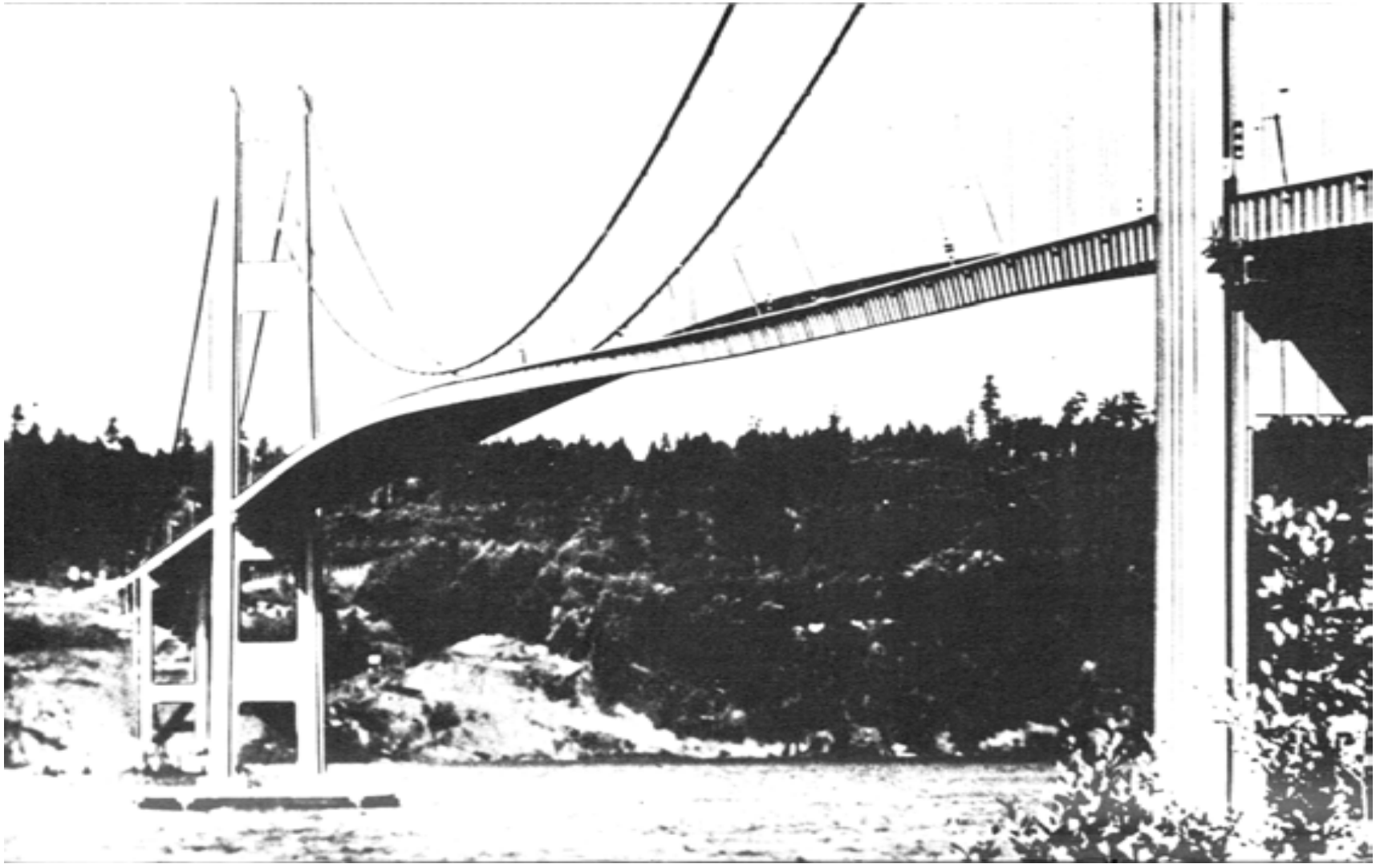
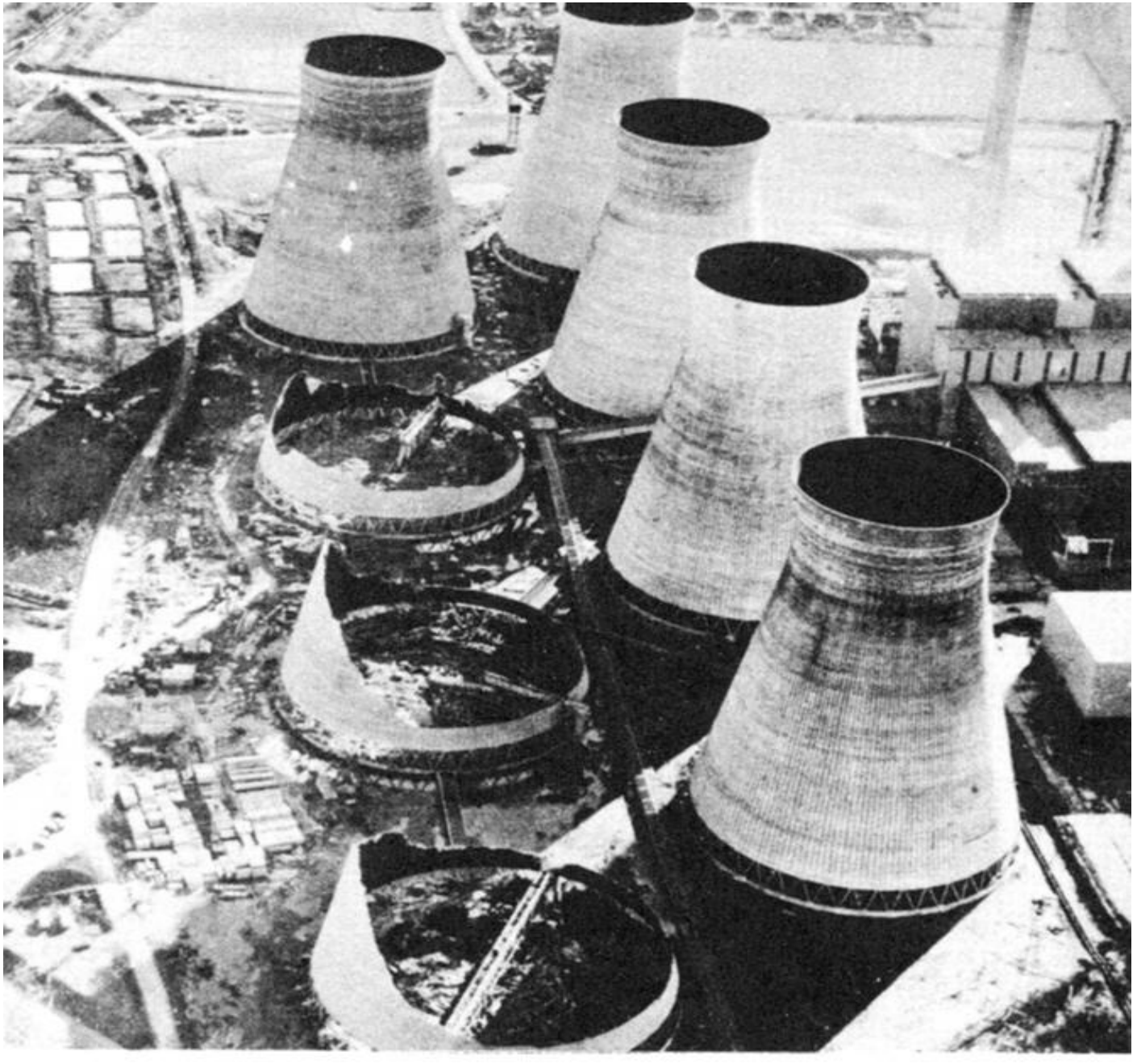
Tacoma Narrows Bridge 1940

