JCSS

Joint Committee
on Structural Safety

Workshop on Assessment of Existing Structures

28th and 29th January 2021

Standardisation for Assessment of Existing Structures
Evolution from Technical Specification to Eurocode

Part 2 – new Eurocode

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Members of Project Team CEN/TC 250/WG 2/WG2.T2

PT role	Name	Affiliation	Country
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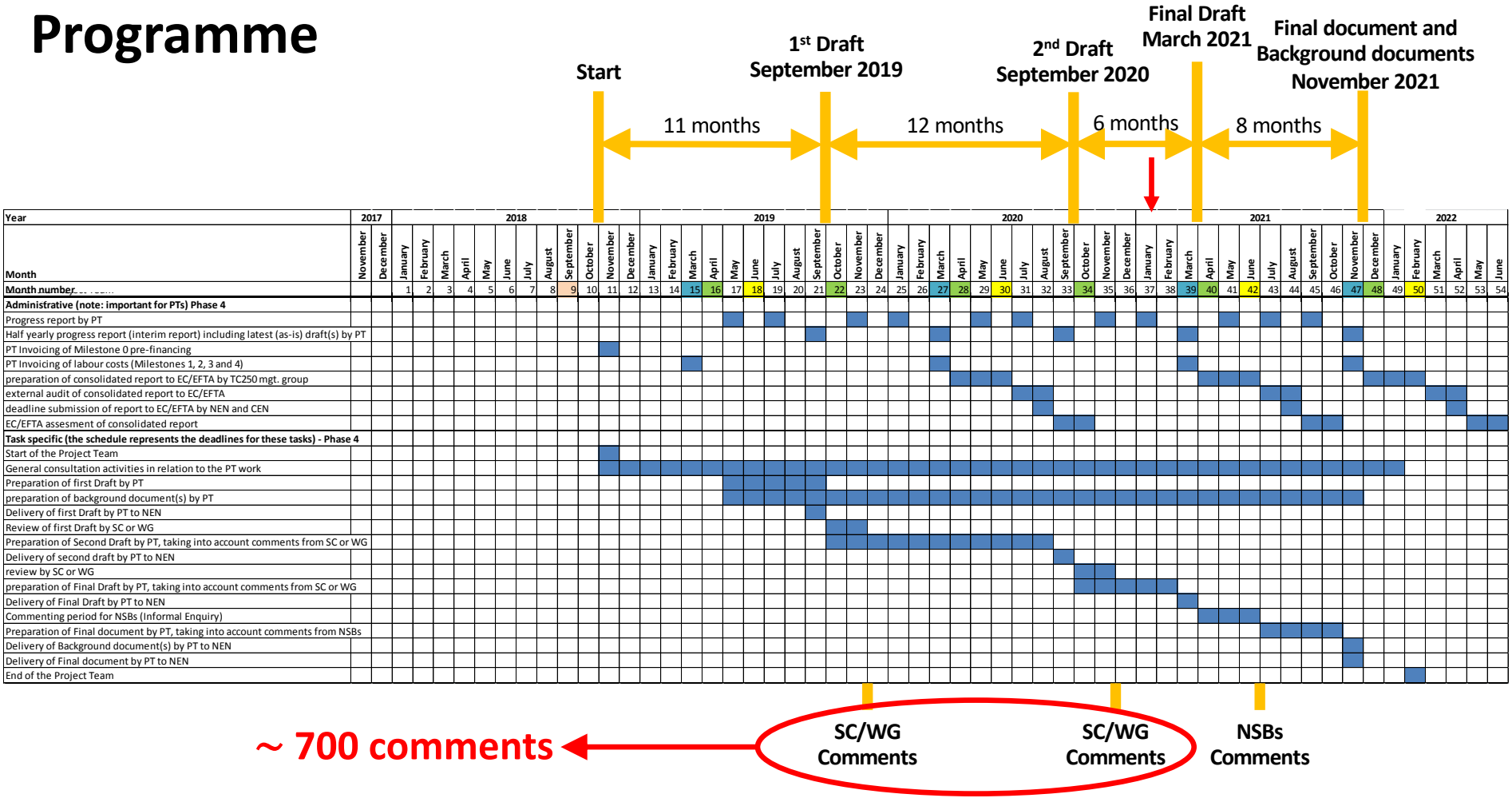
Member	Alan O'Connor	Trinity College Dublin	Ireland
Member	Jon Shave	WSP	UK
Member	Peter Tanner	CESMA Ingenieros	Spain
WG2 Convenor	Thomas Lang	Thomas Lang Consulting GmbH	Switzerland

