Welcome to the first meeting in Prague on 26. and 27.10.2011

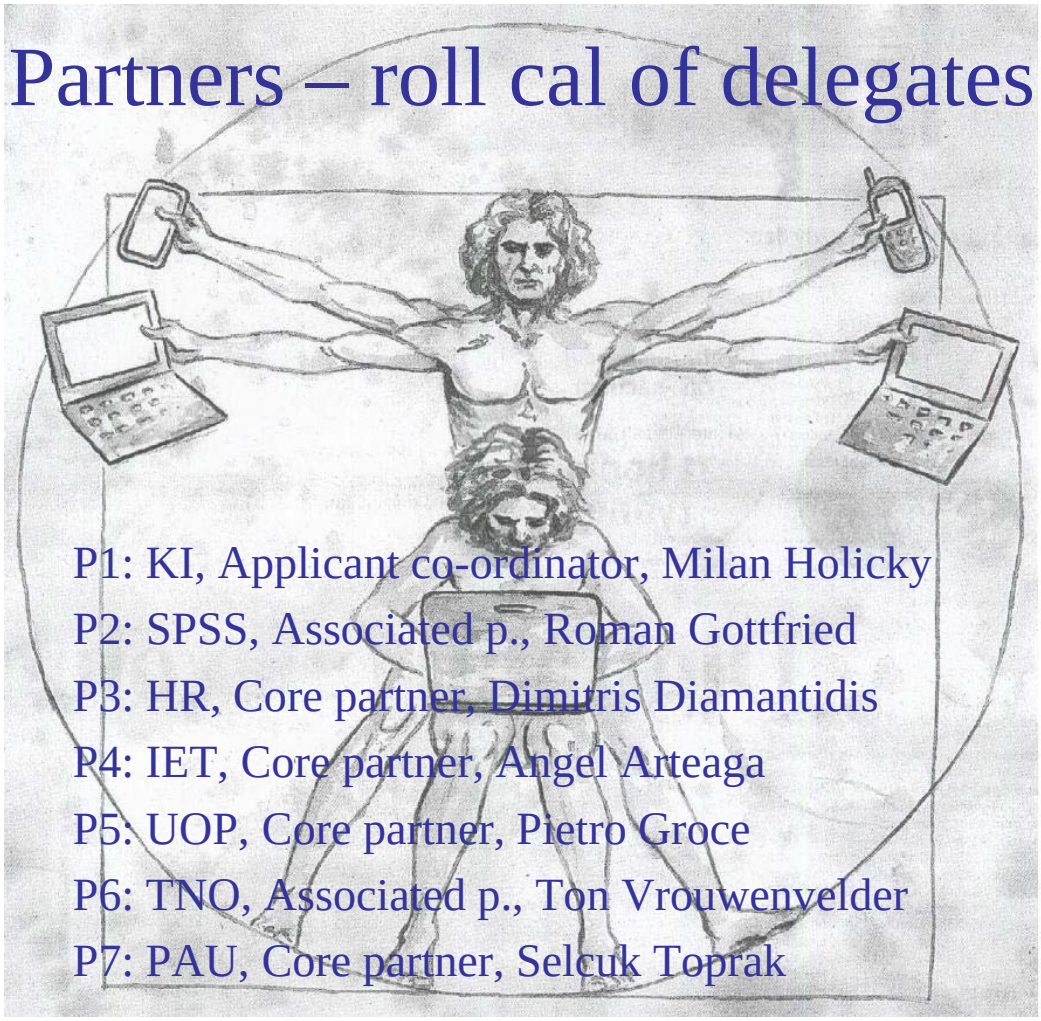
Vocational Training in Assessment of Existing Structures

Agreement number: CZ/11/LLP-LdV/TOI/134005

Draft agenda

1. Opening (on Wednesday, October 26 at 10:00 am).
2. Roll call of delegates.
3. Adoption of the agenda.
4. Contracts and subcontracts.
5. Administrative and financial rules.
6. Discussion of work plan (included in the Proposal).
7. Distribution of tasks and target dates.
8. Subsequent plenary meetings (Madrid 6/2012, Regensburg 10/2012).
9. Closure of the meeting (on Thursday, October 27 at 4:00 pm).