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



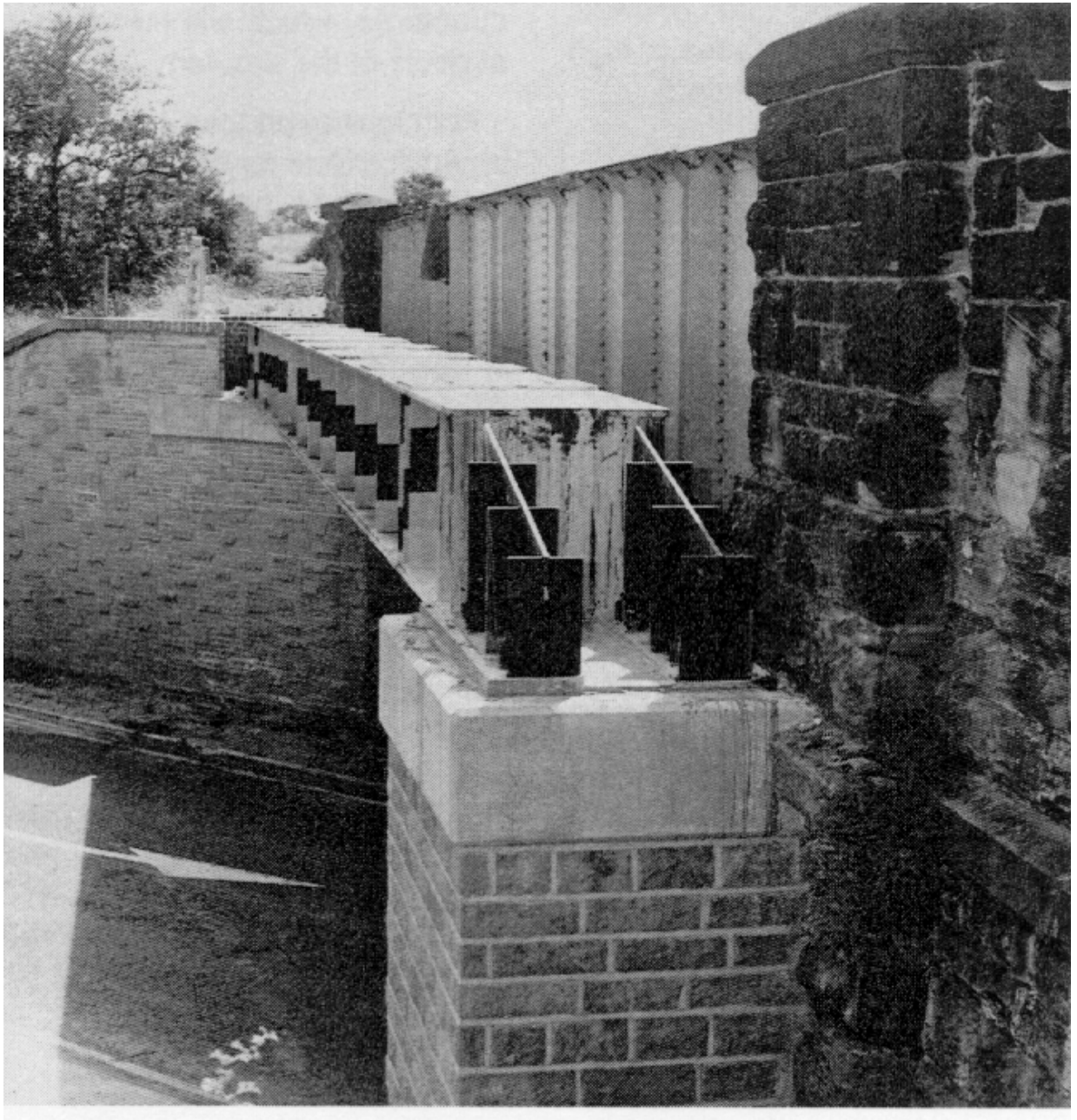
Damaged
caused by
an overloaded
lorry
on a bridge

