EUROPEAN UNION

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EU-ASEAN DIALOGUE ON EUROCODES

2nd EU-ASEAN Regional Workshop on Eurocodes:

Raising Awareness of the Eurocodes and Elaboration of Climatic Maps and Adaptation of Structural Design to Climate Change

Singapore, 9-10 October 2023

Eurocodes in non-EU countries – Western Balkan Region' success story

Roberta Apostolska, E-READI Eurocodes Senior non-key expert

Enhanced Regional EU-ASEAN Dialogue Instrument (E-READI)

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Enhanced Regional EU-ASEAN Dialogue Instrument (E-READI)

OUTLINE

- About the EN Eurocodes
- National implementation of the EN Eurocodes
- Eurocodes in non-EU countries – Western Balkan Region' success story
- Challenges and opportunities

The European standardization system

Design Standards: the **Eurocodes**

Material and **Product** Standards: steel, concrete, structural bearings, barriers, parapets, etc.

European Technical Approvals: expansion joints, prestressing tendons, etc.

Execution standards: execution of concrete and steel structures, etc.

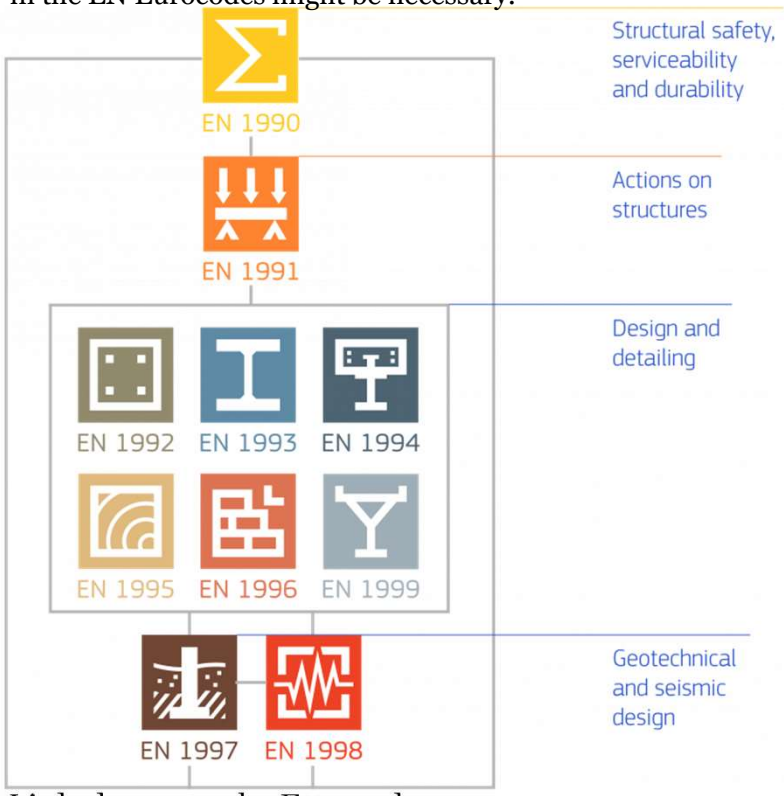
Test standards: testing of concrete, masonry units, fire tests, etc.

European Standards (EN) family

http://eurocodes.jrc.ec.europa.eu

The Eurocodes at a glance

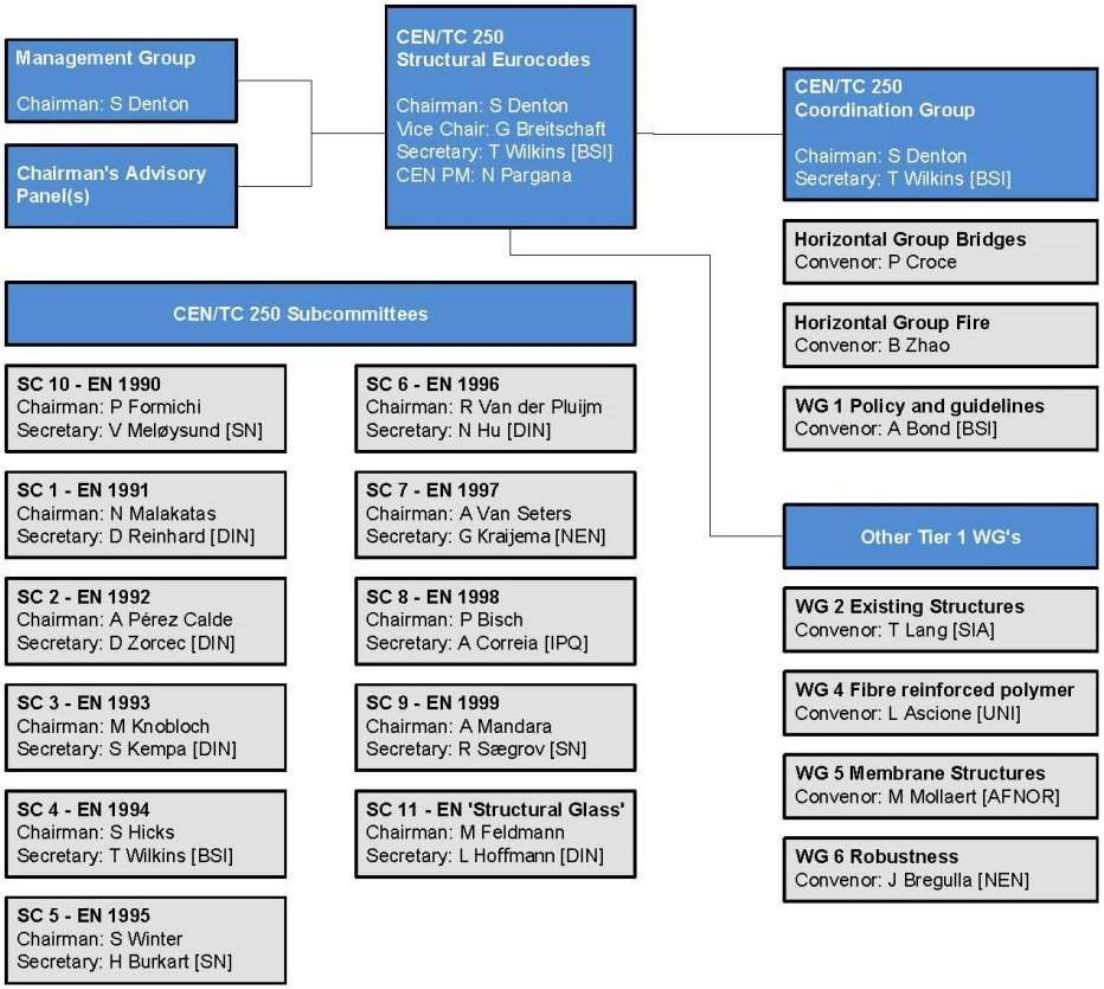
The EN Eurocodes apply to the **structural design of buildings and other civil engineering works** including, geotechnical aspects, structural fire design and situations including earthquakes, execution and temporary structures. For the design of special construction works (e.g. nuclear installations, dams, etc.) other provisions than those in the EN Eurocodes might be necessary.