Partners – roll cal of delegates



P1: KI, Applicant co-ordinator, Milan Holicky

P2: SPSS, Associated p., Roman Gottfried

P3: HR, Core partner, Dimitris Diamantidis

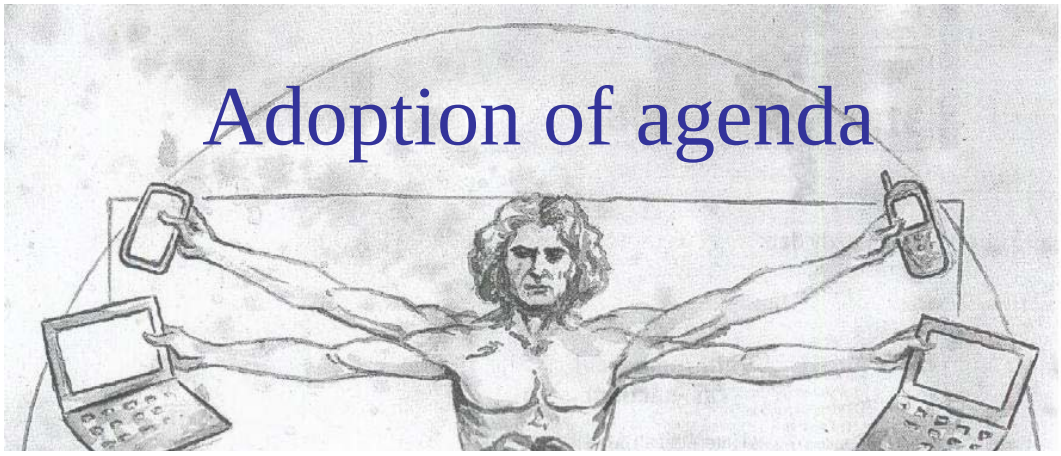
P4: IET, Core partner, Angel Arteaga

P5: UOP, Core partner, Pietro Groce

P6: TNO, Associated p., Ton Vrouwenvelder

P7: PAU, Core partner, Selcuk Toprak

Adoption of agenda



Draft agenda

1. Opening (on Wednesday, October 26 at 10:00 am).
2. Roll call of delegates.
3. Adoption of the agenda – Any other business. Referenced materials …
4. Contracts and subcontracts. – pink folder, shifted to Thursday.
5. Administrative and financial rules. – pink folder, shifted to Thursday.
6. Discussion of work plan (included in the Proposal).
7. Distribution of tasks and target dates.
8. Subsequent meetings (Madrid 6/2012, Regensburg 10/2012).
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Contracts and subcontracts

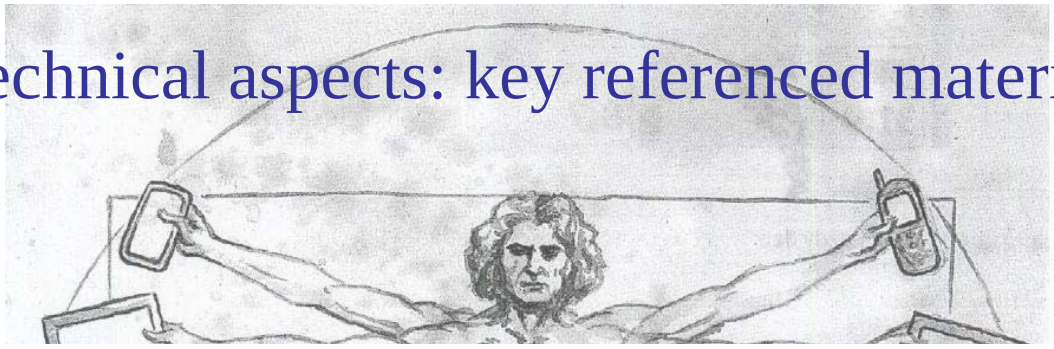
- Duration: from 1.10.2011 to 30.9.2013
- Total approved 305909,50 EUR, National agency support of 74,81%, i.e. 228850,90 EUR

	Direct costs									
	Staff costs	1. Travel and subsistence	2. Subcontracting (up to 30%)	3. Equipment (up to 10%)	4. Other	A. Total direct costs	B. Total project indirect costs (up to 7%)	Total project expenditures (A+B)	Approved grant (up to 75%)	Partner´s own funding
Total - NA	232449,50	34080,00	23479,00	0,00	4250,00	294258,50	11651,00	305909,50	228850,90	77058,60
P1(P0*)-CZ	51990,00	5500,00	8850,00	0,00	1500,00	67840,00	2660,00	70500,00	52741,05	17758,95
P2(P1*)-CZ	17450,00	4500,00	4325,00	0,00	500,00	26775,00	1069,00	27844,00	20830,10	7013,90
P3(P2*)-DE	47067,50	4655,00	3554,00	0,00	750,00	56026,50	2277,50	58304,00	43617,22	14686,78
P2(P3*)-ES	43705,00	5675,00	2000,00	0,00	500,00	51880,00	2023,00	53903,00	40324,83	13578,17
P3(P4*)-IT	44187,50	4650,00	2000,00	0,00	500,00	51337,50	2024,50	53362,00	39920,11	13441,89
P4(P5*)-NL	2017,00	4517,50	0,00	0,00	0,00	6534,50	247,00	6781,50	5073,24	1708,26
P5(P6*)-TR	26032,50	4582,50	2750,00	0,00	500,00	33865,00	1350,00	35215,00	26344,34	8870,66
P6(P7*)-										
P7(P8*)-										
P8(P9*)-										
P9(P10*)-										