Cooling Towers at Ferrybridge in Yorkshire



Cooling towers at Ferrybridge in Yorkshire, 1966

Protecting beam to a railway bridge



Farmer‘s story

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

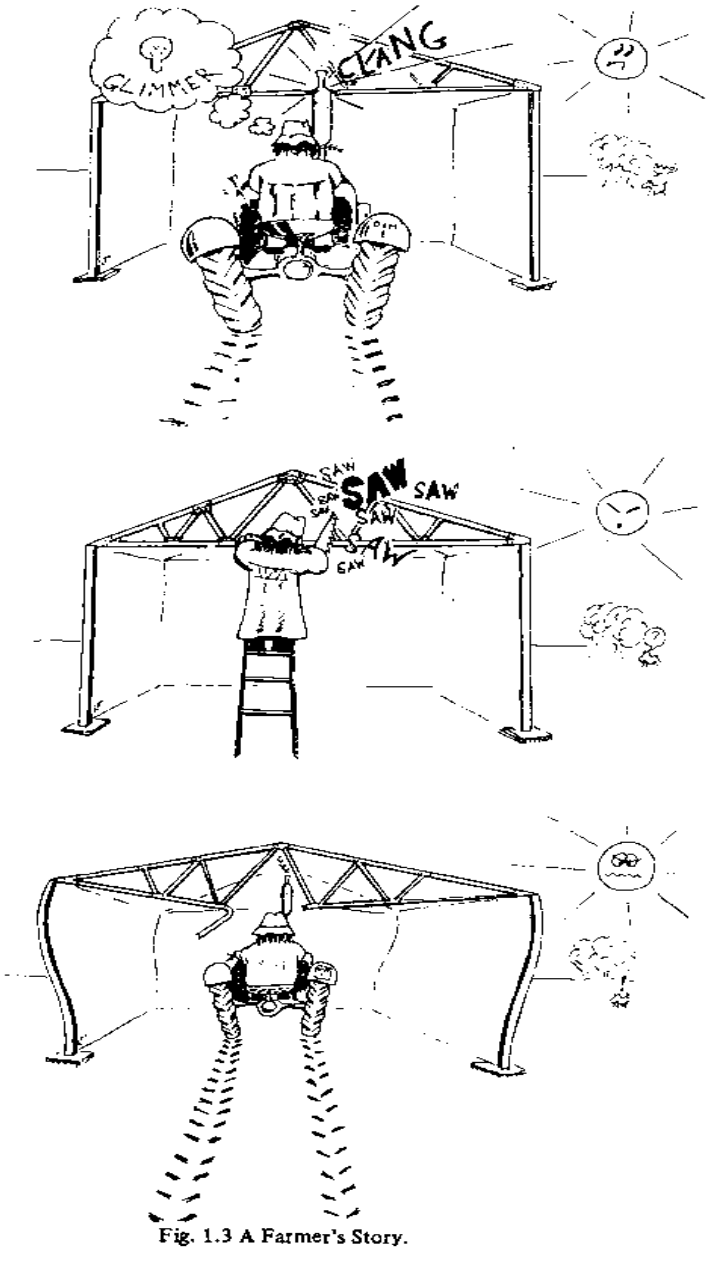
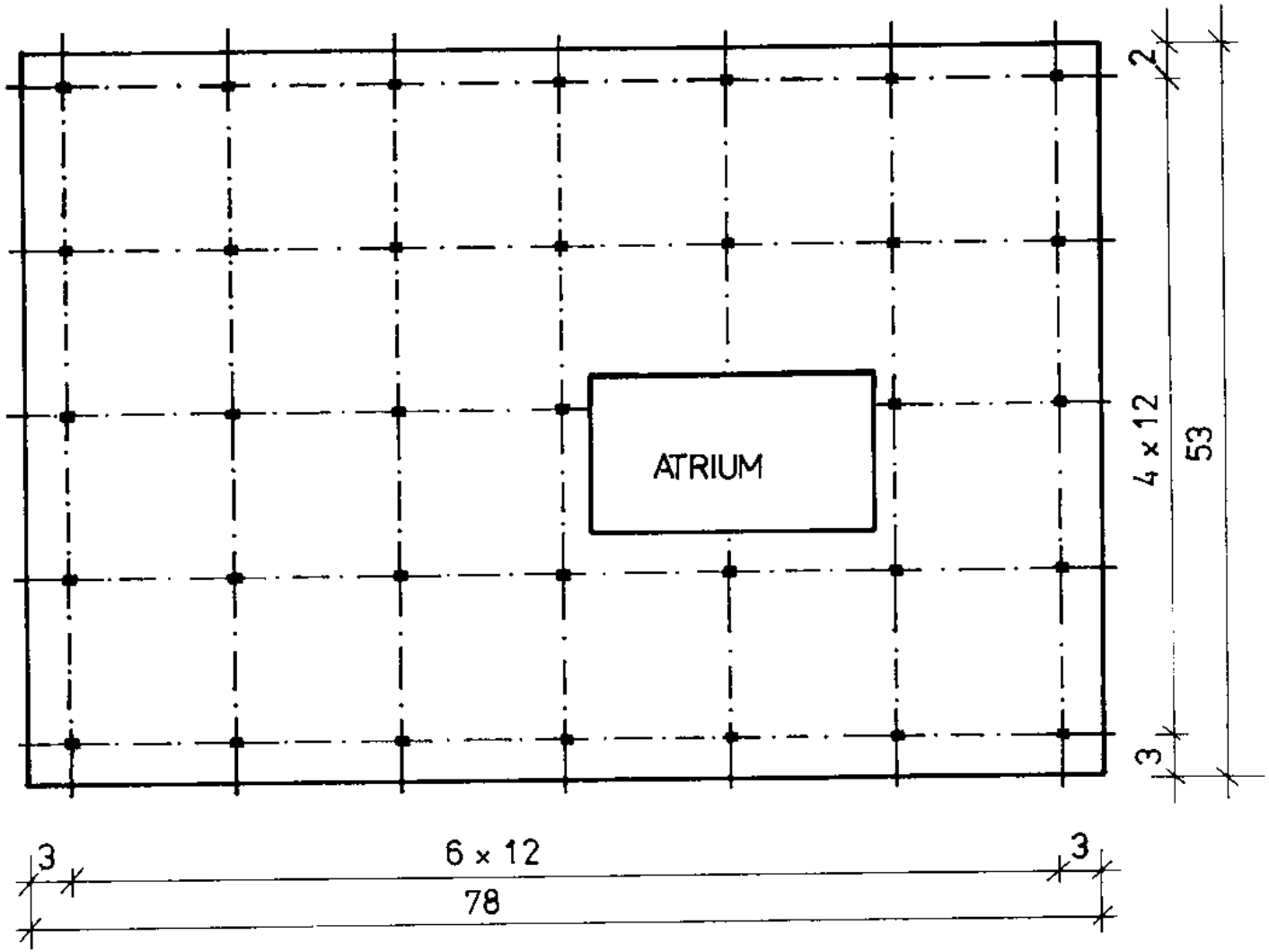


