Assessment and Repair of Fire Damaged Structures

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Outline of Presentation

- General introduction: reparability, difference between assessment for repair and fire resistant design
- General procedure
- Methods of assessment
- Methods of repair
- Useful references

General Introduction

- Many fire damaged buildings are repairable

- Cost of structural repair often only a small proportion of total repair bill

Assessment Procedure

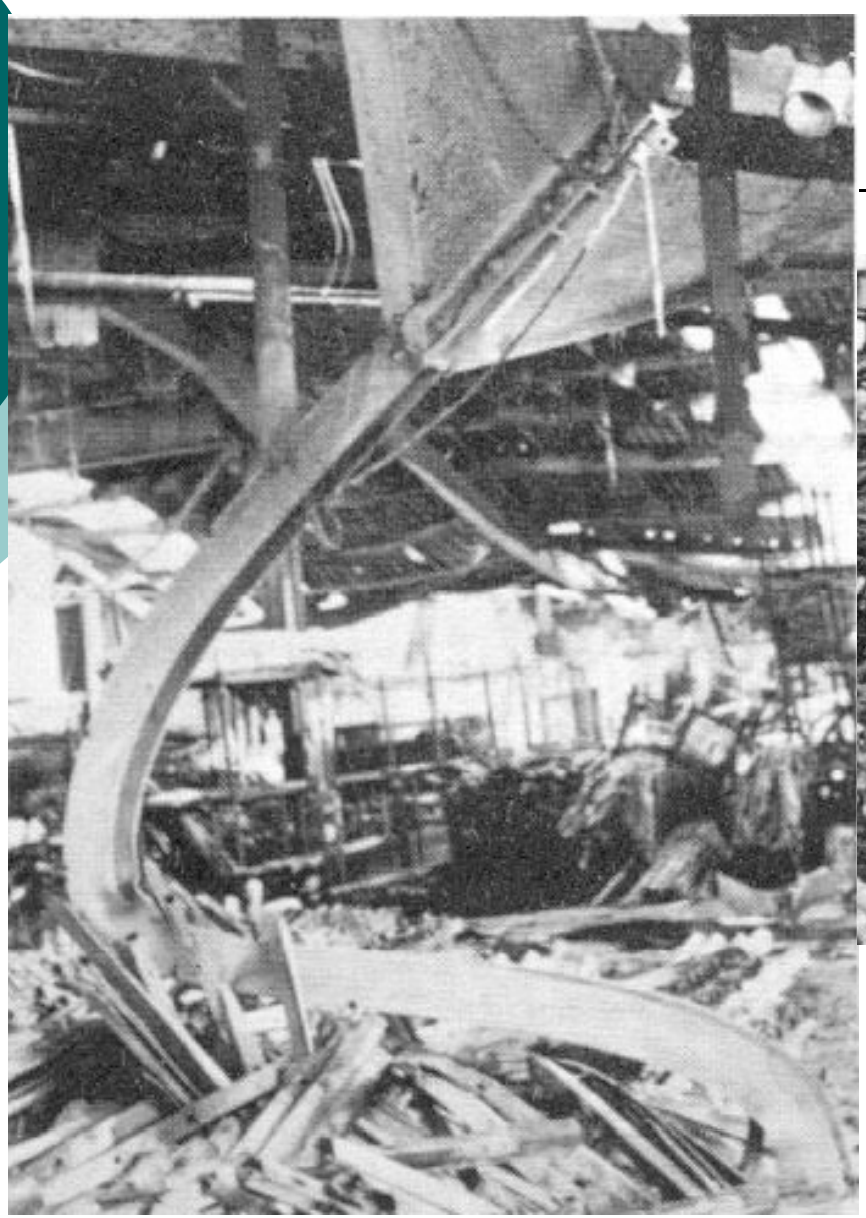
- Site visit
- Desk study
- Detailed collection of evidence
- Damage assessment
- Specification of repairs