Administrative and financial rules

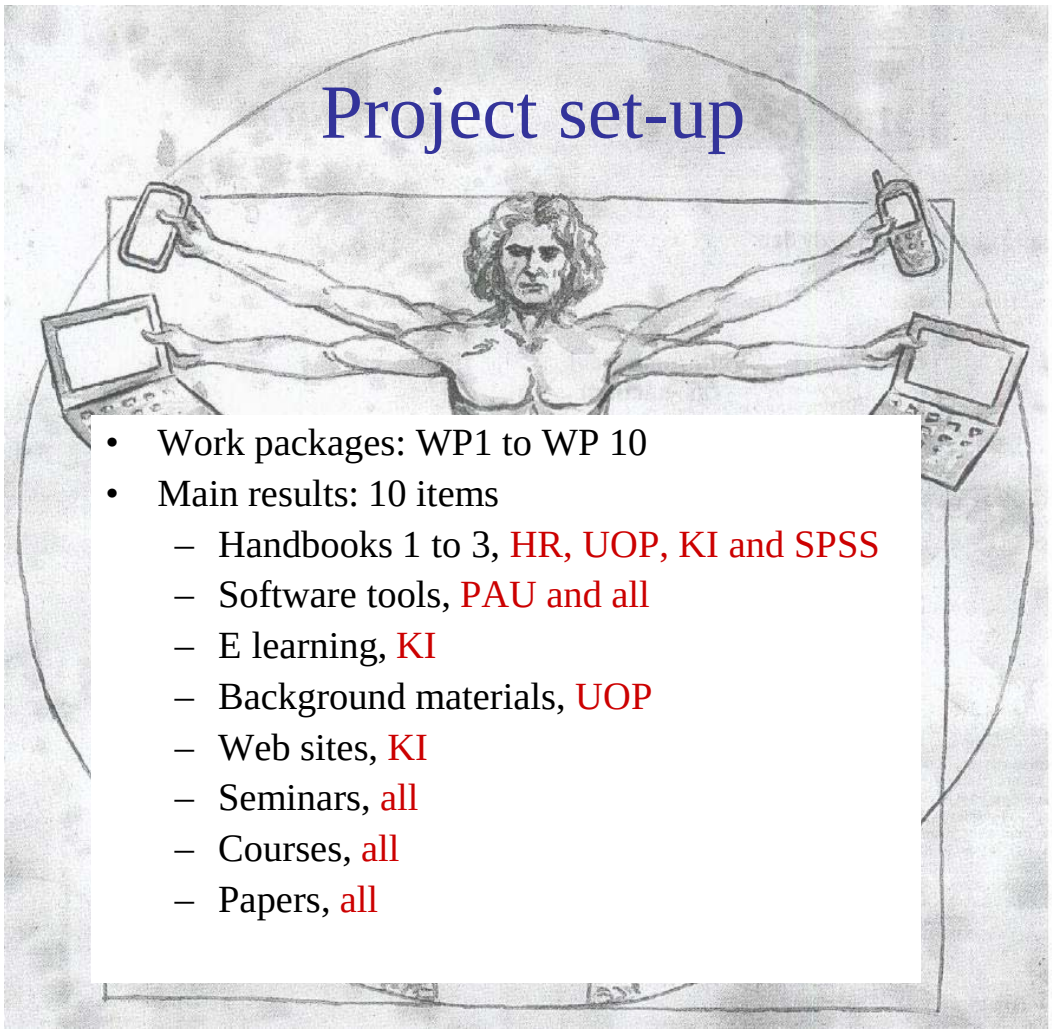
- Project duration 24 months
  from 1.10.2011 to 30.9.2013
- Interim report (1.10.2011 to 30.9.2012)
- Final report (1.10.2011 to 30.9.2013)
- All rules are given in Lifelong Learning Programme Guide for 2011 – sent you by e-mail with minutes
- Guide available on http://ec.europa.eu/education/llp/doc848_en.htm
- In an uttermost case, contact please
  Jana.Pallierova@klok.cvut.cz