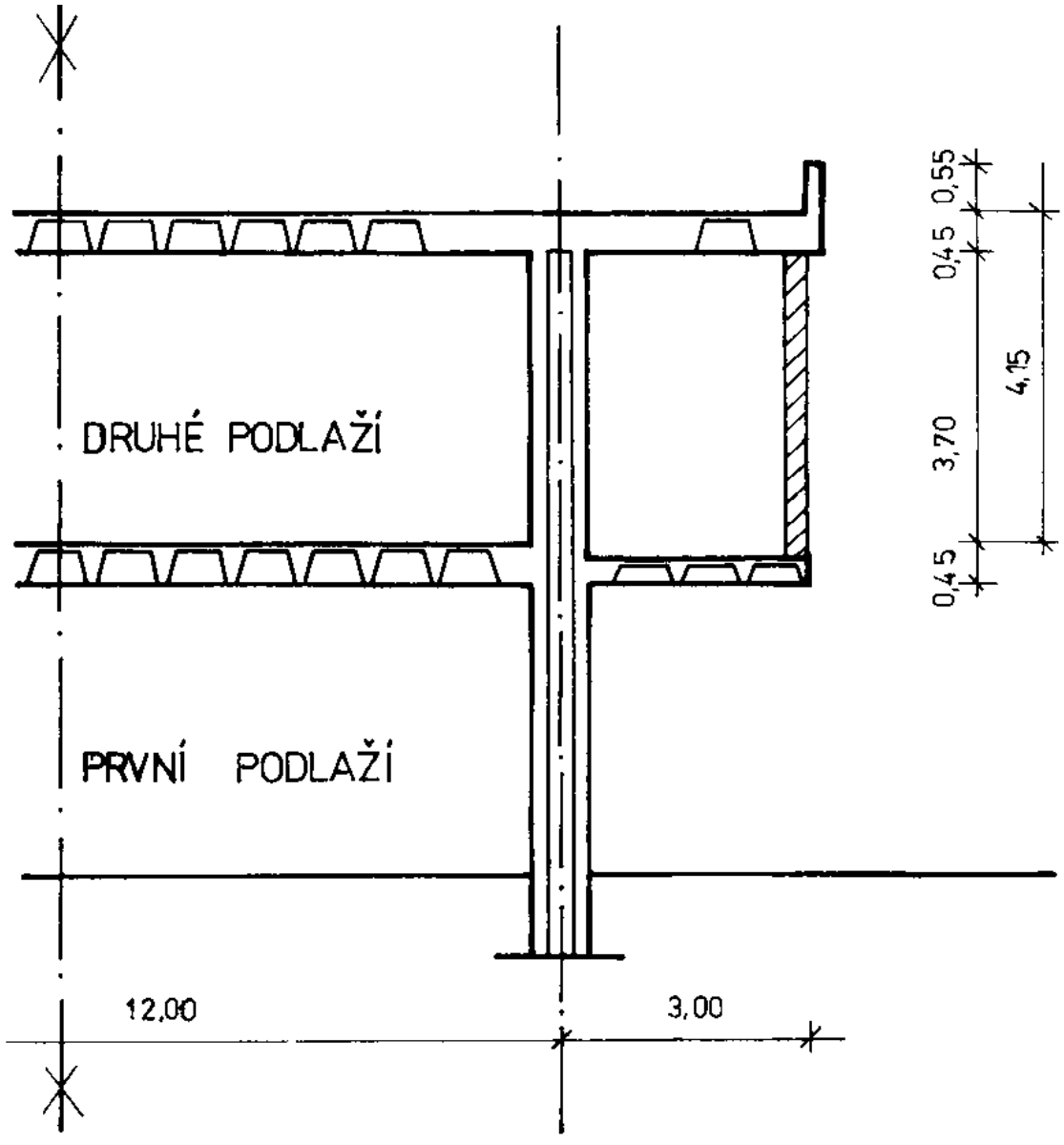
Fig. 1.3 A Farmer's Story.

