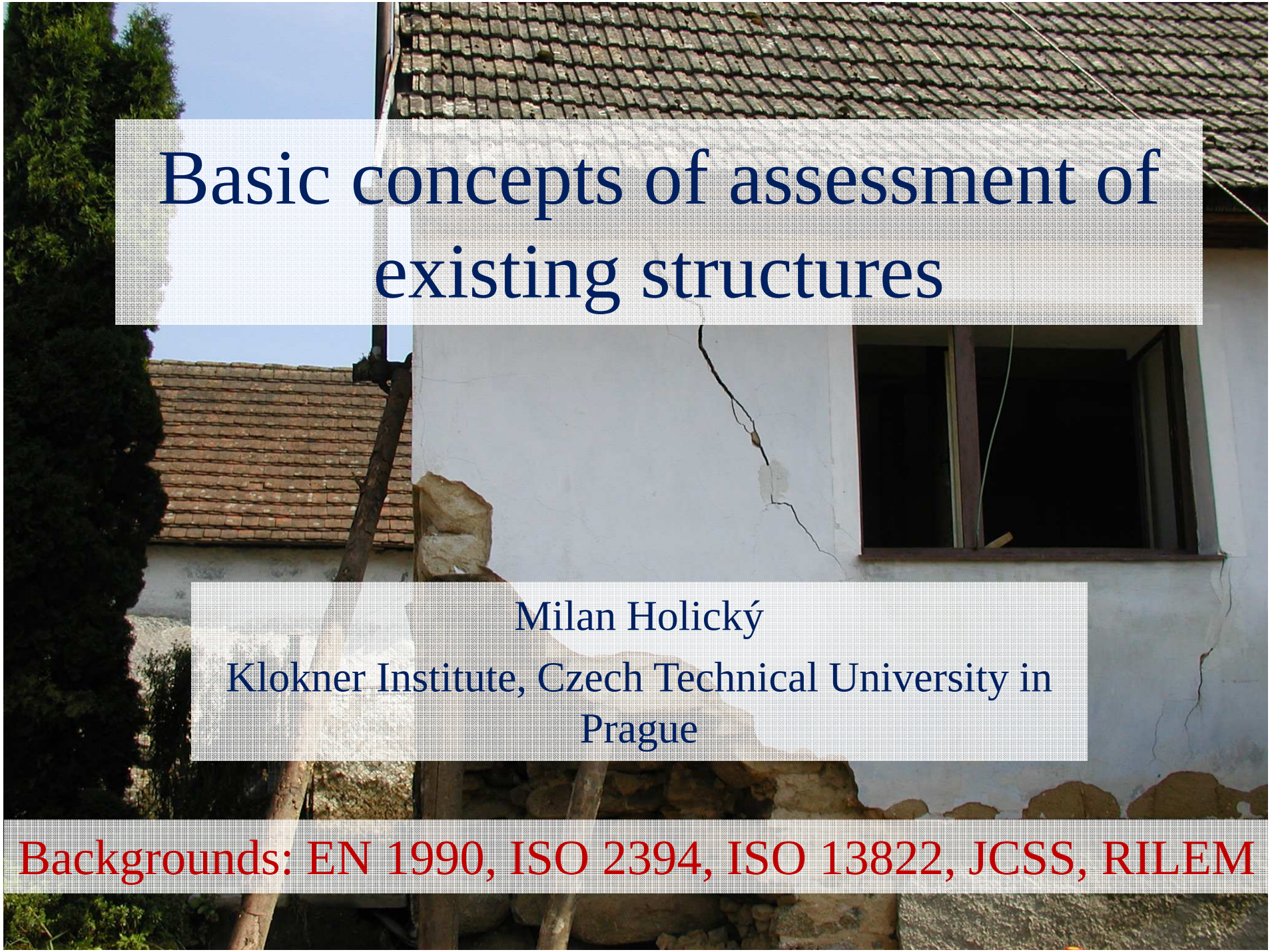


Basic concepts of assessment of existing structures

Milan Holický

Klokner Institute, Czech Technical University in Prague

Backgrounds: EN 1990, ISO 2394, ISO 13822, JCSS, RILEM

When assessment of existing structures ?