Technical aspects: key referenced materials



- EN 1990, Basis of structural design, 2002
- ISO 2394, General principles …,1998
- ISO 13822, Assessment of existing …, 2010
- ISO 3898, Names and Symbols, 2010
- ISO 8930, List of terms, 2010
- ICC: International Existing Building Code, 2009
- RILEM, Probabilistic Assessment …, 2000
- JCSS PMC, present version 2001
  http://www.jcss.ethz.ch/
- JRC-ECCS-Joint report, 2008
- Fib Bulletins, new expected in 2012
- CEN TC250/WG2 Existing Structures, since July 2011

Project set-up



- Work packages: WP1 to WP 10
- Main results: 10 items
  - Handbooks 1 to 3, HR, UOP, KI and SPSS
  - Software tools, PAU and all
  - E learning, KI
  - Background materials, UOP
  - Web sites, KI
  - Seminars, all
  - Courses, all
  - Papers, all

Main results

N	Short description of result	
1	Handbook 1 - Innovative methods for the assessment of existing structures	30.9.2012
2	Handbook 2 - Operational techniques for the assessment of existing structures	31.5.2013
3	Handbook 3 - Basis for assessment of existing structures	31.5.2013
4	Software tools for practising engineers	
5	E-learning	
6	Background materials for new Eurocode on the assessment of existing structures and ISO 13822	
8	Web sites	
10	Contributions to technical journals	
7	National seminars	
9	National short-term courses	

26.10.2011

26.10.2011

26.10.2011

26.10.2011

Partners involvement

Main outcomes

		1 HB1	2 HB2	3 HB3	4 Soft	5 Elearn	6 Backg	7 Semin	8 Web	9 Cours	10 Papers	11 Transl
P1	KI	×	×	●	×	●		●	●	●	×	×
P2	SPSS	×	×	●	×	×		×		×	×	●
P3	HR	●	×	×	×	×	×	●	×	●	×	
P4	IET	×	×	×	×	×	×	●		●	×	
P5	UOP	×	●	×	×	×	●	●	×	●	×	
P6	TNO	×	×	×				×			×	
P7	PAU	×	×	×	●			●		●	×	

● convenor

× partner

Handbook 1: Innovative methods

P3 and all – 30.9.2012

- General framework of the assessment (terminology and basic requirements for safety, serviceability and durability, basic variables, assessment of heritage structures)
- Reliability differentiation (risk acceptability criteria, differentiation of reliability levels, probabilistic optimisation of the life-cycle costs)
- Advanced methods of assessment, model uncertainties
- Statistical evaluation of data for the assessment (materials, geometry, actions, degradation, evaluation of results of inspections, proof loading and testing)
- Probabilistic reliability assessment (time-variant analysis, updating, satisfactory past performance)
- Worked examples (integrated).

Handbook 1: Preliminary contents

P3 – 30.9.2012

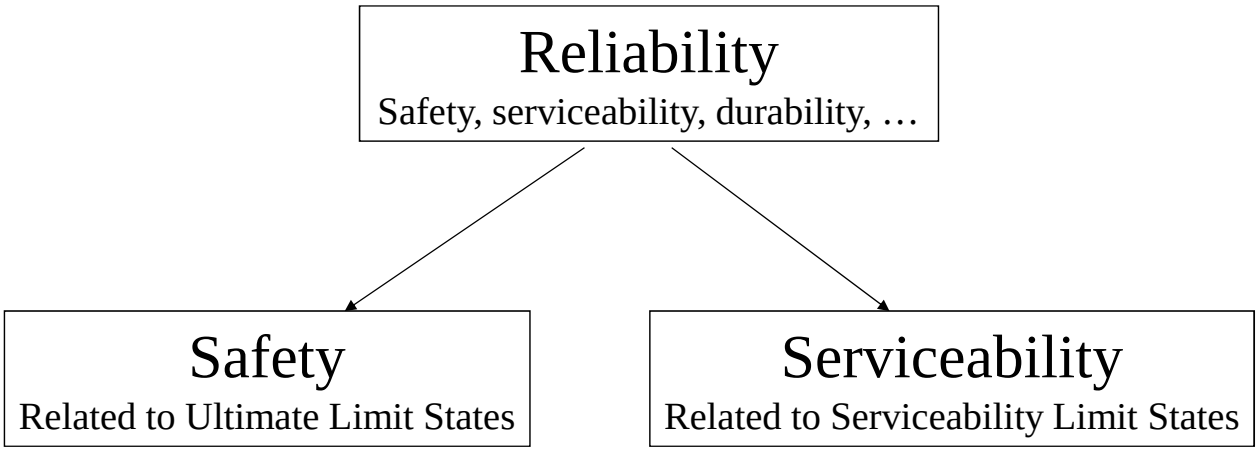
- Basic concepts, terminology – P1, P4
- Current Standards for existing structures – P3
- Requirements on performance (safety and serviceability, …)– P1, P3
- Reassessment Process/Decision criteria P3
- Information processing/basic variables of existing structures – P3
- Structural Assessment (Limit state analysis, global behaviour-robustness-system analysis- non-linear behaviour) P5
- Probabilistic assessment – P1
- Reliability differentiation – P3
- Probabilistic optimization, life cycle consideration – P1
- Verification methods (Design value method/Partial Safety Factor) – P3
- Evaluation of experiments/ proof loading – P7
- Bayesian updating (Annex 1) – P1
- Software tools (Annex 2)– All
- Examples (Integrated in text) – P1, P3, P5, P7