Programme


Start
1st Draft
September 2019
2nd Draft
September 2020
Final Draft
March 2021
Final document and
Background documents
November 2021
11 months
12 months
6 months
8 months
Year
2017
2018
2019
2020
2021
2022
Month
November
December
January
February
March
April
May
June
July
August
September
October
November
December
Month number
Administrative (note: important for PTs) Phase 4
Progress report by PT
Half yearly progress report (interim report) including latest (as-is) draft(s) by PT
PT Invoicing of Milestone 0 pre-financing
PT Invoicing of labour costs (Milestones 1, 2, 3 and 4)
preparation of consolidated report to EC/EFTA by TC250 mgt. group
external audit of consolidated report to EC/EFTA
deadline submission of report to EC/EFTA by NEN and CEN
EC/EFTA assesment of consolidated report
Task specific (the schedule represents the deadlines for these tasks) - Phase 4
Start of the Project Team
General consultation activities in relation to the PT work
Preparation of first Draft by PT
preparation of background document(s) by PT
Delivery of first Draft by PT to NEN
Review of first Draft by SC or WG
Preparation of Second Draft by PT, taking into account comments from SC or WG
Delivery of second draft by PT to NEN
review by SC or WG
preparation of Final Draft by PT, taking into account comments from SC or WG
Delivery of Final Draft by PT to NEN
Commenting period for NSBs (Informal Enquiry)
Preparation of Final document by PT, taking into account comments from NSBs
Delivery of Background document(s) by PT to NEN
Delivery of Final document by PT to NEN
End of the Project Team
~ 700 comments
SC/WG Comments
SC/WG Comments
NSBs Comments

Tasks of WG2.T2

Development of new harmonised European technical rules for the assessment and retrofitting of existing structures, which are related to the principles and fundamental requirements of the EN Eurocodes.

The technical rules for existing structures are not self-standing rules but they complement those of relevant EN Eurocodes by identifying and distinguishing the differences between the design of new structures and the assessment and retrofitting of existing ones.

Tasks of WG2.T2

New Eurocode

3 Tasks:

Sub Task 1: EN Eurocode for Existing Structures - General rules

Sub Task 2: EN Eurocode for Existing Structures – Actions

Sub Task 3: Report on requirements and guidance on the development of material-specific assessment and retrofit provisions

New Eurocode: main challenge

different countries had developed in the past different products, approaches and codes of practice

the new Eurocode on existing structures should account for these differences and, hence, should give Countries a wider possibility to add specific rules for different peculiarities

New Eurocode: general

Additional provisions to EN 1990 to cover the assessment of existing structures and the retained elements of existing structures that are being retrofitted

New Eurocode: general

- Provisions related to using **updated data** for basic variables and updated structural models
- General principles regarding **actions** for assessment complementing EN 1991

New Eurocode: general

- ✕ No specific rules for initiation of assessment
- ✕ No specific rules on how to undertake interventions that may be carried out as a result of an assessment
- ✕ No material-specific technical provisions for the assessment and retrofitting of existing structures
- ✕ No provisions for design of new elements that will be integrated into an existing structure (see EN 1990)
- ✕ No provisions for seismic assessment and retrofitting of existing structures (see EN 1998-3)

New Eurocode: list of contents

What is an existing structure?

What is an existing structure?