- rehabilitation of an existing facility when new structural members are added to the existing load-carrying system;
- adequacy checking in order to establish whether the existing structure can resist loads associated with the anticipated change in use of the facility;
- repair of a structure deteriorated due to time dependent environmental effects or which has suffered damage from accidental actions, for example, impact;
- doubts concerning actual reliability of the structure.

Motivation of the project

- Existing structures represent a huge economic asset getting larger and larger every year.
- Many existing structures do not comply with the requirements of the EUROCODES
- The assessment of existing structures requires knowledge beyond the scope of design codes for new structures.
- The ultimate goal is to limit construction intervention to a minimum, thus complying with the principles of sustainable development.
- Authorities, owners and engineers need guidelines how to deal with existing structures

General aspects

Assessment is in many aspects different from designing a new structure - ISO 13822

The following aspects seems to be the most significant:

- effect of construction, alterations, misuse;
- past performance, damage, deterioration, maintenance;
- actual actions, geometry and material property;
- reliability differentiation (consequences, cost of safety measures, societal, political and culture aspects).

Two main principles

- Actual characteristics of structural material, action (permanent load), geometric data and structural behaviour should be considered.

- Currently valid codes should be considered (models for actions and resistances), codes valid in the period when the structure was designed, should be used as guidance documents.