? Damaged structures, deterioration, fatigue, residual life, heritage structures, earthquake check list, scoring systém, ?

Basic concepts

- Reasons for assessment
- Difference between design of new and assessment of existing structures
- Performance concepts (safety, serviceability, durability, robustness)
- Actual structural conditions, diagnosis
- Original documentation
- History of loading and interventions , structural evolution
- Deterministic and probabilistic approach
- Heritage structures

Hierarchy of fundamental terms



- In ISO 8930 „the structural safety is related to the ultimate limit states“ (see ISO clauses 2.3.1, 2.3.6, 2.13.11 and others). The same concept is accepted in existing ISO 2394 and Eurocode EN 1990.
- When used in the sense of „safety of people“ then it should be distinguished, or different terms like “protection” or “security” could be used.

Standards

- Provide information about national and international documents
- ISO 13822, including annex I
- ISO 8930, 3898
- ISO 2394
- ISO 13823 and 13824
- EN 1990 and 1998
- Swiss, US, SAMCO, BRE, Italy

Requirements on performance

- Safety, serviceability,
- Durability, robustness,
- Utility, risk
- Reliability level

Reassessment Process/Decision criteria

- Preliminary examination
- Detail ivestigatin
- Expert investigation

Information processing/basic variables of existing structures

- Representative data
- Reference information
- Experimental data
- Expert judgments

Handbook 2: Operational methods

P5 – 31.5.2013

- Operational methodology of collecting and evaluating data for the assessment (materials, geometry, actions, degradation, evaluation of results of inspections, proof loading and testing)
- Overview of material properties of existing structures
- Justifiable simplifications in structural analysis
- Reliability assessment based on partial factor method, updating
- Worked examples:
- -- evaluation of data (material tests, permanent actions, updating of traffic load models based on measurements, degradation processes)
- -- proof loading
- -- Worked examples - assessment of

Handbook 2: Preliminary contents

P5 - 31.5.2013

- Review of operational methods (structural, probabilistic) P5, P2
- Verification procedure (specification of partial factors, other) P3
- Updated Actions and action effects P4
- Updated Material properties P4
- Updated Geometric data P4
- Evaluation of measurements/tests/inspection planning P1, P2
- Case studies
  - bridge P5
  - concrete building P4
  - pipeline P7
  - heritage structure P5, P7

Handbook 3: Basis of Assessment

P2 and P1 – 31.5.2013

- General framework of the assessment (terminology and basic requirements for safety, serviceability and durability)
- Methods of assessment
- Statistical evaluation of data for the assessment (materials, geometry, actions, degradation, evaluation of results of inspections, proof loading and testing)
- Verification of buildings (partial factor method)
- Worked examples.

Handbook 3: Main topics

P2, P1 – 31.5.2013

- General philosophy (conclusions from HB 1 and 2)
- General framework of the assessment P2
- Standards/Common procedures P3
- Existing codes for existing structures (HB 1, HB 2)
- Flow chart
- (Previous) design codes (permissible stresses, global factors)
- Updating of information P1, P3 (with examples)
- Methods of reliability verification P1 (with examples)
- Assessment of buildings P4 Case studies
- Assessment of bridges P5 Case studies
- Assessment of pipelines P7 Case studies

Software tools

P7 and all partners

EXCEL spread sheets
Mathcad sheets
Matlab sheets
Mathematica sheets
Computer aided training programs

An example of Mathcad sheet

Characteristic, design and γM values determined using test data

MATHCAD sheet for determination of the charactreistic, design and partial factor γM values using test data in accordance to EN 1990, Annex D .