Internal view

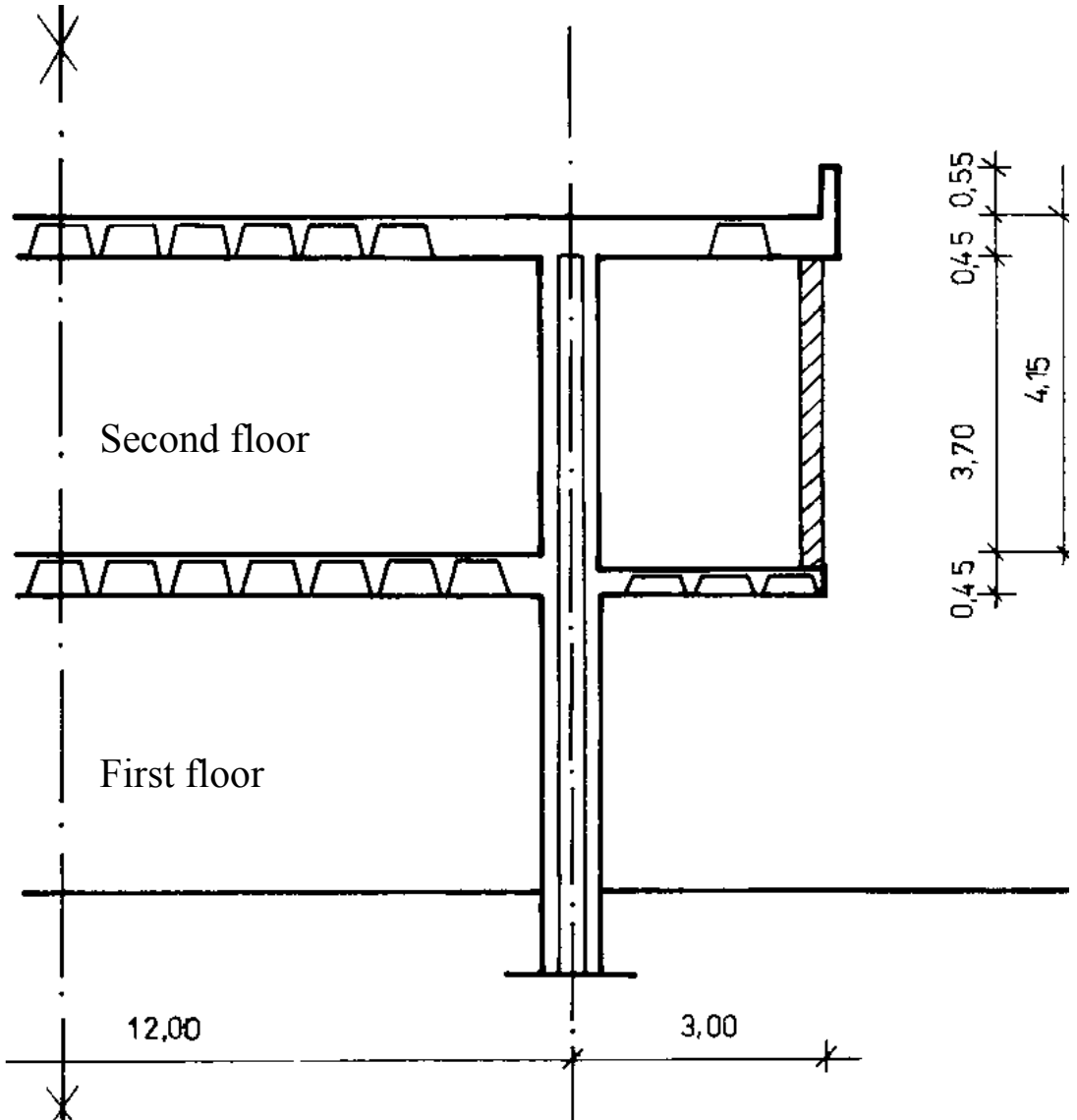
Plan view



Section



Section view of the structure

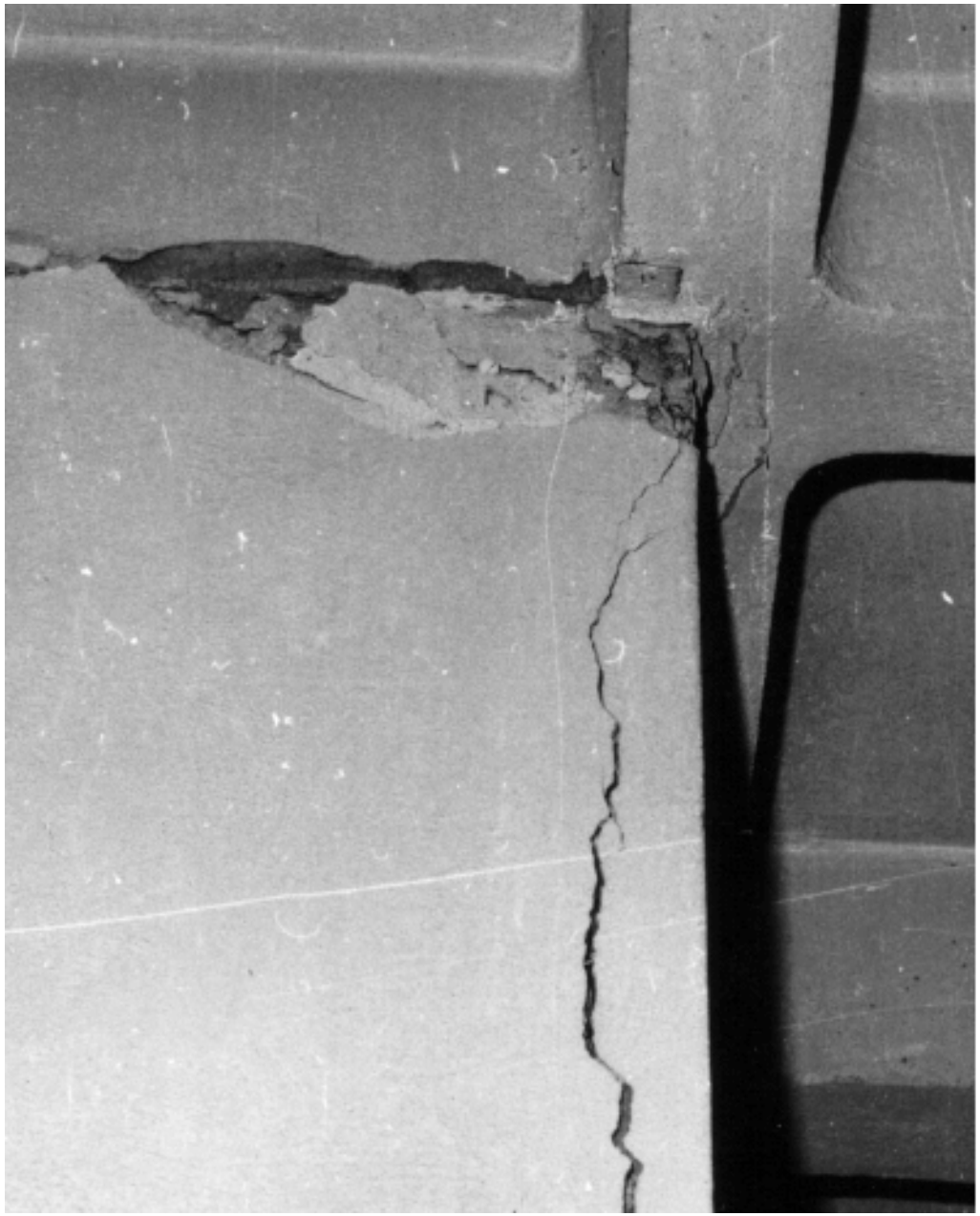


Damage of partition walls