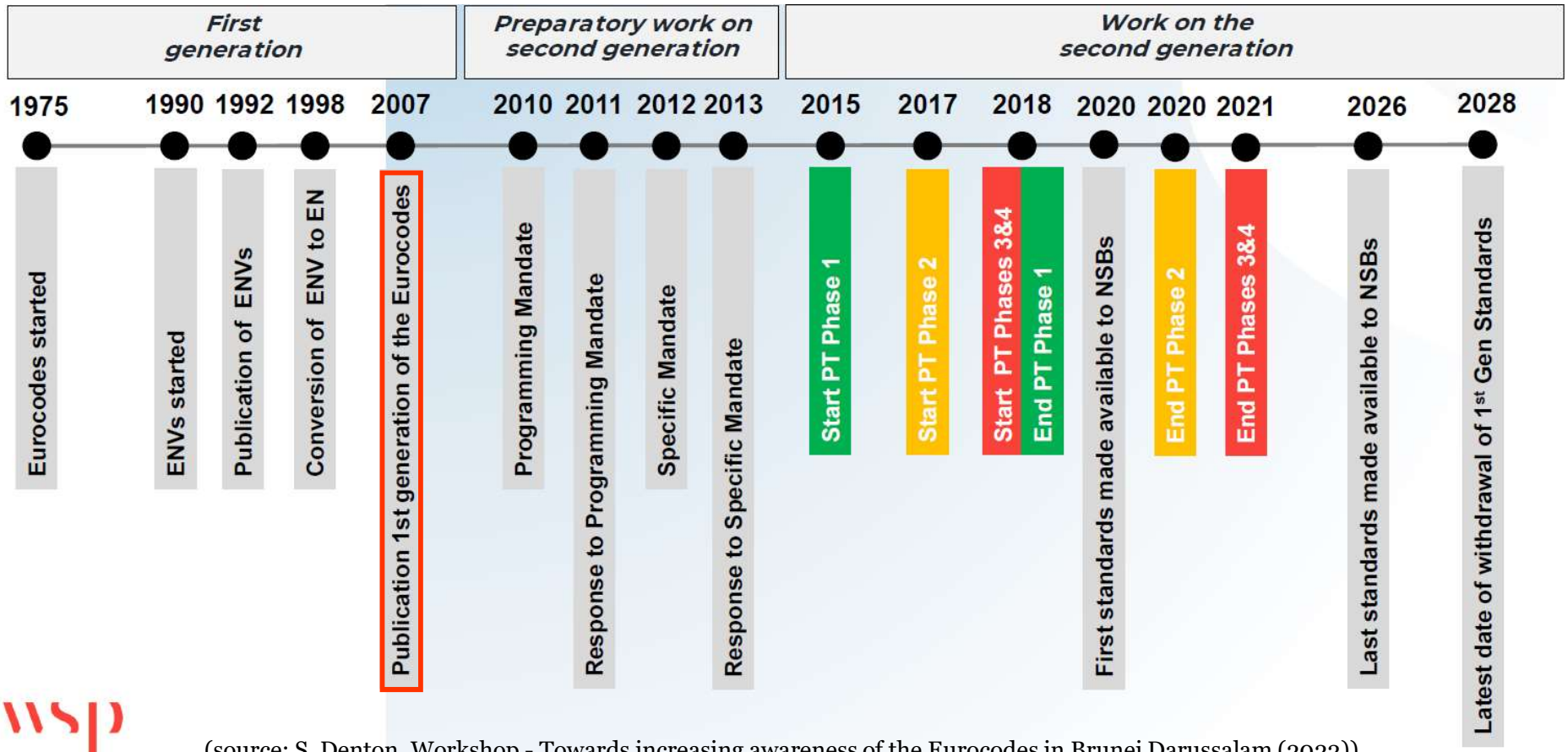
Links between the Eurocodes
(source: https://eurocodes.jrc.ec.europa.eu/en-eurocodes/eurocodes-family)

CEN/TC250 "Structural Eurocodes“

The EN Eurocodes are developed under the guidance and co-ordination of CEN Technical Committee 250 (CEN/TC250) "Structural Eurocodes“ (source: https://eurocodes.jrc.ec.europa.eu/policies-standards/centc250-structural-eurocodes)



Evolution of the Eurocodes



(source: S. Denton, Workshop - Towards increasing awareness of the Eurocodes in Brunei Darussalam (2022))

International use

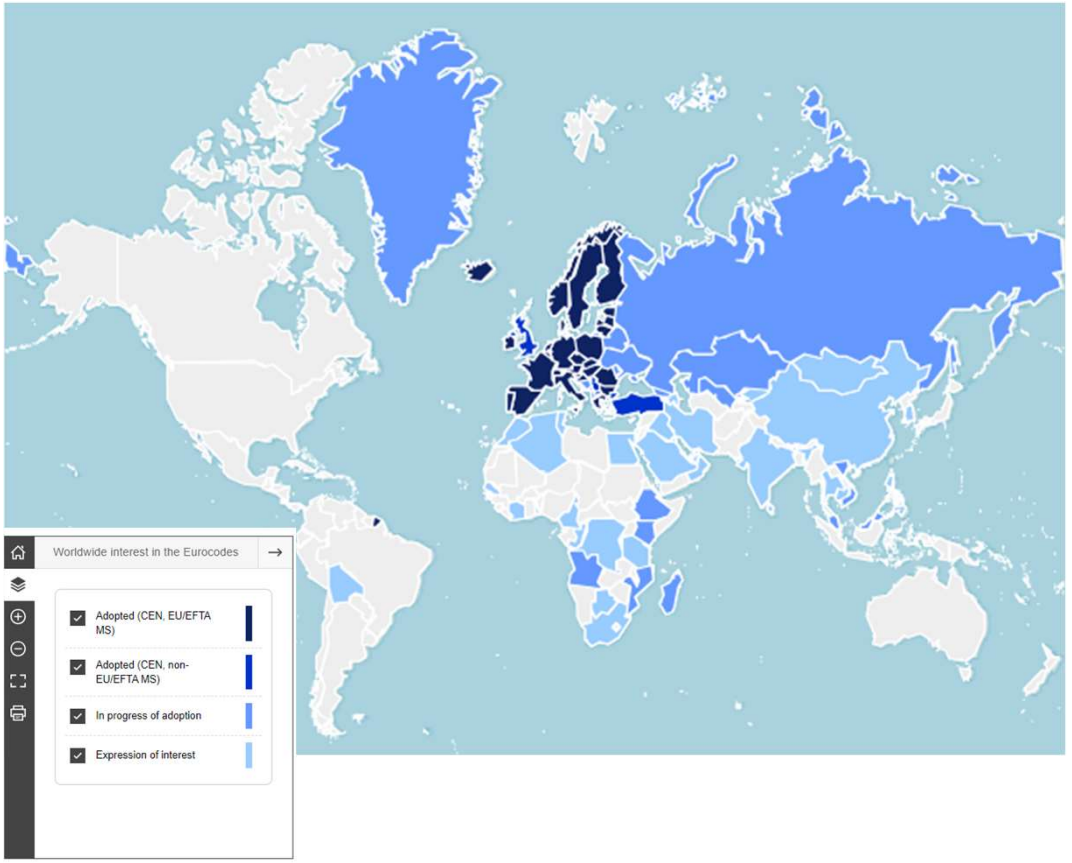
There is a considerable interest in the use of EN Eurocodes outside EU/EFTA by countries:

- whose **National Standards are based on European National Standards** that will soon be withdrawn;
- who want to **update their National Standards** based on technically advanced codes;
- who are **interested in trading** with the European Union and EFTA Member States.

What are the Eurocodes?

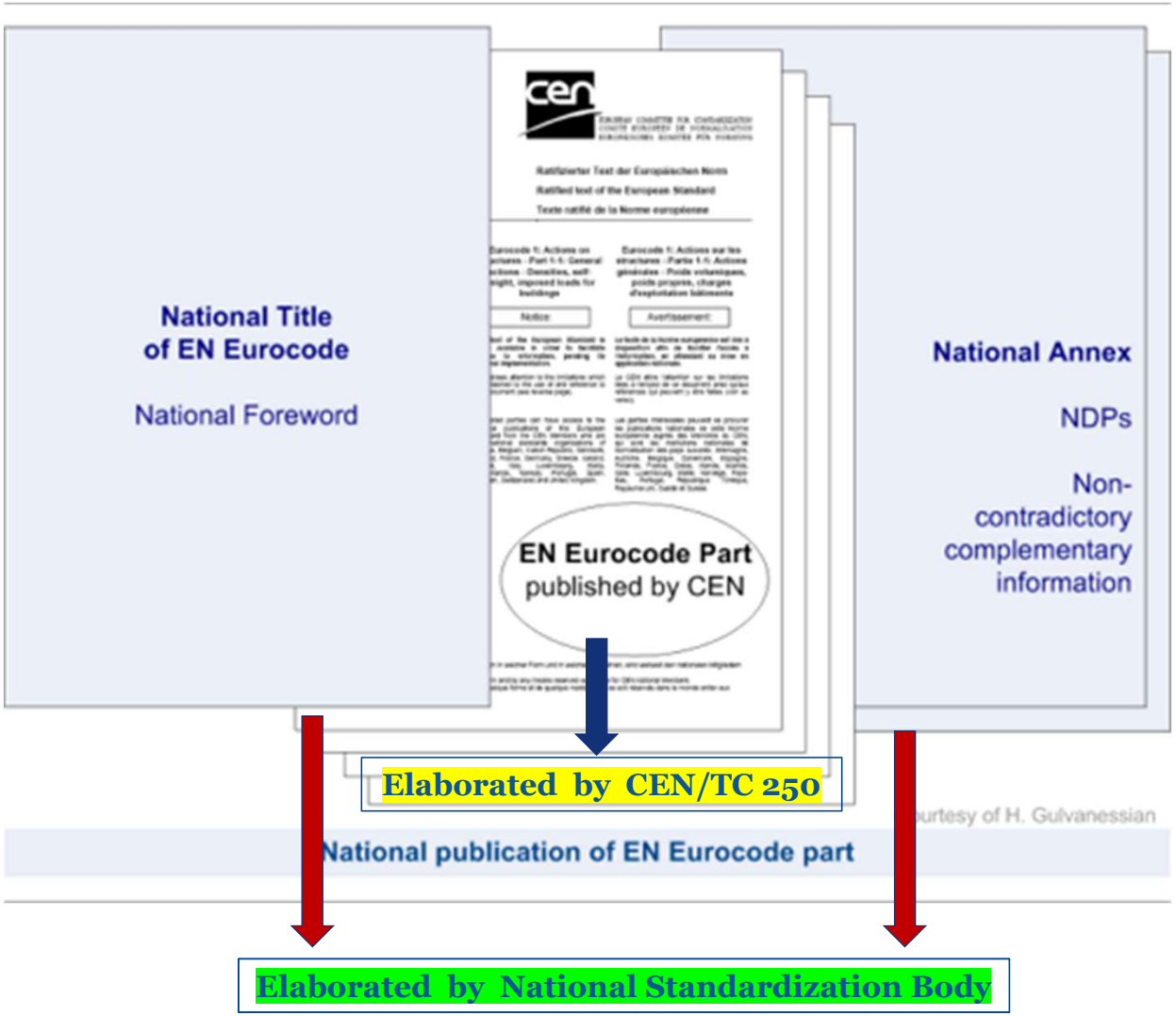
- **a complete set of design standards** that cover in a comprehensive manner all principal construction materials, all major fields of structural engineering and a wide range of types of structures and products;
- the most **up-to-date codes of practice**;
- **flexible**, offering the possibility for each country to adapt the Eurocodes to their specific conditions regarding climate, seismic risk, traditions, etc. **through the Nationally Determined Parameters**. Nationally Determined Parameters can also be adapted to the national approach and setup regarding risk and safety factors.