Approximating curves for coeficients of fractile estimation given in EN 1990, Annex D

5% fractile V uknown	$ksfit(n) := 11.7 \cdot n^{-1.75} + 1.65$	$ksfit(10) = 1.858$
5% fractile V known	$k\sigma fit(n) := 0.66 \cdot n^{-0.87} + 1.65$	$k\sigma fit(10) = 1.739$
0,1 % fractile V unknown	$dsfit(n) := 255 \cdot n^{-2.465} + 3.09$	$dsfit(10) = 3.964$
0,1 % fractile V known	$d\sigma fit(n) := 1.27 \cdot n^{-0.902} + 3.09$	$d\sigma fit(10) = 3.249$

Characteristic and design values (relative values related to the mean)

Single variable, V unknown: xk=ξks*μx, xd=ξds*μx

$$\xi ks(n,V) := \frac{\exp\left[(-ksfit(n)) \cdot \sqrt{\ln\left(1+V^2\right)}\right]}{\sqrt{1+V^2}} \qquad \xi ds(n,V) := \frac{\exp\left[(-dsfit(n)) \cdot \sqrt{\ln\left(1+V^2\right)}\right]}{\sqrt{1+V^2}}$$

Single variable, V known: x k=ξkσ*μx, xd=ξdσ*μx

$$\xi k\sigma(n,V) := \frac{\exp\left[(-k\sigma fit(n)) \cdot \sqrt{\ln\left(1+V^2\right)}\right]}{\sqrt{1+V^2}} \qquad \xi d\sigma(n,V) := \frac{\exp\left[(-d\sigma fit(n)) \cdot \sqrt{\ln\left(1+V^2\right)}\right]}{\sqrt{1+V^2}}$$

Web sites

P1 and all partners

- HB translations, CZ - P1 (deadline 07/13)
- E-learning (ENG,CZ) – P1, P2,P3,P4,P5, P7 contributions (deadline 05/13)
- Software tools – P7 and all
- FAQ – (exists in CZ, ENG) - P2,P3,P5 contributions (deadline 06/13)

Background materials

P5

- CEN TC 250/WG2 Development of a new document on Existing structures (deadline 06/13)
- ISO TC 98/SC2/WG 11 – ISO 13822, background materials for a foreseen revision (deadline 06/13)

Meetings

- kick-off meeting, Prague, 26.,27.10/2011
- plenary meeting in Barcelona, 28., 29. 05/2012
- plenary meeting in Regensburg, 18.,19.10/2012
- plenary meeting in Pisa, 04/2013
- plenary meeting in Denizli, 06/2013
- final plenary meeting in Prague, 09/2013

Additional meetings between P1, and relevant partners will be planned depending on work progress. A first meeting is scheduled:
- Pisa, ~ 8. and 9.03/2012 discussion handbook 1, preparation seminar Madrid and Regensburg.
Bilateral meetings (for example between P1 and P2) or other upon need

Any other business

- CEN TC250/WG2 Existing Structures, First meeting 13.7.2011
- Fifth International Conference on Forensic Engineering, ICE, London, April 2013
- International IABSE Spring Conference: May 6-8, 2013: Assessment, Upgrading and Refurbishment of Infrastructures
- International conference:

31

SAMCO

SAMCO Final Report 2006
F08a Guideline for the Assessment of Existing Structures

F08a

Guideline for the Assessment of Existing Structures

Dir. u. Prof. Dr. W. Rücker, Dipl.-Ing. F. Hille, Dipl.-Ing. R. Rohrmann

Federal Institute of Materials Research and Testing (BAM),
Division VII.2 Buildings and Structures
Unter den Eichen 87, 12205 Berlin, Germany