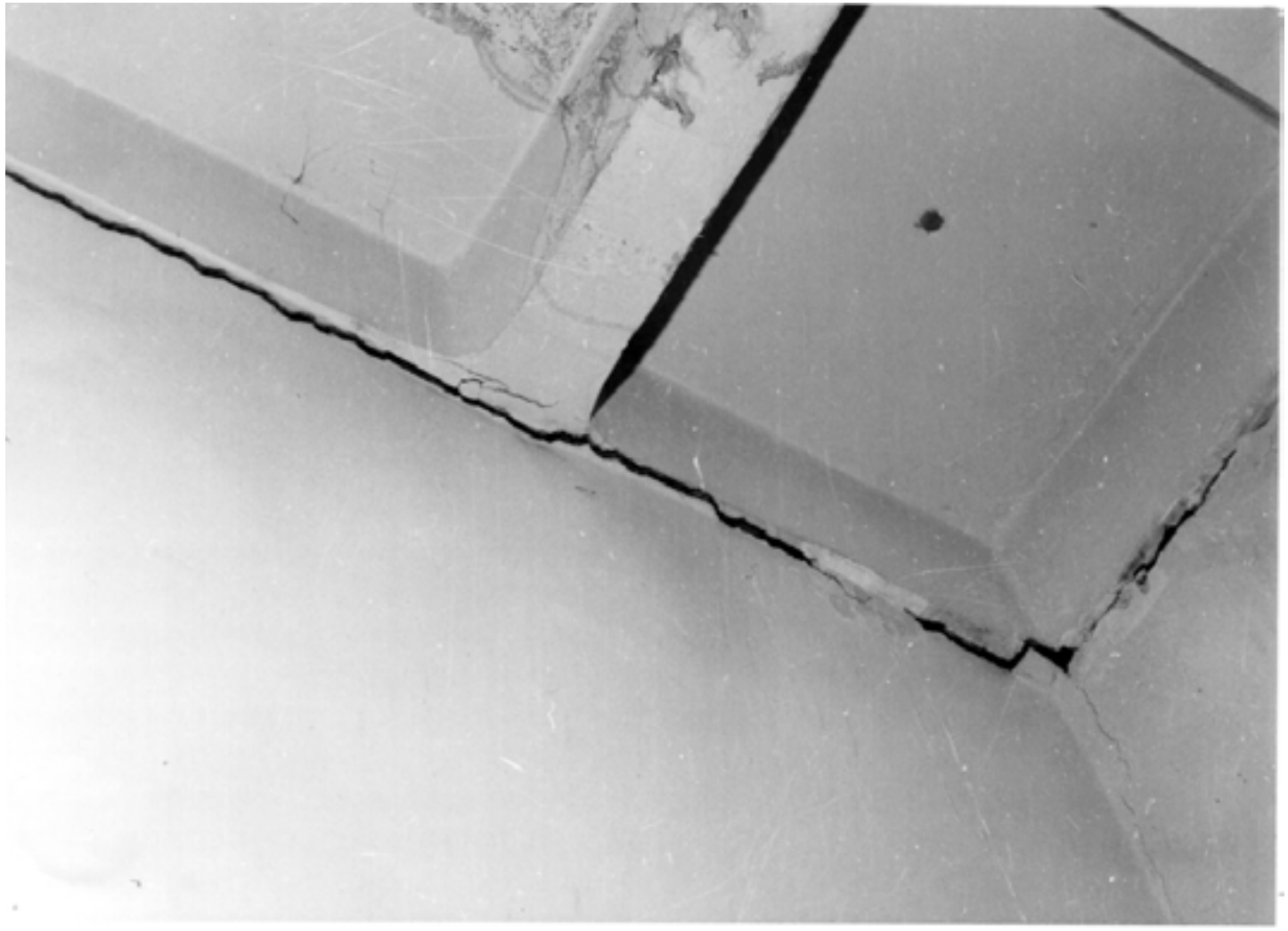
Damage of façade

Façade wall

Detail



Separation of partition walls



Failure Causes and Repair

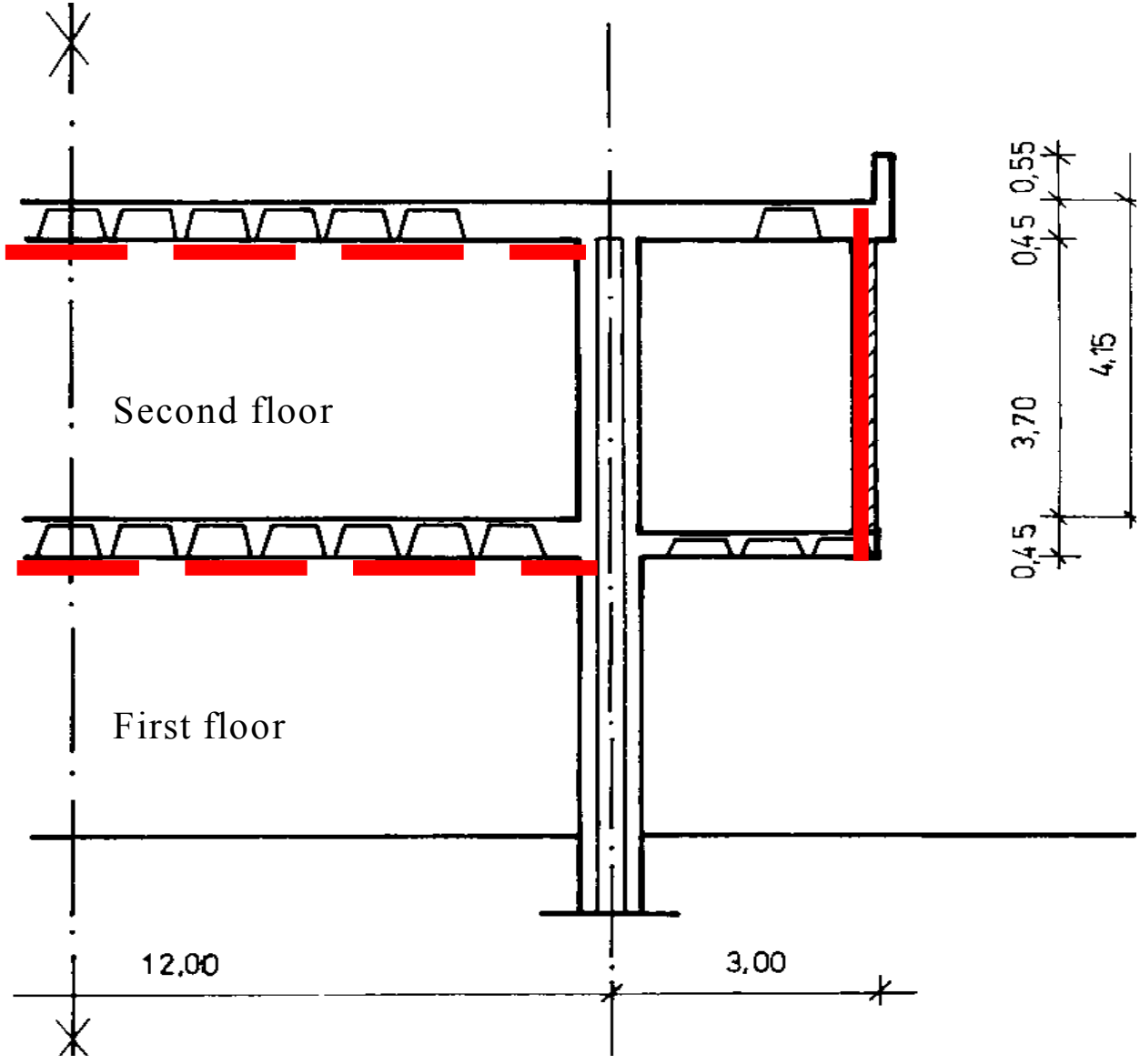
Origin	Design 40%	Execution 30%	Use 15%	Other 15%