Worldwide interest

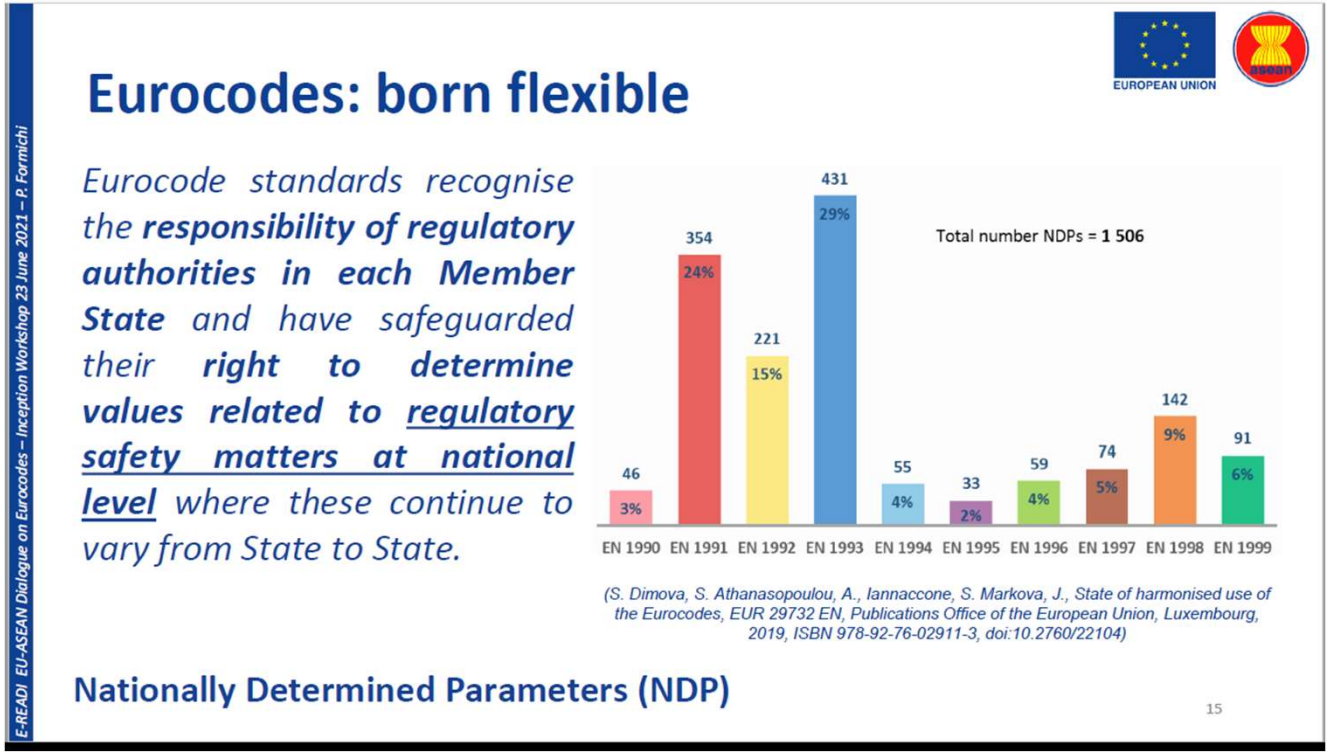


https://eurocodes.jrc.ec.europa.eu/en-eurocodes/use-outside-euefta-member-states

National implementation of the EN Eurocodes



National implementation of the EN Eurocodes

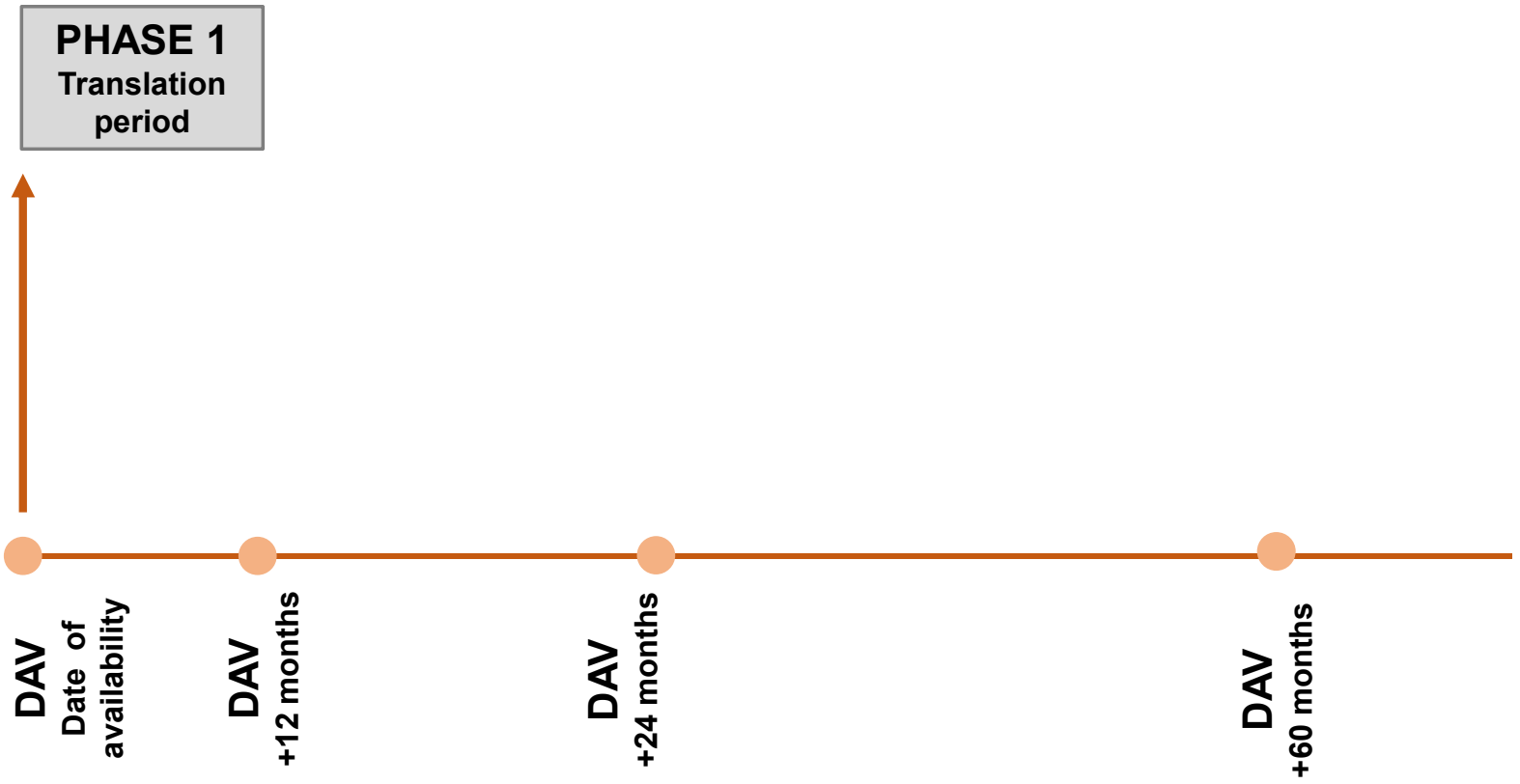


(source: P. Formichi, 1st EU-ASEAN Dialogues on Eurocodes (2021)

National implementation of the EN Eurocode – time schedule

DAV – Date of availability

Date when the CEN has delivered the EN Eurocodes Part to the National Standardisation Body