SAMCO guide, 2006

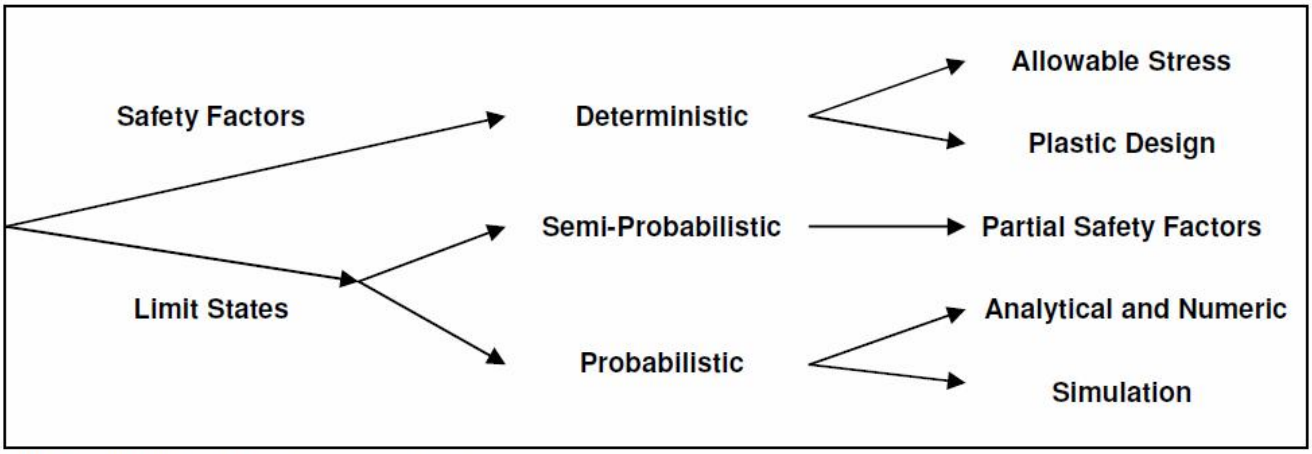


Fig.4: Reliability verification approaches [3]

Warning: this is an example of misleading terminology
Recommendation: follow the Eurocode and ISO terminology

Thanks for attending the first meeting

Hope to see you all in Pisa

The Code Corner

RLG A Technical Services

No. 21 — October 2006

Existing Buildings

By Ronald L. Geren, AIA, CSI, CCS, CCCA, SCIP

If you thought designing a new building to comply with the building code was a difficult task, try applying the building code to an existing building. In many cases, it is impossible, either financially or physically, to bring an existing building into full compliance with the current, adopted building code.

In the past, building codes have included provisions to address the unique situations presented by altering, repairing, or adding to existing structures. However, the content of these provisions was very minimal. For example, the 1997 *Uniform Building Code* had only 2 pages devoted to existing structures. When the *International Building Code* was published for the first time in 2000, the chapter on existing structures expanded significantly to 14 pages.

By the time the International Code Council was ready to publish their second edition (2003) of the International Codes, the family of codes grew by one to include the *International Existing Building Code*, or IEBC. This new member of the International Codes took a dramatic leap by adding 67 pages of provisions, with an additional 214 pages of appendices and resource materials--a one-stop-shop for existing building code compliance. The IBC still has a chapter on existing structures (Chapter 34), but all of its content is based on selected provisions in the IEBC.

The International Existing Building Code - IEBC, 2009 edition

PREFACE

Introduction

Internationally, code officials recognize the need for a modern, up-to-date code addressing repair, alteration, addition or change of occupancy in existing buildings. The *International Existing Building Code®*, in this 2009 edition, is designed to meet this need through model code regulations that safeguard the public health and safety in all communities, large and small.

This comprehensive existing building code establishes minimum regulations for existing buildings using prescriptive and performance-related provisions. It is founded on broad-based principles intended to encourage the use and reuse of existing buildings while requiring reasonable upgrades and improvements. This 2009 edition is fully compatible with all the *International Codes®* (I-Codes®) published by the International Code Council (ICC)®, including the *International Building Code®, International Energy Conservation Code®, International Fire Code®, International Fuel Gas Code®, International Mechanical Code®,* ICC *Performance Code® for Buildings and Facilities®, International Plumbing Code®, International Private Sewage Disposal Code®, International Property Maintenance Code®, International Residential Code®, International Wildland-Urban Interface Code™* and *International Zoning Code®*.

The *International Existing Building Code* provisions provide many benefits, including the model code development process, which offers an international forum for building professionals to discuss performance and prescriptive code requirements. This forum provides an excellent arena to debate proposed revisions. This model code also encourages international consistency in the application of provisions.