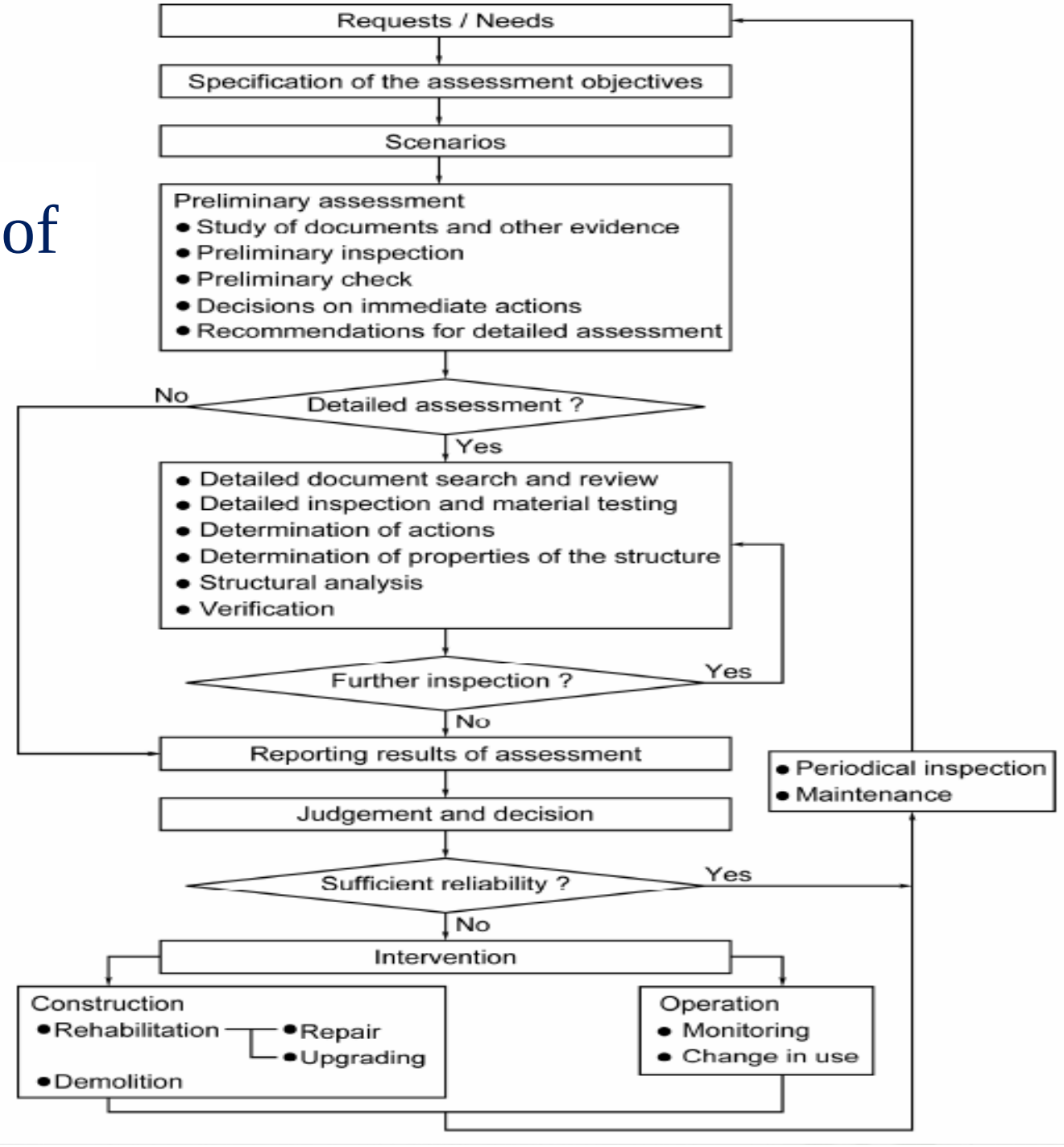
Main steps of assessment

Assessment is an iterative process consisting of:

- specification of the assessment objectives;
- scenarios related to structural conditions and actions;
- preliminary assessment including recommendations;
- detailed assessment including reliability verification;
- report including proposal for intervention;
- repetition of the sequence if necessary.