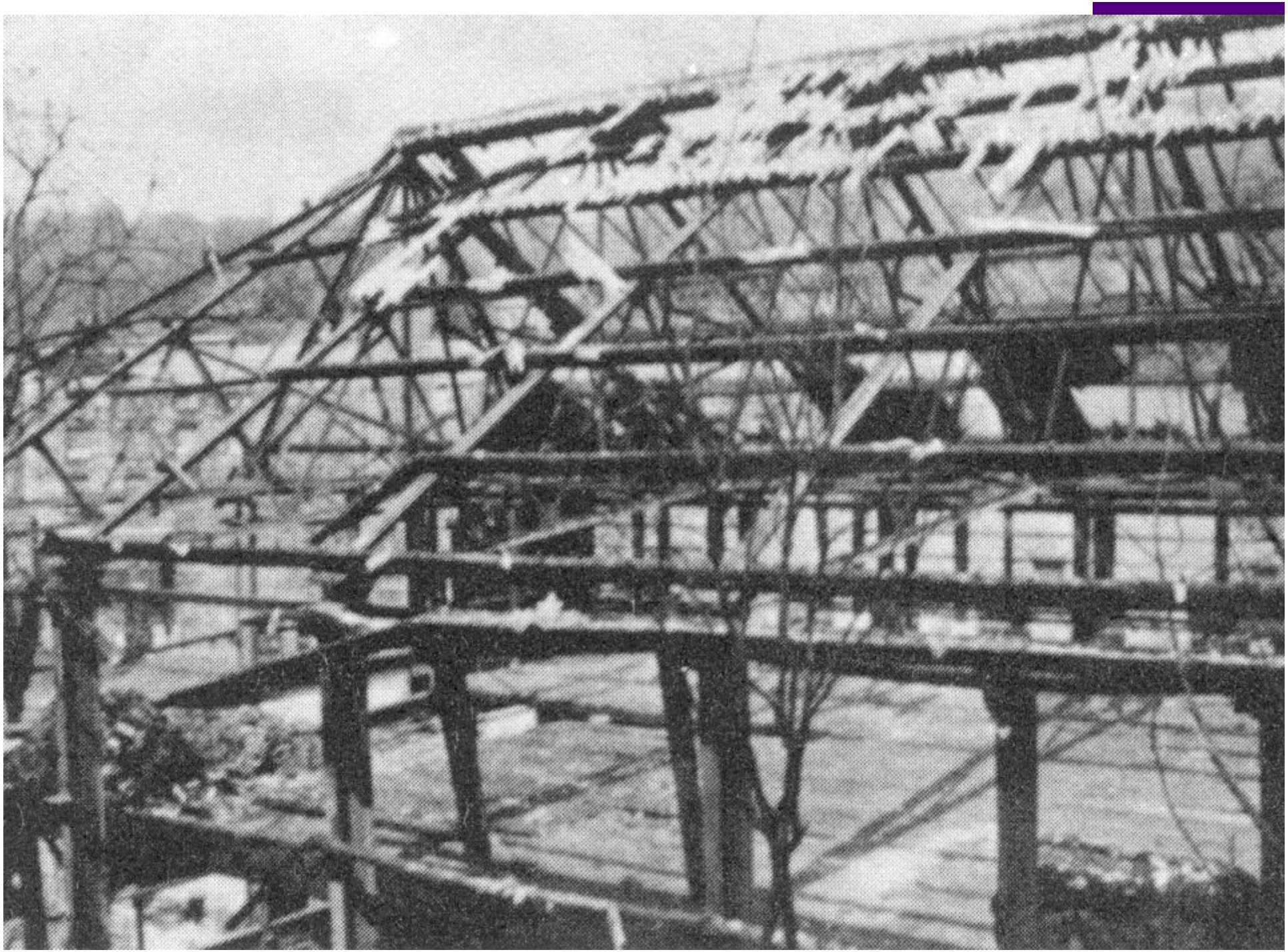
Site Visit

- To gain early scale of damage
- To advise on safety of building and to recommend protection measures

Desk Study

- To collect relevant information, e.g. original design of building, construction materials, usage before fire, cause of fire, duration of fire, fire spread, contents left unburnt
- To establish a strategy for more detailed information gathering





Detailed Assessment Strategy

- No damage
- Total damage – scrap
- Major damage – replacement of structural member
- Repairable damages - detailed collection of evidences

Detailed Collection of Evidence

- Residual strength and stiffness of material after fire exposure (NDT)
- Temperature attained in structure
- Fire development