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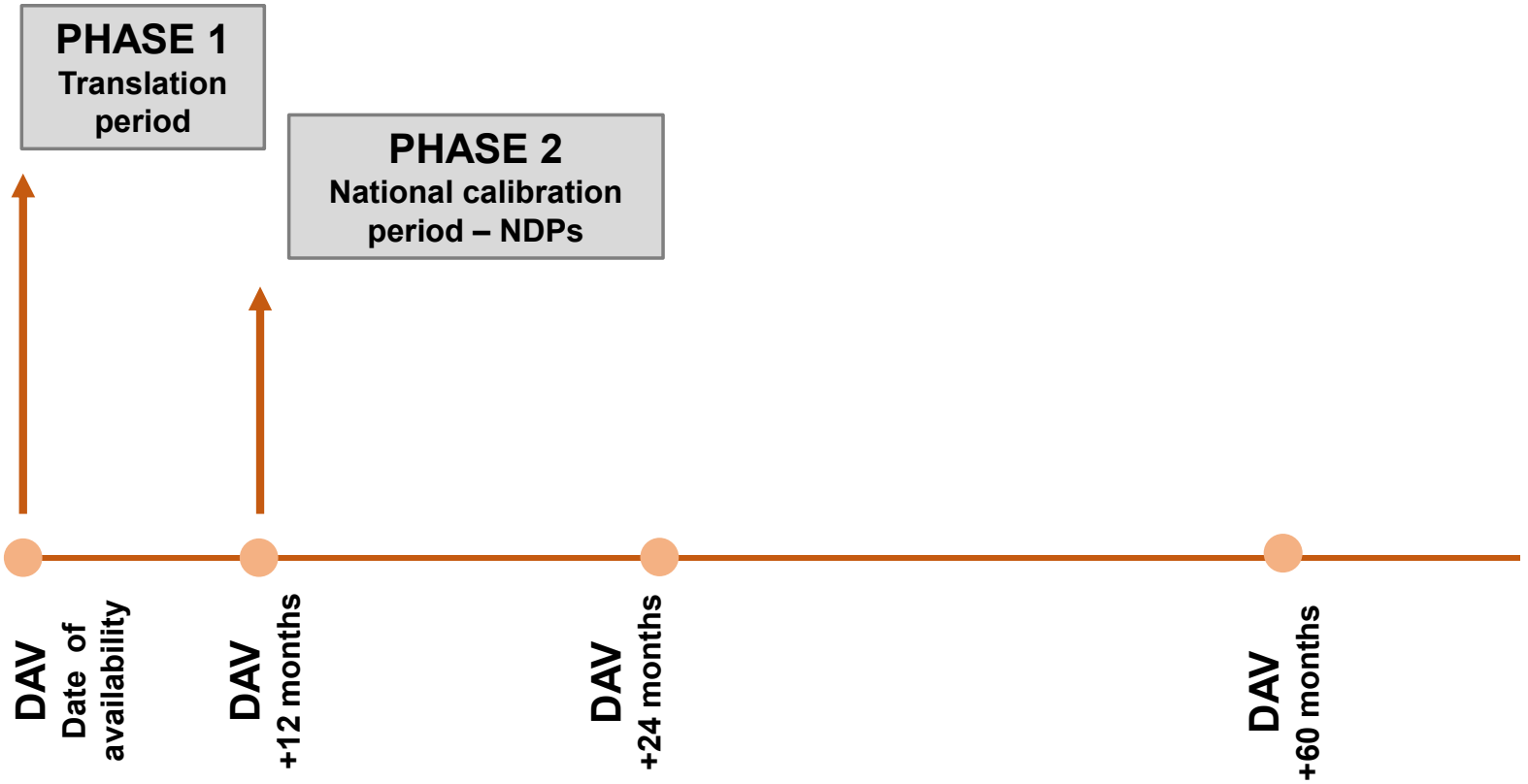

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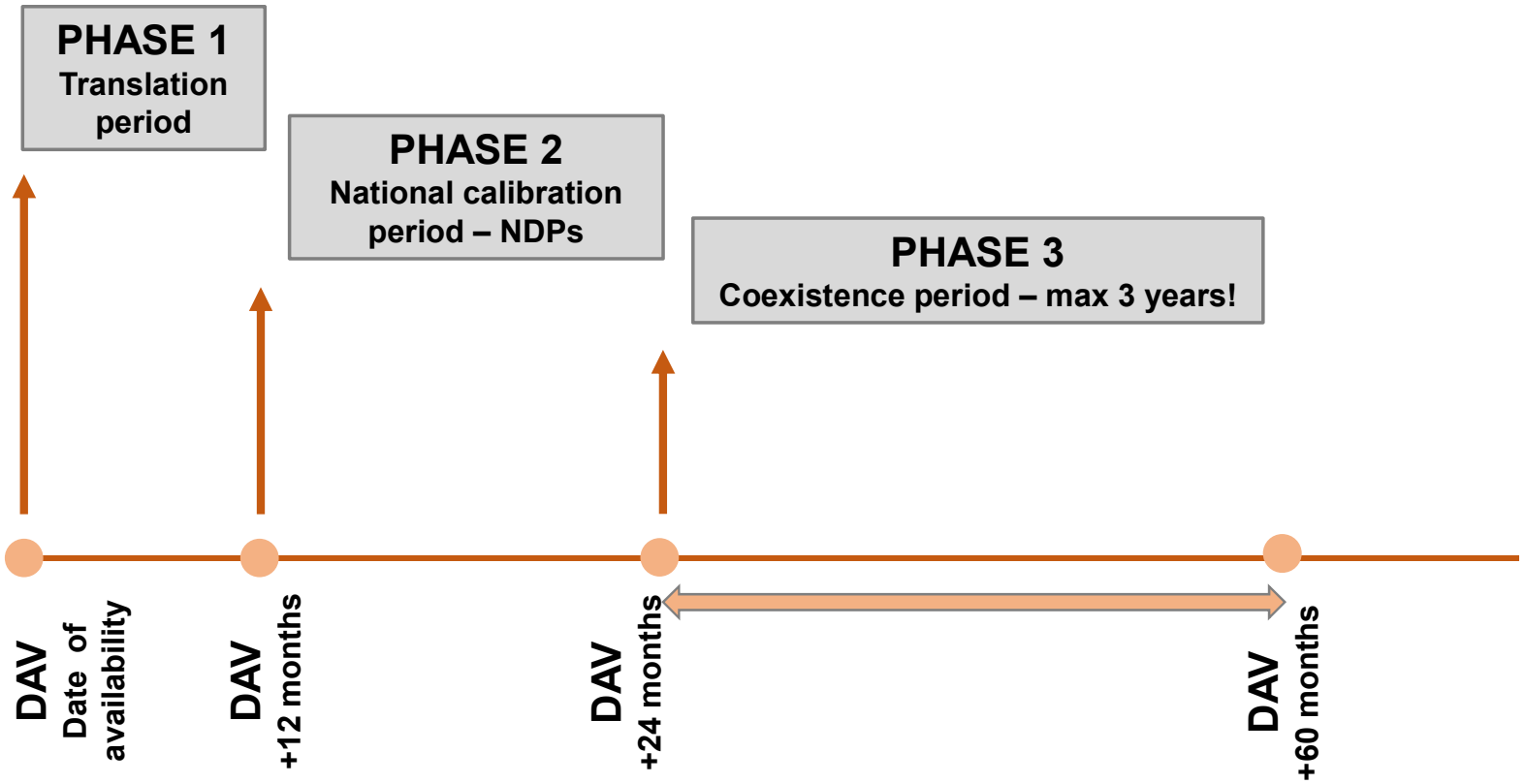