Causes	Errors due to human activity 80%		Actions 20%	

There was no need to increase bearing capacity.

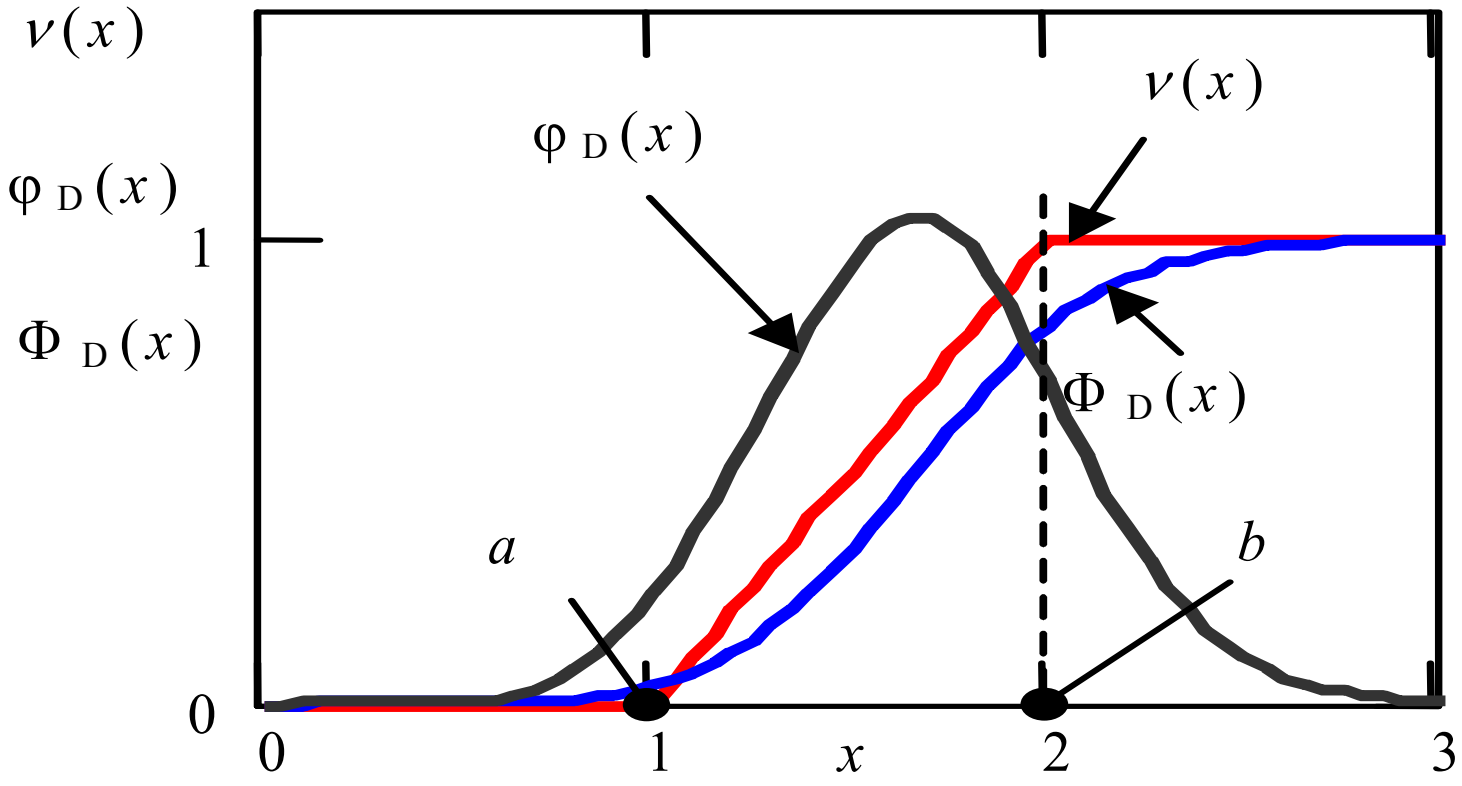
To improve performance (serviceability)