- Correlation of results

Fire Developments

- Burnt combustible materials
- Opening
- Construction materials of enclosure

- Correlation with physical evidence

Temperatures Attained in Structural Members

- Fire development + thermal analysis
- Metallurgy analysis
- Colour changes in concrete
- More detailed testing: thermoluminescence test
- Physical evidence

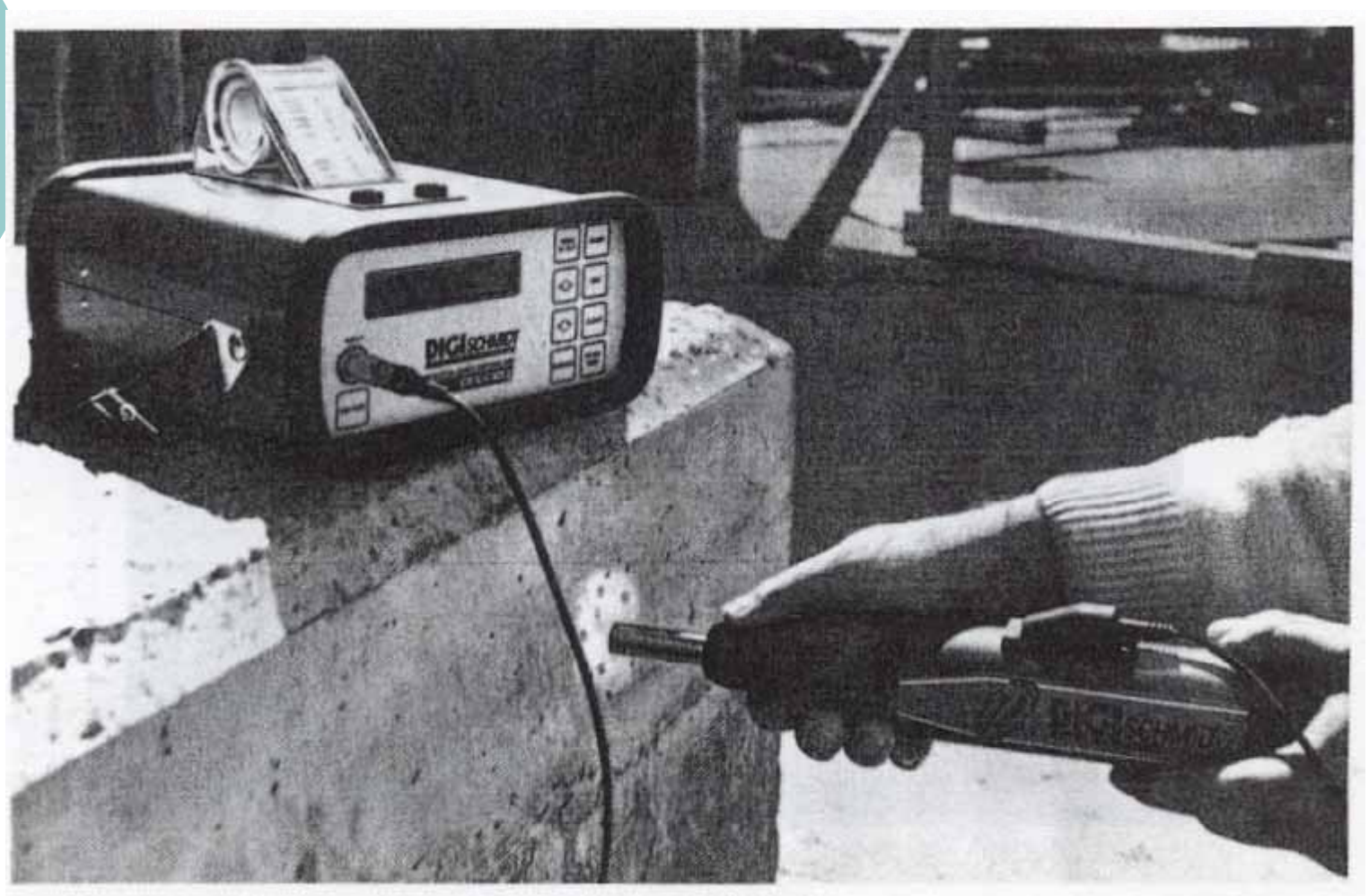
- Correlation of results

Mechanical Properties

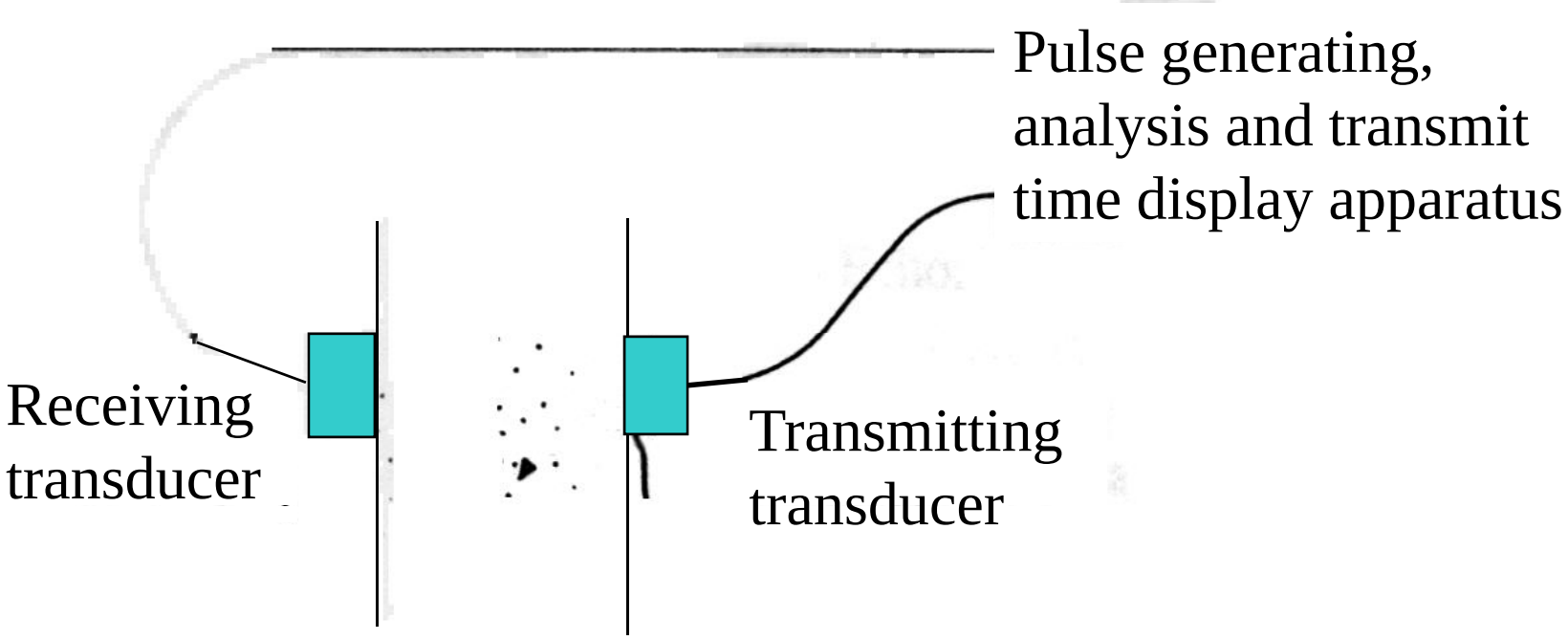
- Temperatures + residual properties relationships
- Non-destructive testing
- Destructive testing

- Correlation of results

Schmit Hammer Test



Ultrasonic Pulse Velocity Test



Destructive Tests

- Concrete core tests
- Fracture tests of steel

- Use them sparingly!

Design Calculations for Repair

Load:

- Include extra weight of repair materials
- Temporary support loads
- Reduced material factors

- Treat structure as simply supported

Repair Methods

- Reconstruction
- Sprayed concrete
- Resin repair
- Overcladding
- Others: FRP strengthening, change of use, additional supports

Useful Documents

- Testing concrete in structures, a guide to equipment for testing concrete in structures, CIRIA technical report 143, 1992
- The reinstatement of fire damaged steel and iron framed structures, Corus (British Steel), 1986
- Assessment and repair of fire-damaged concrete structures, Concrete Society technical report 33, 1990
- Appraisal of existing structures, ISE, 1996