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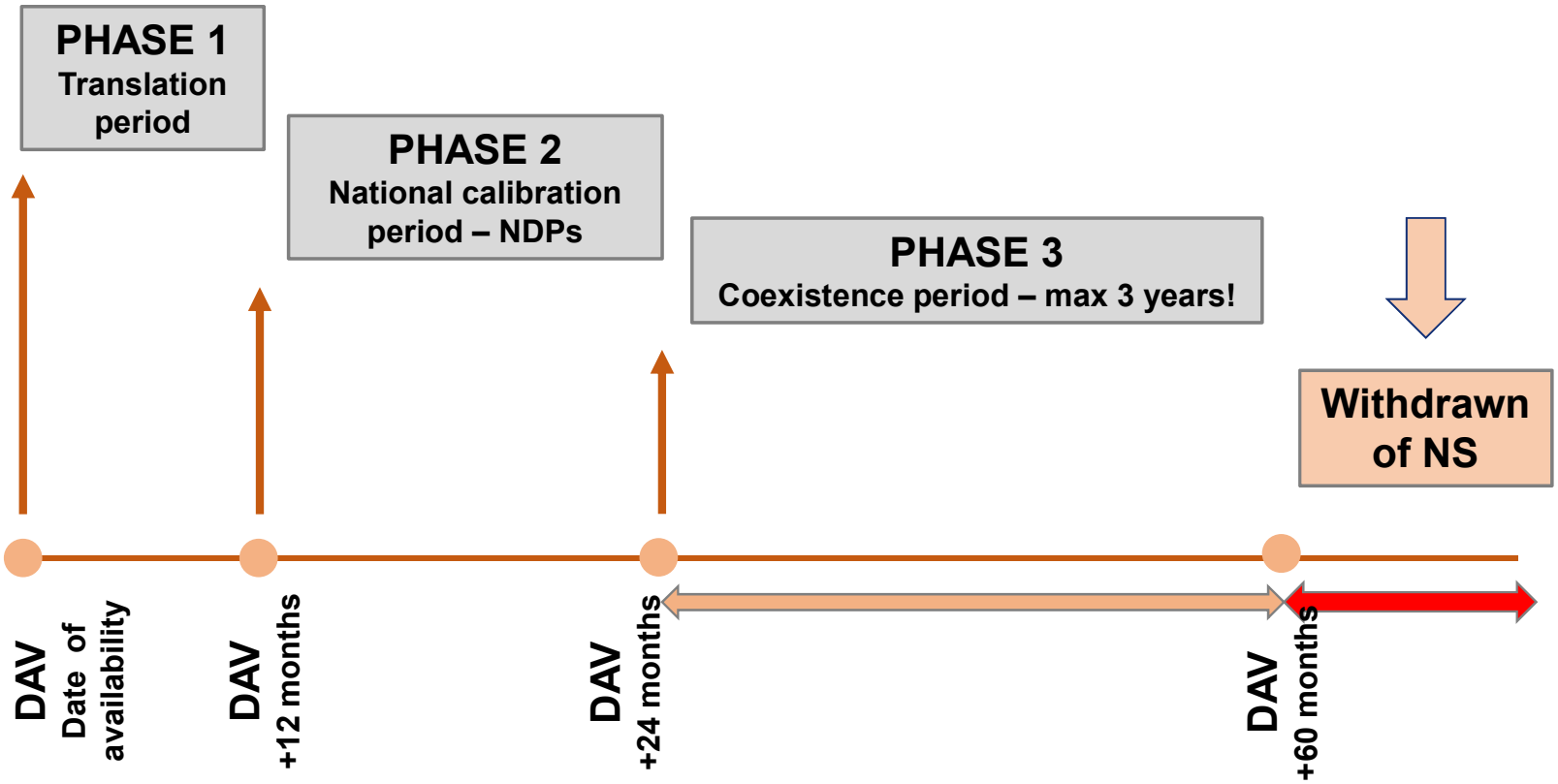
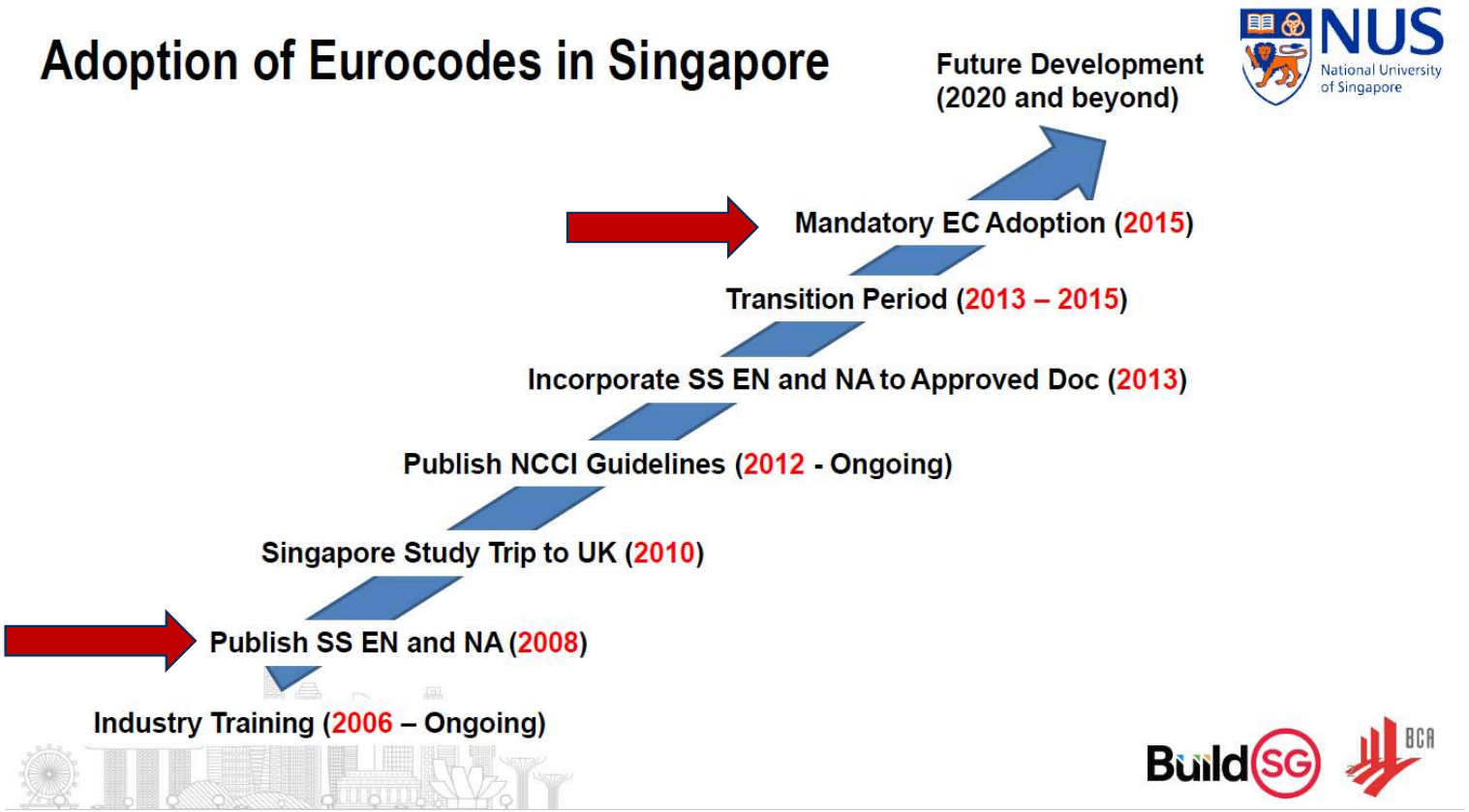
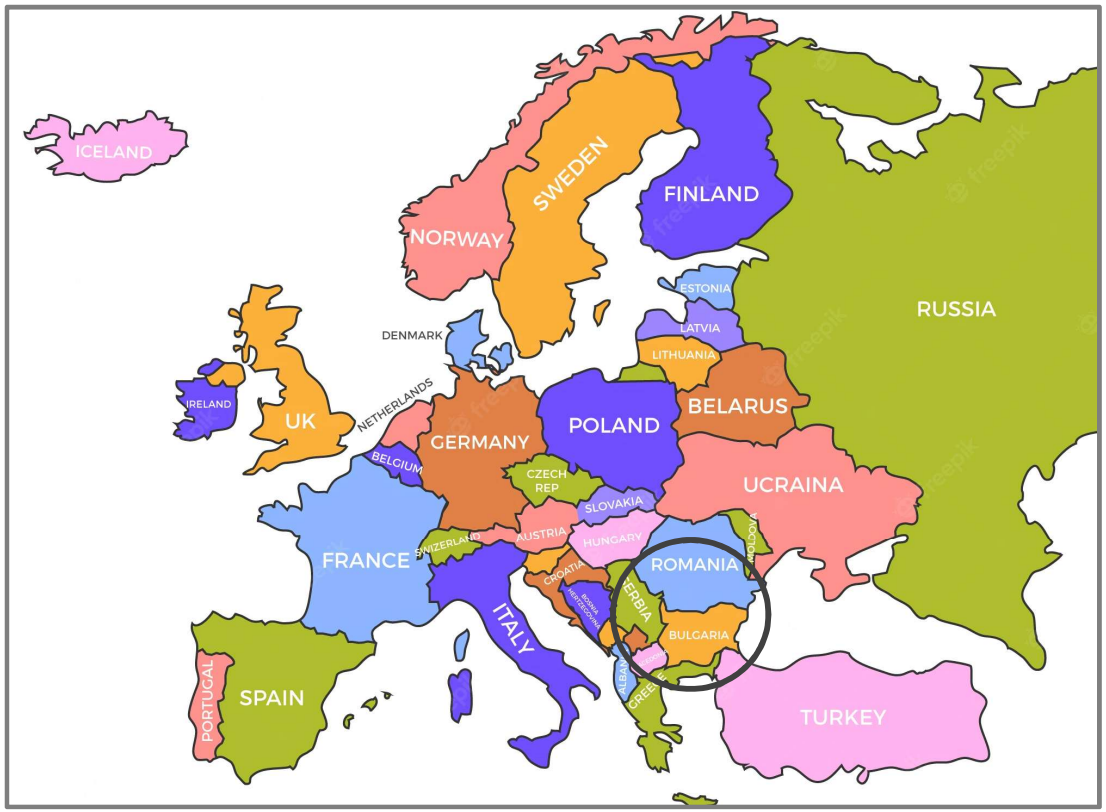


National implementation of the EN Eurocode – example of Singapore



(source: R. Liew, 1st EU-ASEAN Dialogues on Eurocodes (2021)

Eurocodes in non-EU countries – Western Balkan Region (WBR)' success story

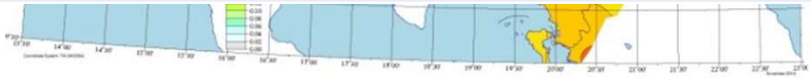


Area: app. 210.000 km²

Population: app. 18 mil.