prEN 1990

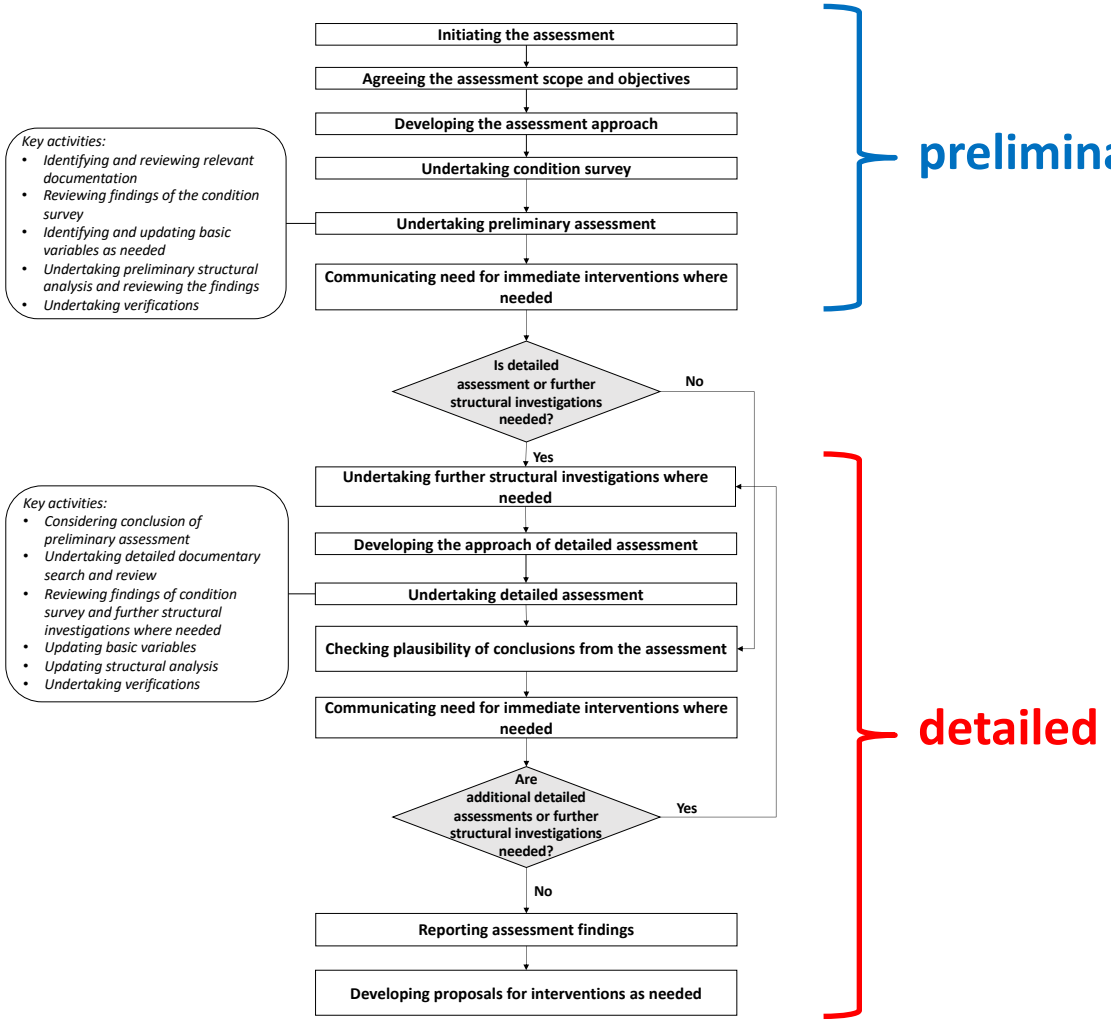
structure: part of the construction works that provides stability, resistance, and rigidity against various actions

New Eurocode

existing structure: any structure that physically (materially) exists

Assessment process

Stepwise process with increasing levels of detail and accuracy



Methods of assessment

Quantitative assessment based on calculations, or

Qualitative assessment based on past performance, or

a combination of quantitative and qualitative assessment

Restrictions on the use of the assessment based on past performance can be set by the National Annex

Requirements at ULS

Assessment based on past performance

- No evidence of significant damage, distress, defect, excessive deformation, displacement or deterioration
- the structural system is understood
- satisfactory performance for a sufficiently long period of time
- any predicted deterioration would not be expected to affect the safety
- the risk (likelihood and consequence) associated with local failures can be classified as acceptable

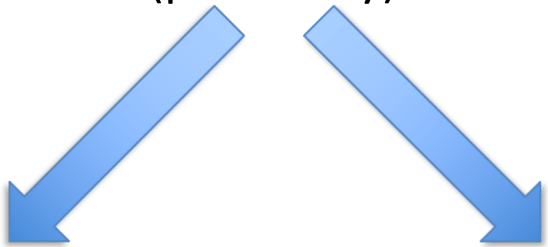
Detailed structural investigation needed for the limit state being assessed

Verification methods

partial factor method

\+

(possibility)



reliability-based method

risk-informed method

Partial factor method

$$E_a \leq R_a$$

$$E_a = \gamma_{Sa} E\left\{\sum(\gamma_f \psi F_k);\ a_a;\ X_{Ra}\right\}$$

$$R_a = \frac{1}{\gamma_{Ra}} R\left\{\frac{\eta X_k}{\gamma_m};\ a_a;\ \sum F_{Ea}\right\}$$

$$E_a = E\left\{\sum F_a;\ a_a;\ X_a\right\} = E\left\{\sum(\gamma_F \psi F_k);\ a_a;\ X_{Ra}\right\}$$

$$R_a = R\left\{X_a; a_a;\ \sum F_{Ea}\right\} = R\left\{\frac{\eta X_k}{\gamma_M};\ a_a;\ \sum F_{Ea}\right\}$$

fixed partial factors

(cluster of cases)

adjusted partial factors

(individual case)

Reliability-based approach

$$P_f = \mathrm{P}\{g(x) < 0\} \leq P_{ft}$$

P_{ft} (NDP) is the target probability of failure for a given reference period

Reference period: period of time that is used as a basis for statistically assessing extreme realizations of variable actions and possibly for accidental actions

Reliability-based approach

$$P_f = \mathrm{P}\{g(x) < 0\} \leq P_{ft}$$

The target reliability for an existing structure should take account of the relevant factors, including:

- the possible cause and /or mode of attaining a limit state
- the possible consequences of failure in terms of risk to life, injury, potential economical losses
- the relative costs of safety measures to increase reliability
- the reference period

The target reliability for an existing structure may be specified in one or both of the following ways:

- by the classification of the structure as a whole
- by the classification of its members

Reliability-based approach

$$\beta = -\Phi^{-1}(P_f) > \beta_t$$

Where annual target reliability indices are used, they should be fulfilled in each sub sequent year of the remaining service life of the structure

Interventions

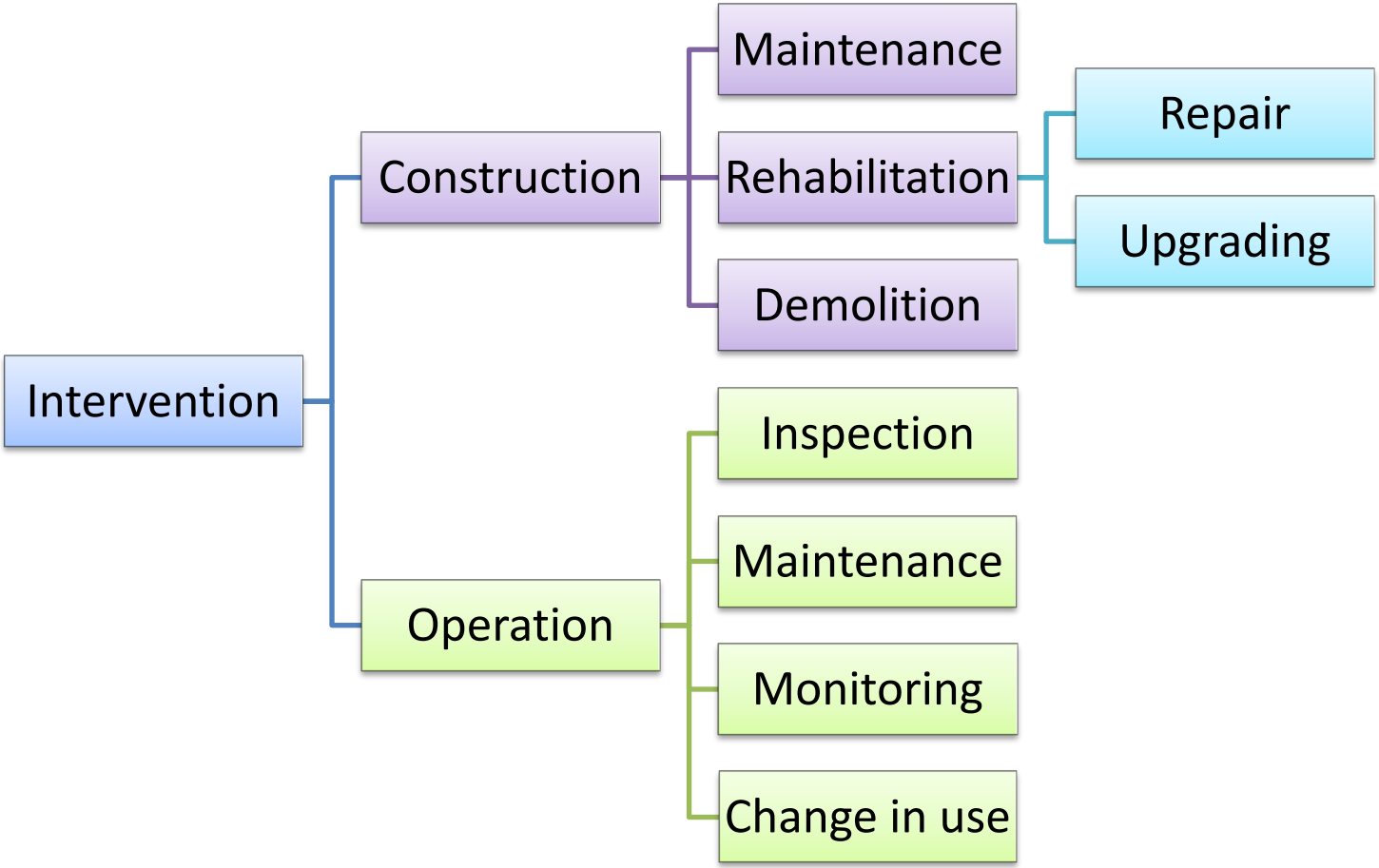
Proposal for interventions should be given in the conclusions of the assessment

Interventions

Interventions should be defined taking account of the following:

- the type and importance of the structure
- the specific requirement that is not met
- possible cause and mode of attaining a limit state
- expected consequences of failure
- options of interventions that are available

Options of interventions



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