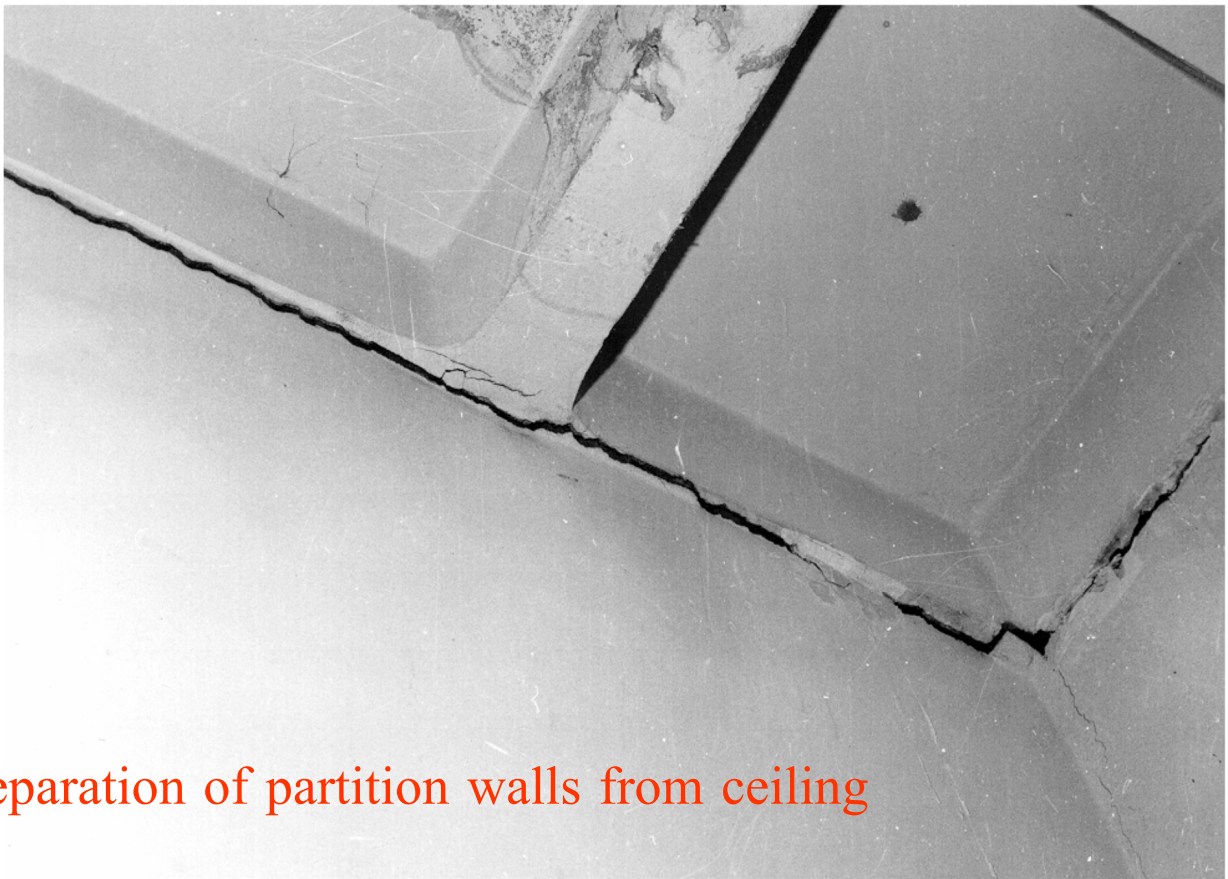
Pipers Row Car Park, Wolverhampton, 1997