Safety acceptance criteria for existing structures

Dimitris Diamantidis
University of Applied Sciences, Regensburg, Germany

Paolo Bazzurro
AIR Worldwide, San Francisco, California, U.S.A

Abstract

Due to the social and economic need of utilizing existing structures, their safety evaluation is of major concern. In principle, criteria for safety acceptance of existing structures should be based on present guidelines, standards and methodologies. The mere fact that the structure fulfils the code of its time of construction cannot be decisive. Codes have changed over time due, for example, to technology development and experience gained with the performance of structures when struck by past events. This does not mean, however, that if a new code with more severe requirements than old ones comes into practice, old buildings should necessarily be deemed unsafe. A "discount" in the safety requirements for existing structures is simply unavoidable due to economical and legal constraints. The present contribution discusses current risk acceptability criteria for existing structures based on:

- experience gained from European practice
- review of current criteria for existing structures in seismic regions of US
- industrial experience gained from various projects
- recommendations given by the Joint Committee on Structural Safety (JCSS)
- cost benefit approach including implied costs to avert casualties

Suggestions for future recommendations for risk acceptance criteria of existing structures are also provided.

JRC Scientific and Technical Reports

Assessment of Existing Steel Structures: Recommendations for Estimation of Remaining Fatigue Life

B. Kühn, M. Lukić, A. Nussbaumer, H.-P. Günther, R. Helmerich, S. Herion, M.H. Kolstein, S. Walbridge, B. Androic, O. Dijkstra, Ö. Bucak

Background documents in support to the implementation, harmonization and further development of the Eurocodes

Joint Report

Prepared under the JRC – ECCS cooperation agreement for the evolution of Eurocode 3 (programme of CEN / TC 250)

Editors: G. Sedlacek, F. Bijlaard, M. Géradin, A. Pinto and S. Dimova

First Edition, February 2008

EUR 23252 EN - 2008

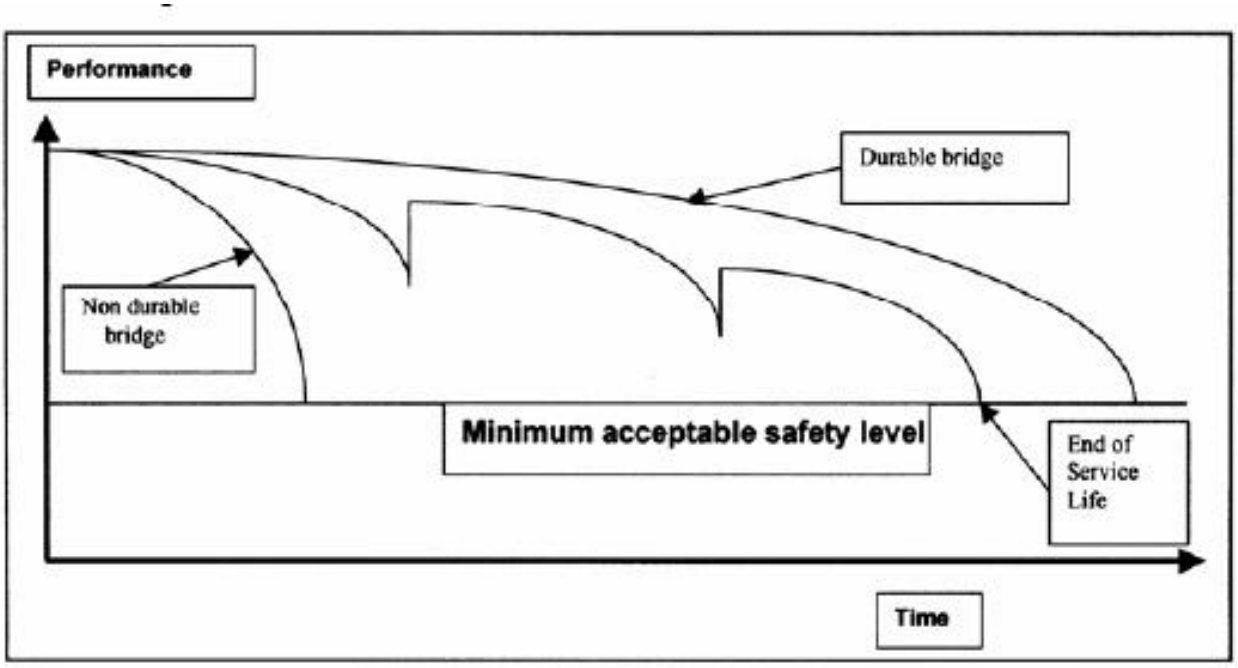


Fig. 2-9: Reliability re-evaluation [Lit. 57]

Department of Civil and Environmental Engineering
Stanford University

PERFORMANCE-BASED ASSESSMENT OF EXISTING STRUCTURES ACCOUNTING FOR RESIDUAL DISPLACEMENTS

by

Jorge Ruiz-Garcia
and
E. Miranda

2005