Seismic hazard maps of WBR

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	RN Macedonia	Serbia
	Income level: upper middle income					
	Industry, (included construction) value added (% of GDP)					
2018	21.3	24.5	26.3	15.9	23.9	25.5
2019	20.1	23.7	26.6	/	23.9	25.6
2021	21	25	27	15	22	25
https://databank.worldbank.org/home.aspx						



Seismic hazard map of Western Balkans showing peak ground acceleration for 10-percent probability of exceedance in 10 years (**RP 95 years)** (Gulerce et al., 2017, BSHAP-2 (NATO SpS-984374)

Seismic hazard map of Western Balkans showing peak ground acceleration for 10-percent probability of exceedance in 50 years (**RP 475 years**) (Gulerce et al., 2017, BSHAP-2 (NATO SpS-984374))

Existing regulation for (seismic) design of buildings in WBR

Seismic Zoning Maps	Official Building Codes
1948: Seismic Zoning Map of FNR Yugoslavia, (Official Gazette of FNRY no. 61/48)	**1948: Temporary Technical Regulation (PTP) for loading of structures, (Part 2, No. 11730)**
1950: Seismic Zoning Map of Yugoslavia, (Seismological Bureau of FNRY, Belgrade)	**1964: Temporary Technical Regulations for Construction in Seismic Regions (Official Gazette of SFRY No. 39/64)**
1967: Engineering Geology Map of SFR Yugoslavia, (Federal Geological Institute, Belgrade)	**1981: Technical Regulations for Construction of Buildings in Seismic Regions, (Official Gazette of SFRY No. 31/81 & Amendments 49/82, 29/83, 21/88 and 52/90)**
1979: Seismic Zoning Map of Macedonia, (Seismological Observatory, Skopje)	**1985: Technical Regulations for Repair, Strengthening and Reconstruction of Buildings damaged by Earthquakes**
1982: Provisional Seismic Zoning Map of Yugoslavia, (Official Gazette of SFRY no. 49/82)	**1987: Technical Regulation for Concrete and Reinforced Concrete**
1987/1990: Seismic Zoning Maps of SFRY for RP of 50, 100, 200, 500, 1000 and 10000 years (Official Gazette no. 52/90)	

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Seismic Zoning Maps	Official Building Codes
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19[illegible] (S[illegible]	19[illegible]
19 Yu Be	[illegible]n
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PRINCIPAL DESIGN PHILOSOPHY

- **PROTECTION OF HUMAN LIVES AGAINS EARTHQUAKES**
- **PARTIALLY CONTROLLED DAMAGE**

Existing regulation for (seismic) design of buildings in WBR

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PRINCIPAL DESIGN PHILOSOPHY

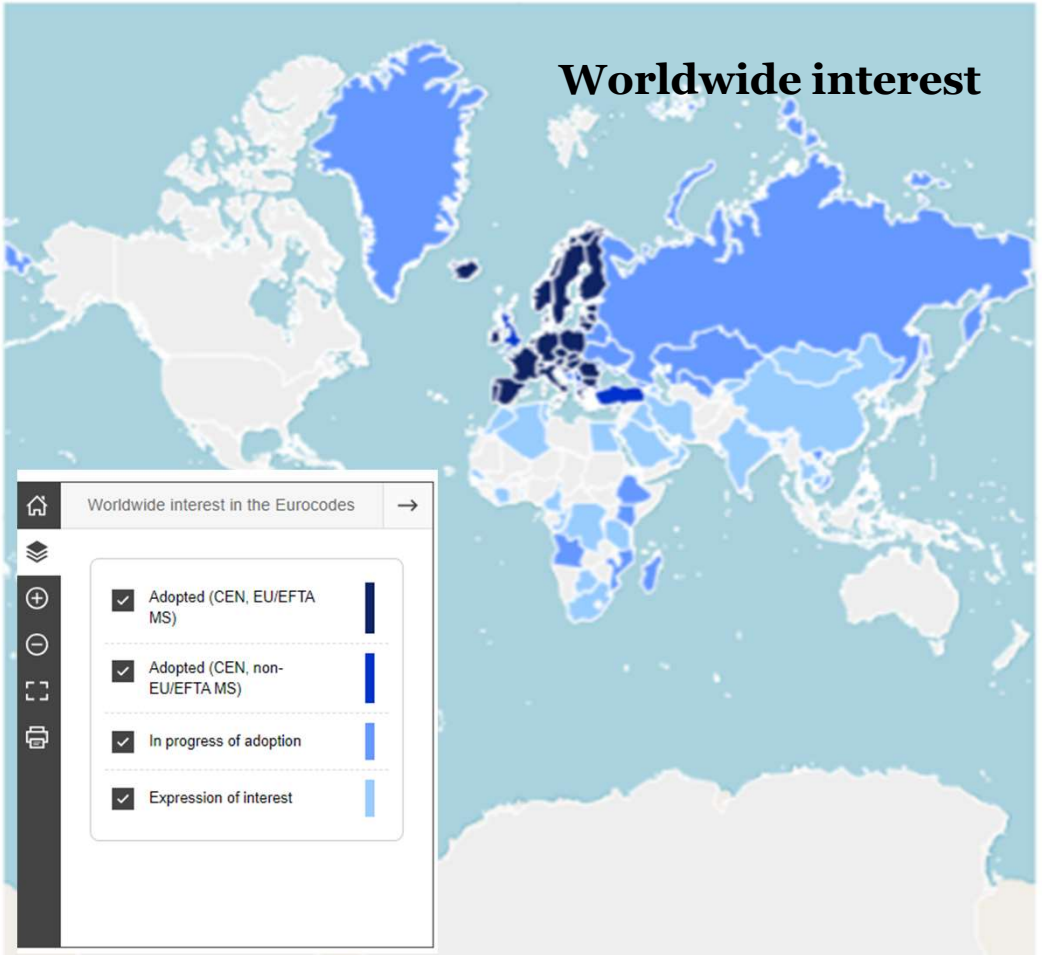
- **PROTECTION OF HUMAN LIVES AGAINS EARTHQUAKES**
- **PARTIALLY CONTROLLED DAMAGE**

1991: Break-up of Yugoslavia and development of own national design regulations

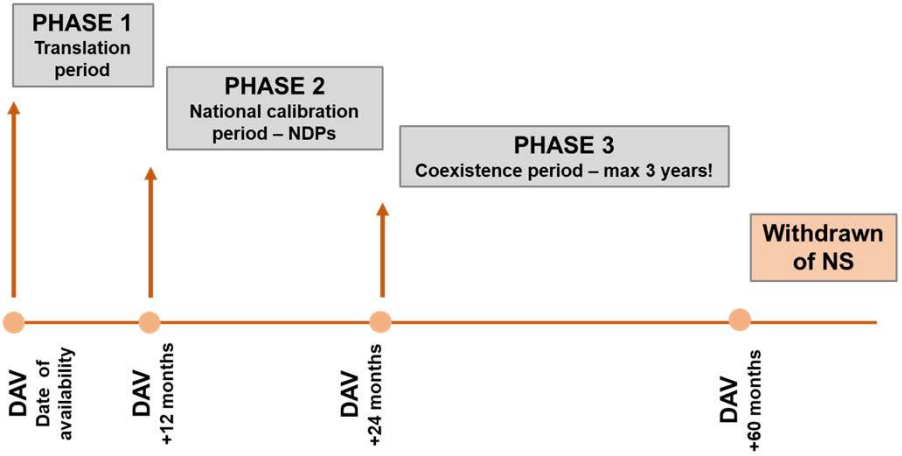
International use

There is a considerable interest in the use of EN Eurocodes outside EU/EFTA by countries:

- whose **National Standards are based on European National Standards** that will soon be withdrawn;
- who want to **update their National Standards** based on technically advanced codes;
- who are **interested in trading** with the European Union and EFTA Member States.
- who has **limited capacities** either in human resources or time constrains to develop own design codes
- a **comprehensive design tool**, which over a mid- to long-term period intends to cover additional fields of design, such as protection of the environment, resources, economy, energy saving, safety- and health conditions and security
- who wants to benefit from their "flexible" philosophy offering the possibility for each country to adapt Eurocodes to their specific conditions regarding climate, seismic and other natural risks, construction practice etc. and **defined own acceptable risk levels**
- who wants to benefit from **regular maintenance and updating**
- .....