Serviceability failure of a department store

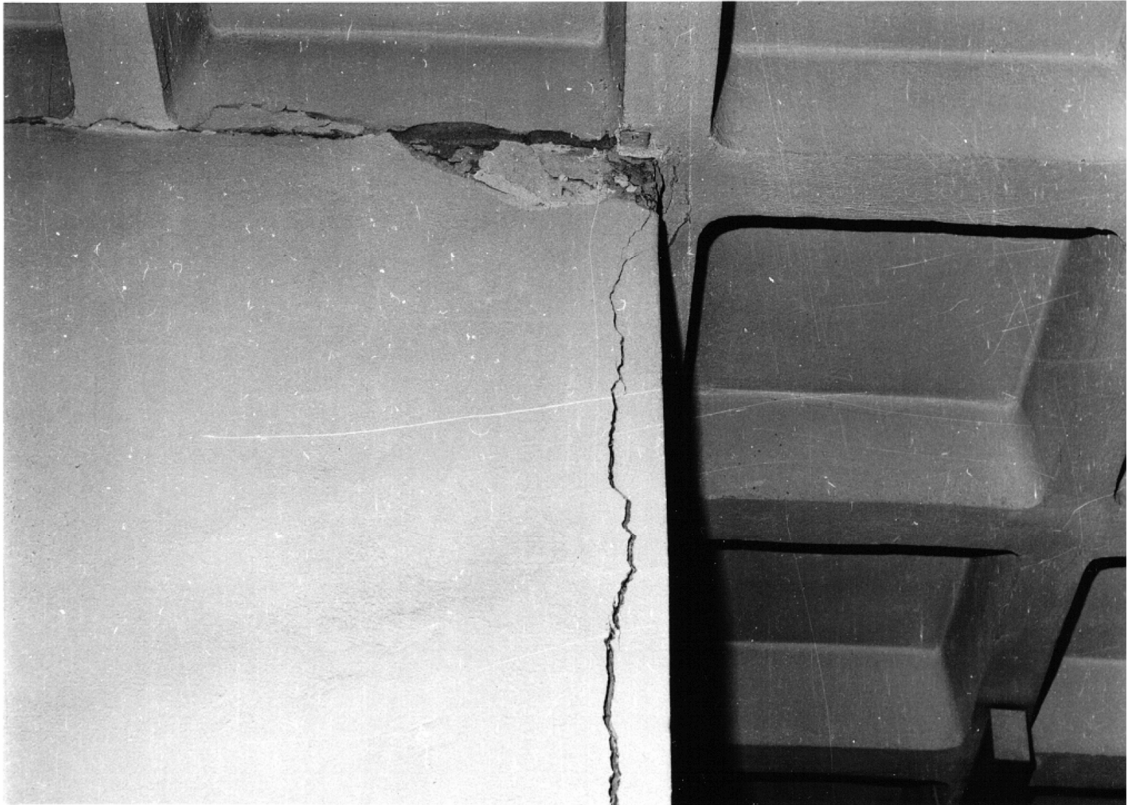


Differential movements



Separation of partition walls from ceiling

Cracks in a partition wall



Environmental influences - cooling towers



Concrete surface damage



Maintenance



Flooding and insufficient robustness



Failure due to explosion



Failures due to explosion



Farmer's story

An example of structural failure due to inappropriate use of a building.

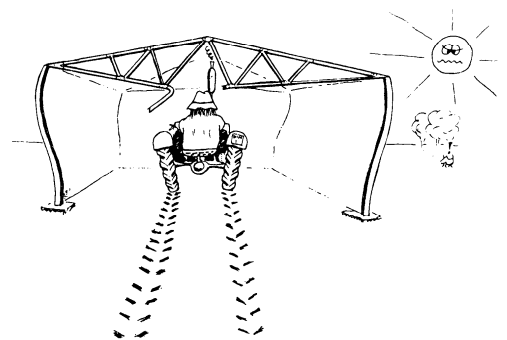
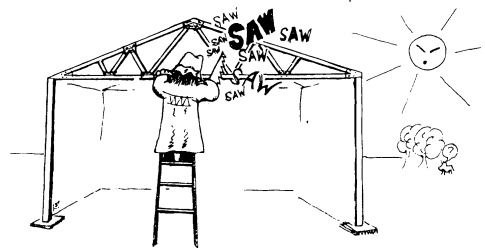
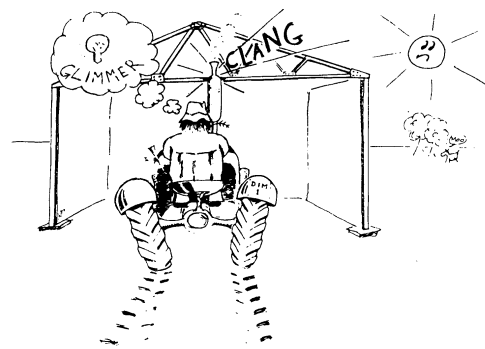


Fig. 1.3 A Farmer's Story.