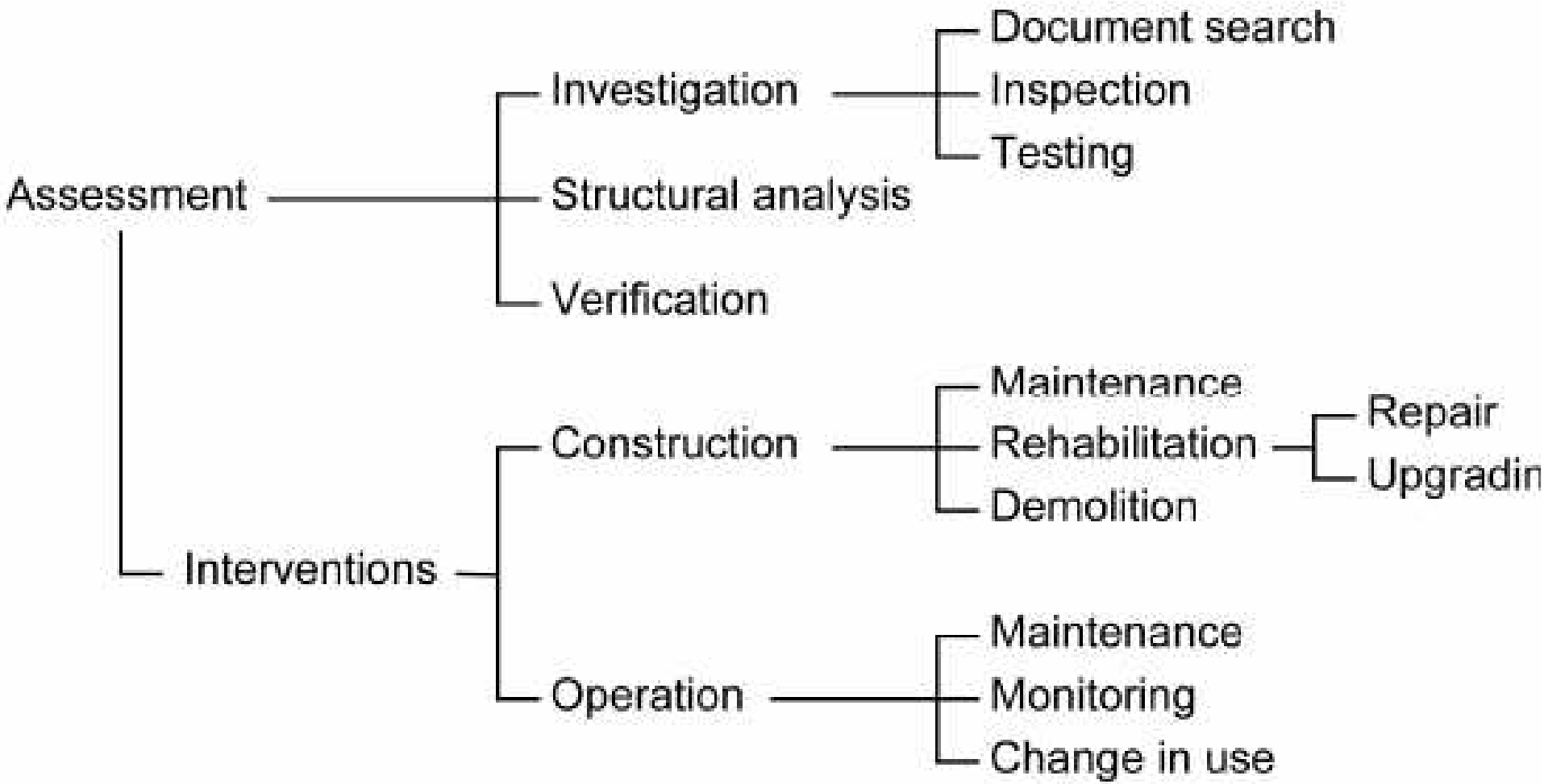
General flow of assessment

Adopted from ISO 13822



Annex A
(informative)