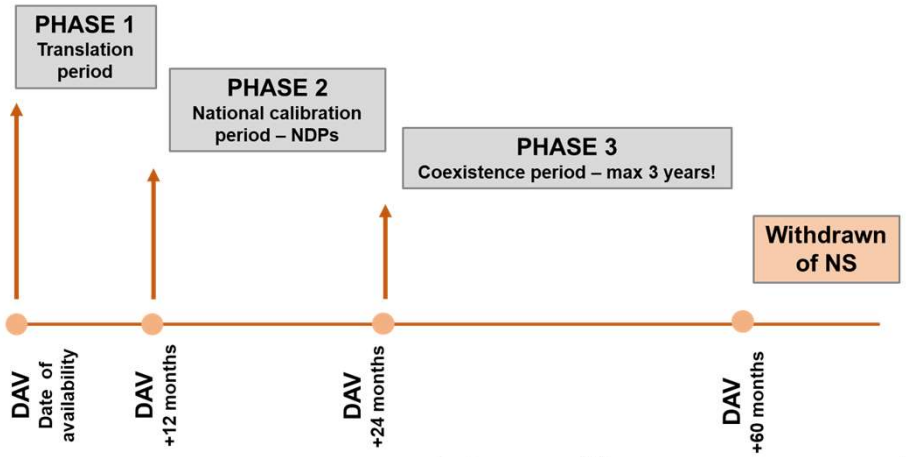


https://eurocodes.jrc.ec.europa.eu/en-eurocodes/use-outside-euefta-member-states

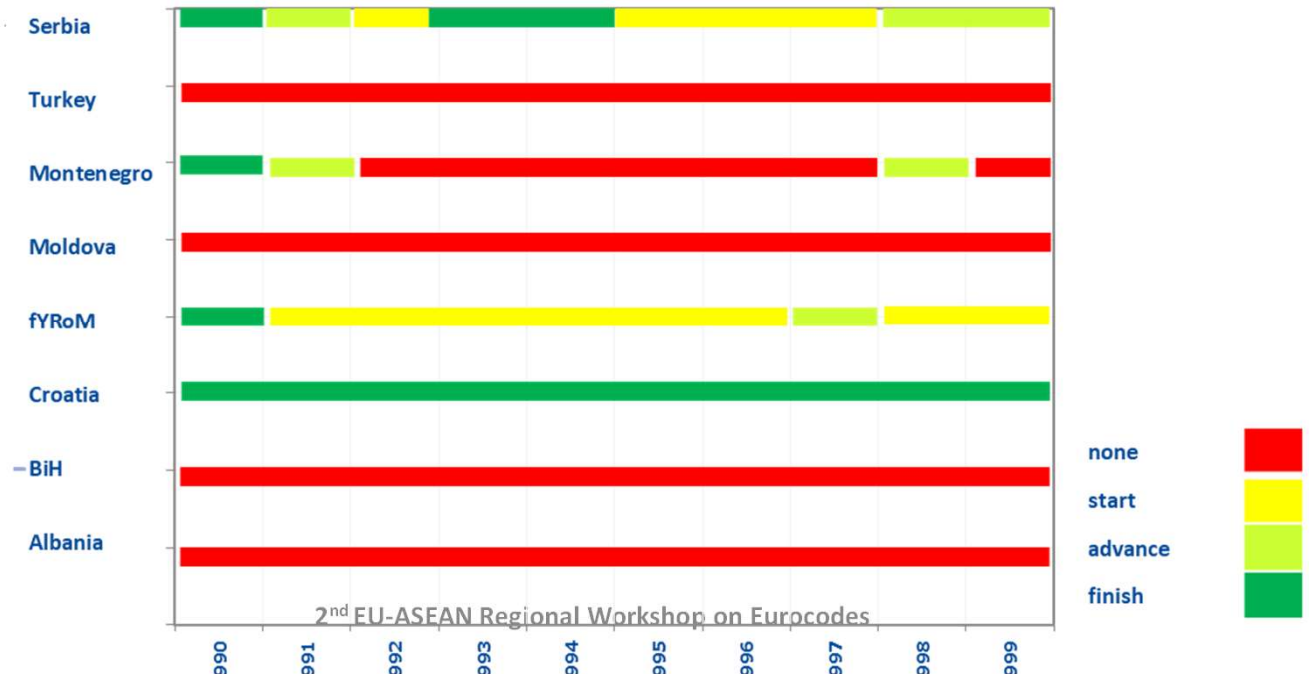


Baseline scenario in WBR - translation (12/2013)

	Progress of translation of the Eurocodes									
	EN1990	EN1991	EN1992	EN1993	EN1994	EN1995	EN1996	EN1997	EN1998	EN1999
AL	✓	✓	✓	✓	none	none	none	none	✓	none
BA	none	none	none	none	none	none	none	none	start	none
MK[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ME	✓	advance	none	none	none	none	none	none	advance	none
RS	✓	✓	advance	✓	✓	✓	✓	advance	advance	✓



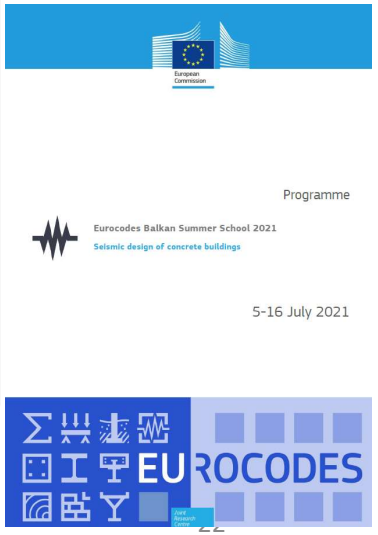
Baseline scenario in WBR - elaboration of NDPs (12/2013)



JRC support for the Eurocodes in the Balkans

2013 — **2021**

More than 330 participants



JRC support for the Eurocodes in the Balkans (2013)

- The workshop was focused on the progress and specific needs for **adoption and implementation** of the Eurocodes and related EN standards in the Balkan region.
- The **important conclusion** was that most of the non-EU countries in the Balkan region **are planning to use the Eurocodes as primary design standards**.
  - ✓ Good progress on Eurocodes translations,
  - ✓ Elaboration of Nationally Determined Parameters (NDPs) and National Annexes (NA) was in the initial phase.
  - ✓ Lack of relevant institutional support
  - ✓ Creating a regional platform for collaboration (driver in the process).

JRC support for the Eurocodes in the Balkans (2014)

- The main goal was to assess recent progress, difficulties and needs for the **definition of the NDPs and NAs** since the first workshop held in 2013, and to boost regional collaboration for cross-border harmonization of NDPs.
- **Significant progress of definition of NDPs was observed.** The average percentage of **acceptance of the recommended values for the NDPs** that have been already defined **was more than 80%.** This percentage was in line with the average of 73% acceptance calculated for the EU Member States in the JRC Eurocodes NDPs database (source: Sousa et al., 2019, EUR 29732 EN).

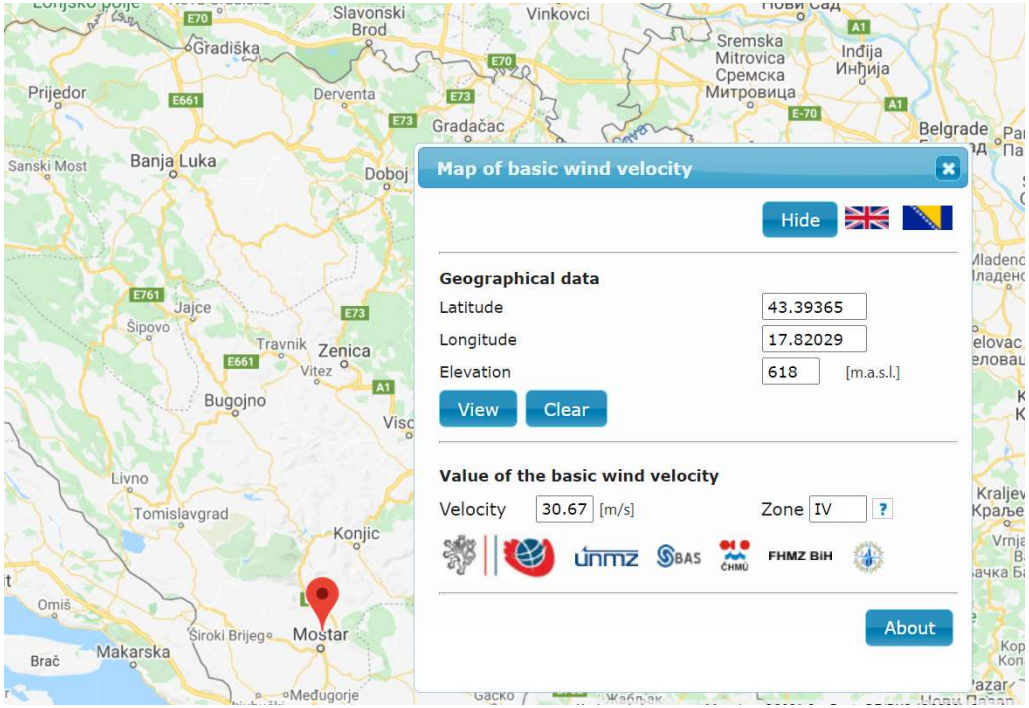
JRC support for the Eurocodes in the Balkans (2015)

- The Workshop was aimed particular to strengthen the capacities of stakeholders for the **elaboration of maps for climatic and seismic actions.** The main conclusion was that the elaboration of seismic hazard maps was in the advanced phase while the elaboration of maps for climatic actions is lagging behind mainly due to **insufficient data** being available.