- partition walls were separated from ceilings,
- cantilevers were braced by partially prestressed ties.

Repair of the structure

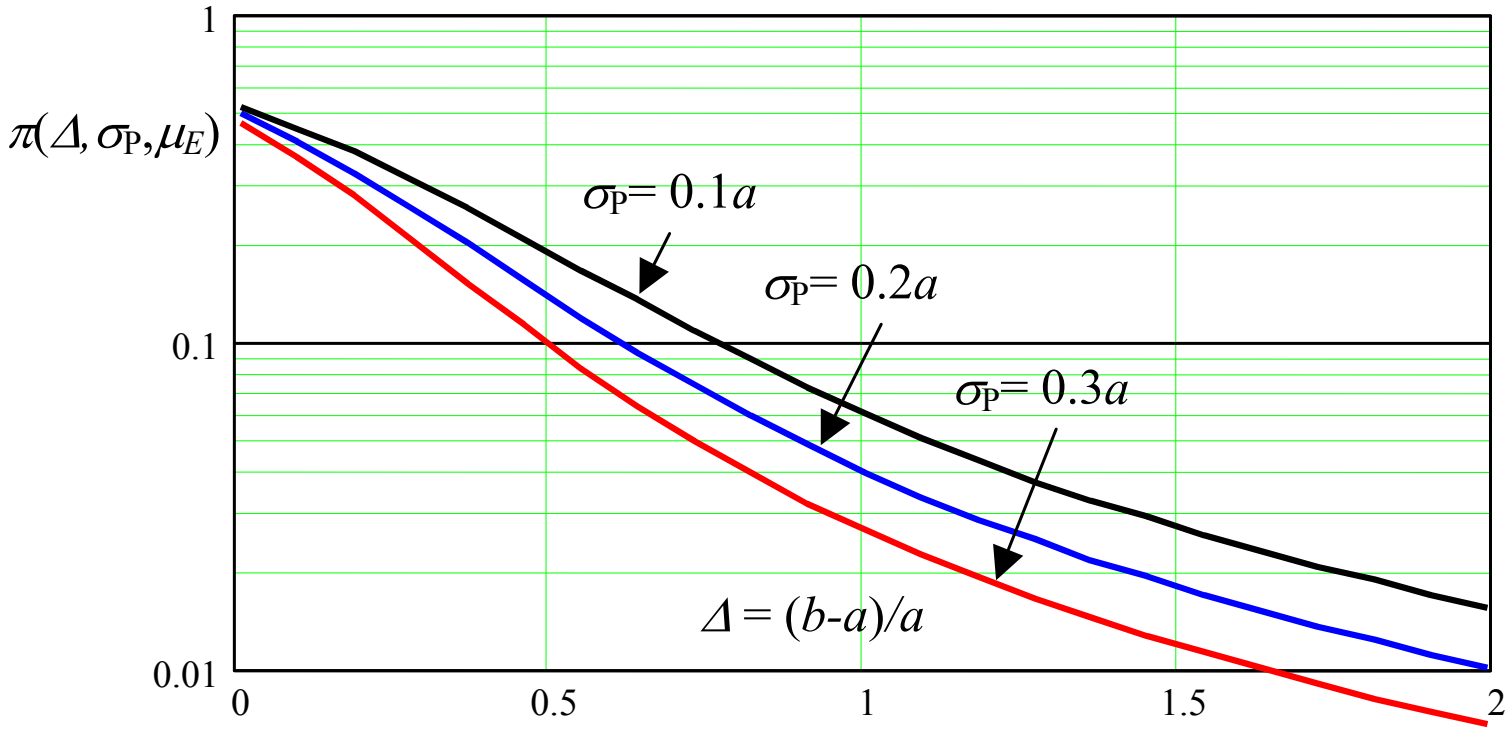


Public perception

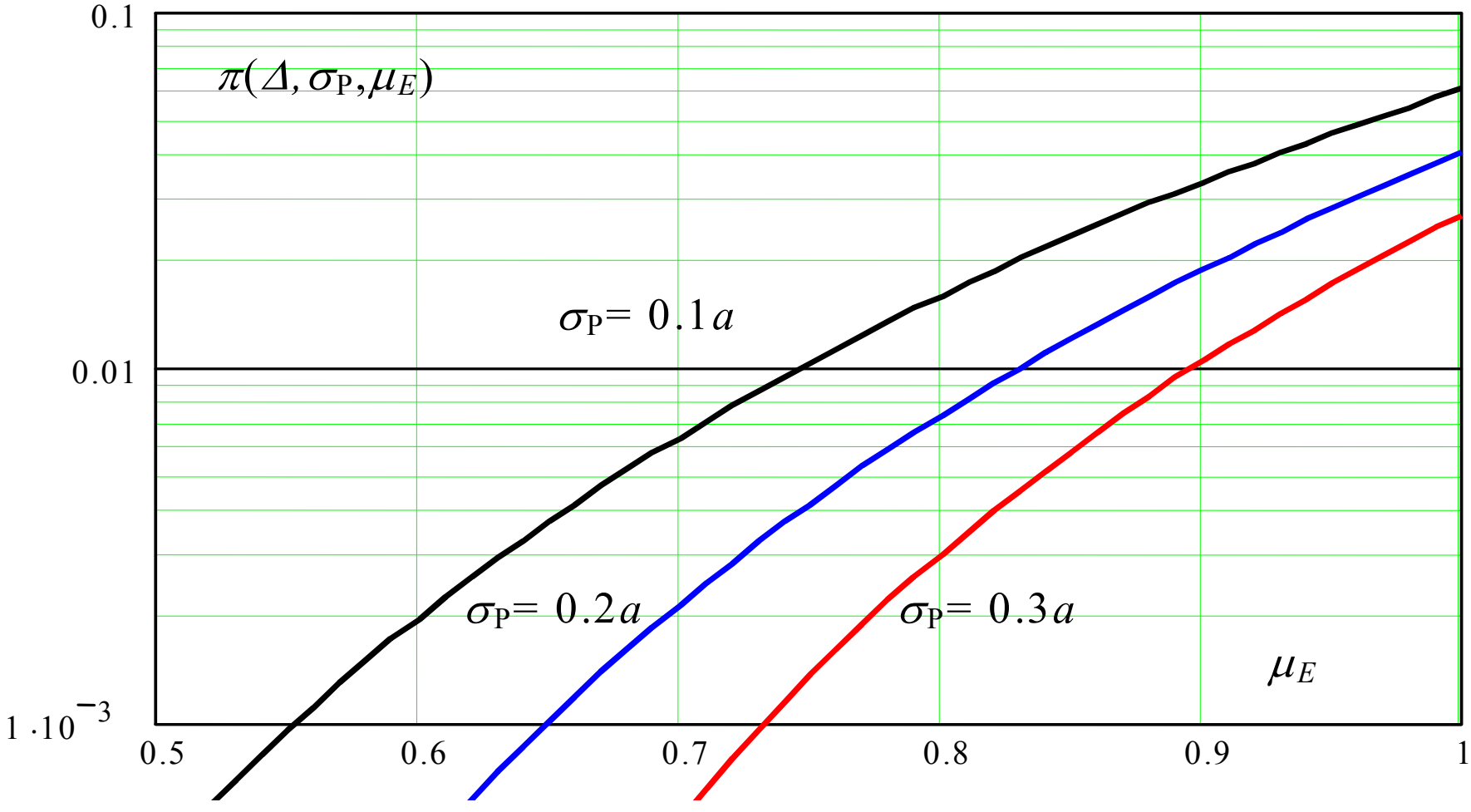


Expected perception level

$$\pi(\Delta, \sigma_{\mathrm{P}}, \mu_E) = \int_{-\infty}^{+\infty} \varphi_E(x)\, \Phi_{\mathrm{D}}(x)\, \mathrm{d}x$$

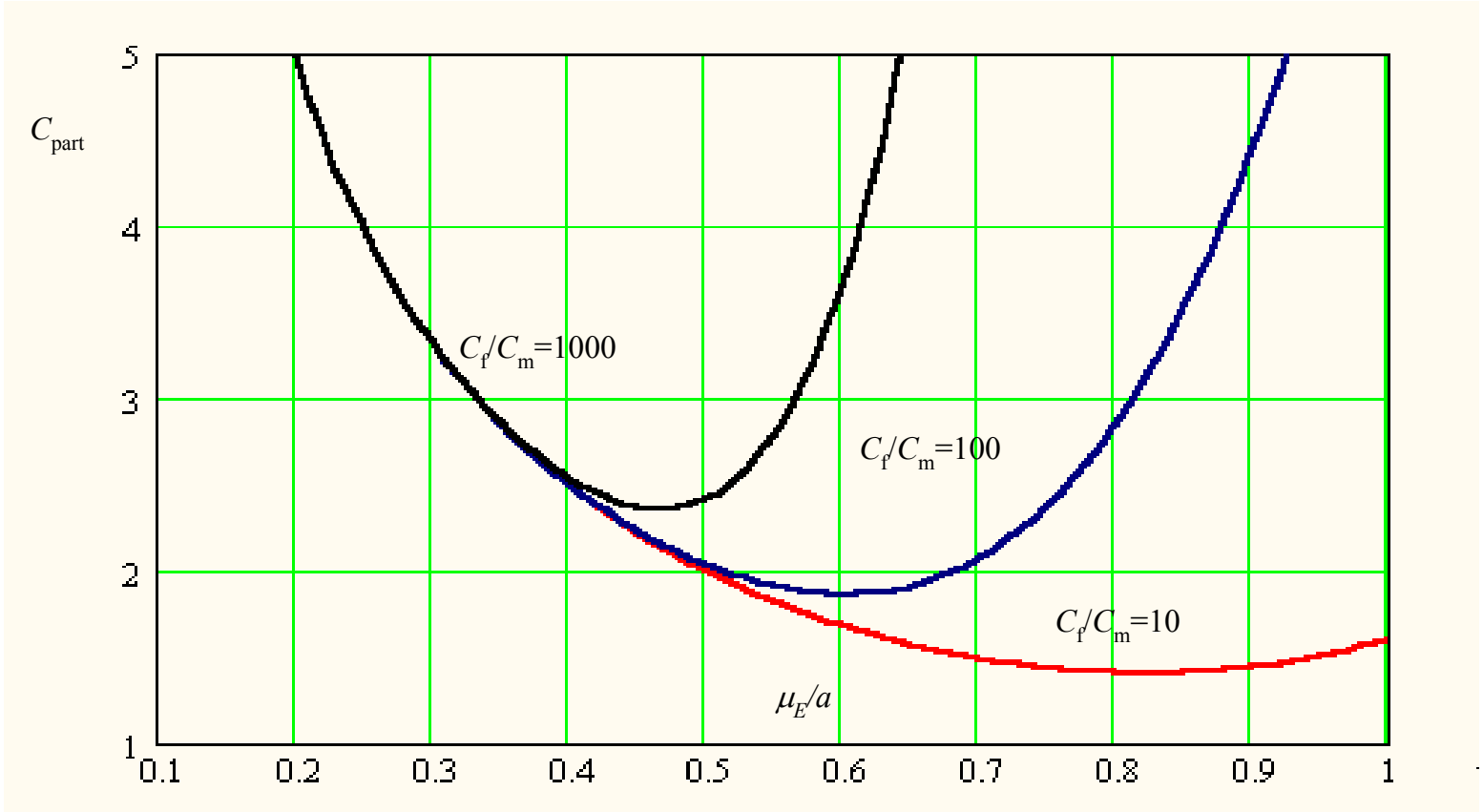


Expected perception level



Optimization of structural performance

$$C_{\text{part}} = 1/\mu_E + \pi(\Delta, \sigma_{\text{P}}, \mu_E)\, C_{\text{f}}/C_{\text{m}}$$



Conclusions

1. Serviceability failure was primarily caused by lack of consideration of deflection in design.
2. Execution faults enhanced unfavorable load effects
3. Current engineering climate affected public perception.
4. There is no distinct value separating acceptable and adverse states of a structure.
5. **Proposed theoretical model seems to explained discrepancies in public (experts) perception.**
6. There seems to be an optimum of the performance indicator leading to the minimum total cost.
7. The effect of vagueness in structural requirements and public perception needs further investigation.

Structural failure and assessment of department store

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Description of the structure
Damage of structural elements
Theoretical model for public perception
Optimisation of performance indicators
Conclusions