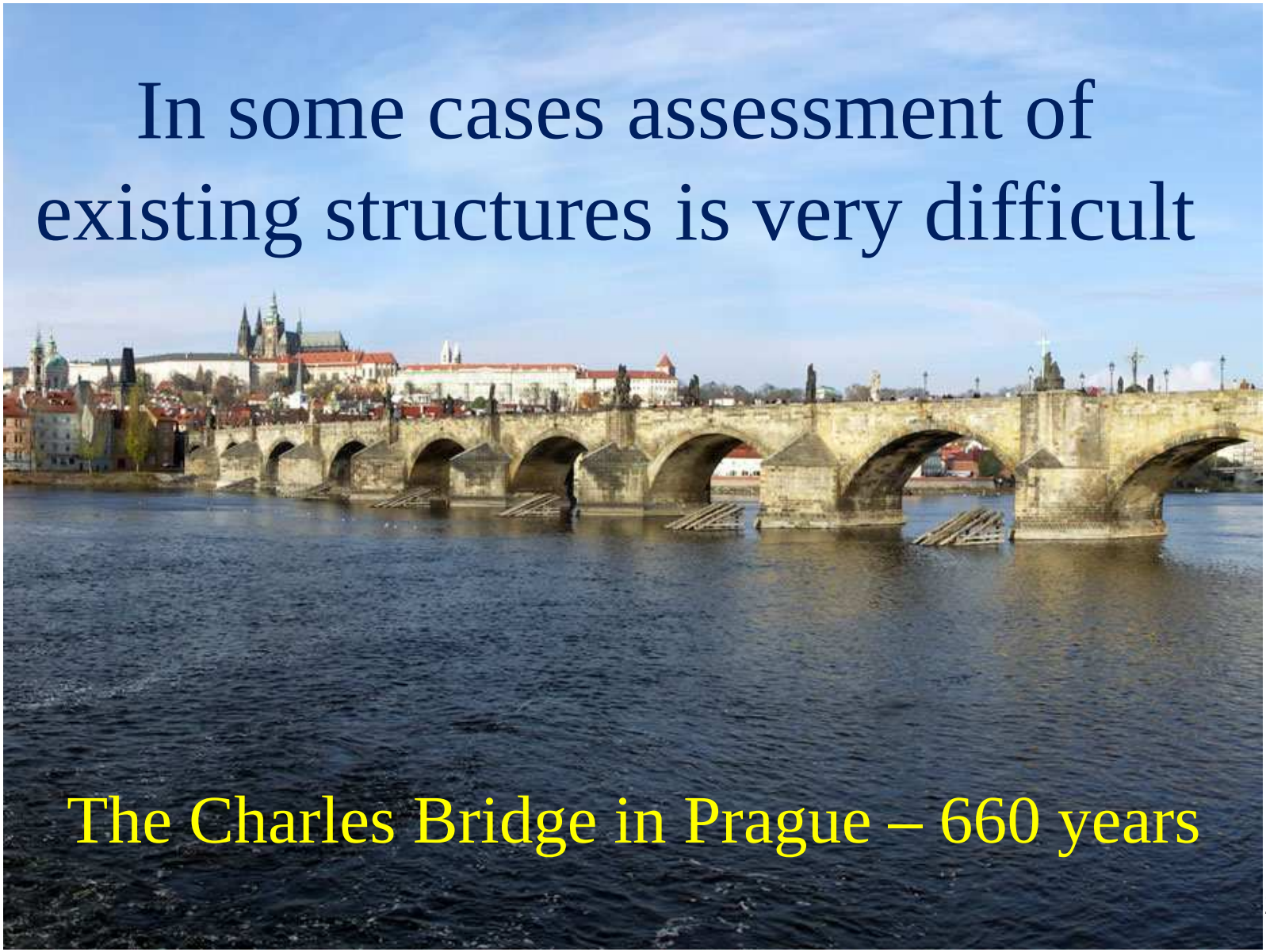
Hierarchy of terms



Summary

- Assessment of existing structures is in many aspects different from designing a new structure
- Actual characteristics of structural material, action (permanent load), and geometric data should be considered.
- Currently valid codes should be considered (models for actions and resistances). Previously used codes as background documents.
- Target reliability level should be optimized taking into account residual life time, consequences and costs of safety measures.
- Partial factor method and probabilistic methods are recommended.
- Assessment based on satisfactory past performance may be used.
- Final report should include recommendations concerning intervention.

Grazie tante per attenzione



Target reliabilities indicated in ISO 13822

Limit states	Target reliability index, β	Reference period
Serviceability		
Reversible	0,0	Intended remaining working life
Irreversible	1,5	Intended remaining working life
Fatigue		
inspectable	2,3	Intended remaining working life
not inspectable	3,1	Intended remaining working life
Ultimate		
very low consequences of failure	2,3	L_S years*
low consequence of failure	3,1	L_S years*
medium consequence of failure	3,8	L_S years*
high consequence of failure	4,3	L_S years*
* L_S is a minimum standard period for safety (e.g. 50 years)		

Partial factor

- Design value

for normal and lognormal distribution

$$x_{\mathrm{d}} = \mu(1 - \alpha\beta\, V)$$

for lognormal distribution:x_{d}

$$= \mu\, exp\left(-\alpha\beta\, \sigma - 0.5\, \sigma^2\right)$$

- Characteristic value

$$\text{for normal } x_{\mathrm{k}} = \mu(1 - kV)$$

$$\text{for lognormal } x_{\mathrm{k}} = \mu\ exp\left(-k\, \sigma - 0.5\, \sigma^2\right)$$

- Partial factor $\gamma_{\mathrm{m}} = \frac{x_k}{x_d}$