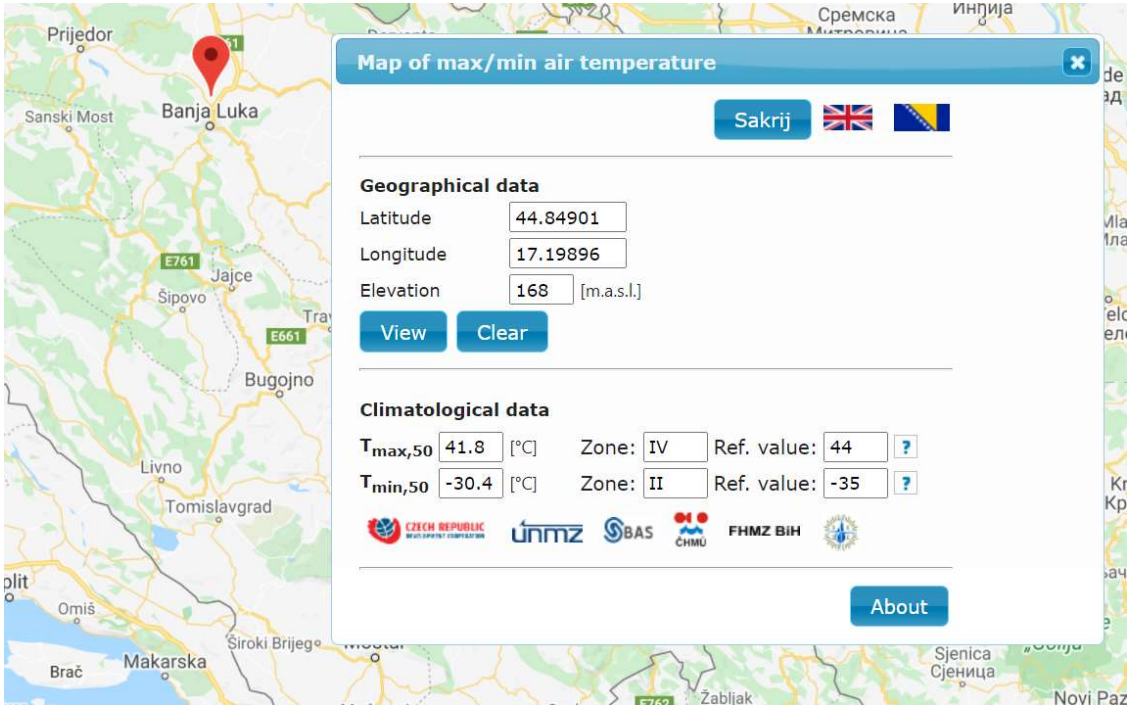
- The process of publication of **NAs to the EN parts which are relevant to the objectives of the Workshop was in its initial phase in all countries**, except in the former Yugoslav Republic of Macedonia, where all NAs have already been published (the maps will be included by the end of 2016).

JRC support for the Eurocodes in the Balkans (2015)
Example of twining collaboration

BAS EN 1991-1-4/NA:2018
Eurocode 1: Actions on structures
Part 1-4: General actions Wind actions – National annex



BAS EN 1991-1-5/NA:2017
Eurocode 1 - Actions on structures
Part 1-5: General actions - Thermal actions – National annex



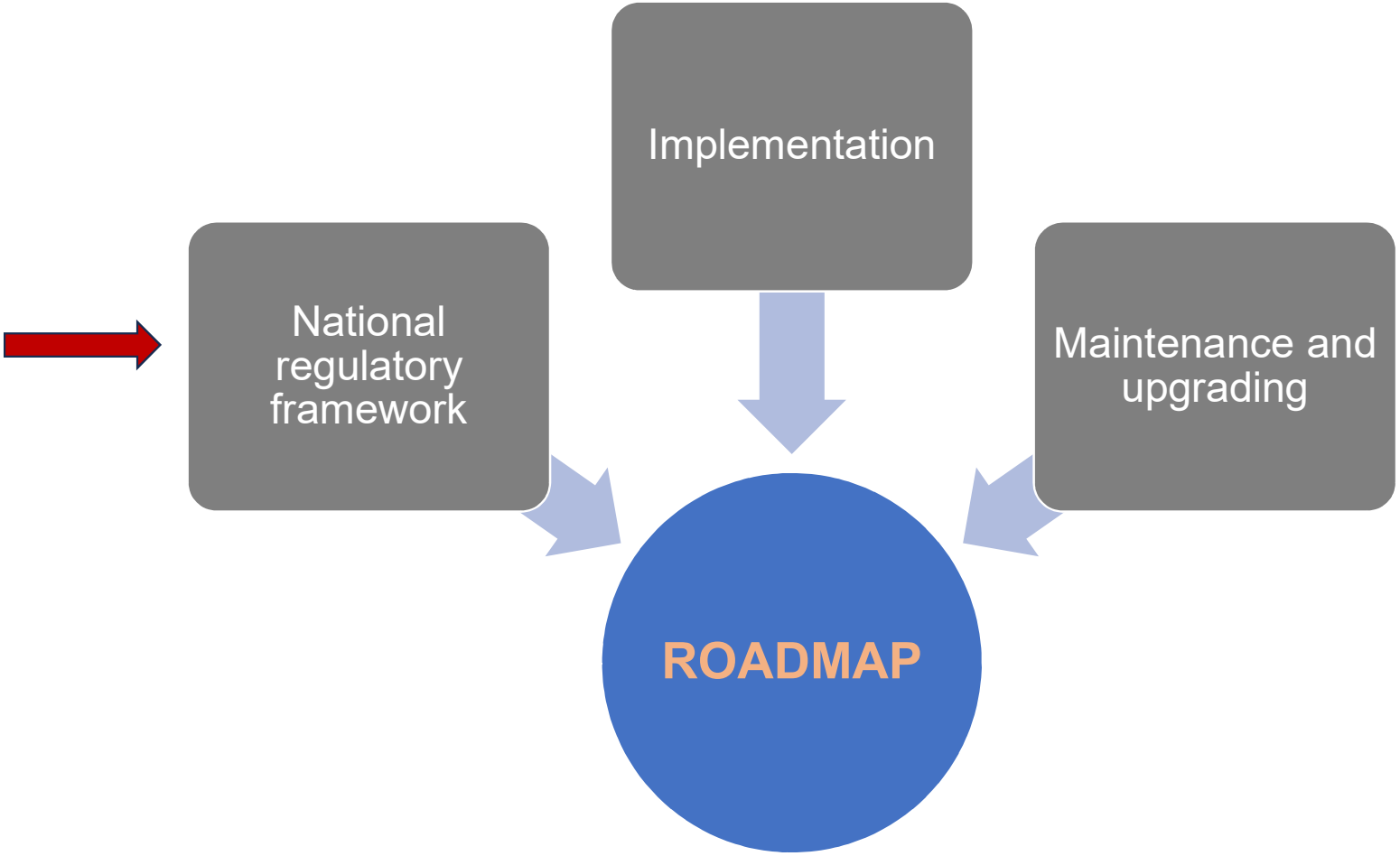
(source: S. Dzidzic, 1st EU-ASEAN Dialogues on Eurocodes (2021)

Example of twining collaboration

JRC support for the Eurocodes in the Balkans (2016)

- The main objectives of the workshop were to: (1) assess recent progress, difficulties and needs (current status) for adoption and implementation of the Eurocodes in non-EU countries from the Balkan region since the last workshop held in Zagreb on 27-28 October 2015; (2) **explore opportunities to facilitate the process of adoption and implementation of the Eurocodes in the Balkan region** and (3) announce the possibilities DG JRC will offer in opening its research infrastructures to external users linked to the Enlargement and Integration Action of DG JRC.
- All countries reported **significant progress in the process of adoption of the Eurocode since the first workshop in Milan (2013).** Most National Standardisation Bodies have adopted the **Eurocodes as standards, in parallel with existing national design codes** that are part of the National regulatory framework. Also, in most countries, practitioners use National codes and Eurocodes in parallel (as long as National regulatory frameworks are respected). **None of the countries have adopted and implemented the Eurocodes in the National regulatory framework.**

JRC support for the Eurocodes in the Balkans (2018)



Status of Eurocodes implementation in WBR

Country	Status
Albania	All 58 EN Eurocodes Parts and NA are published by GDS as Albanian standards (SSH Standards), (*http://www.dps.gov.al/standard/index.php?national_committee_id=17&item_from=20*). Ministry of Infrastructure and Energetics issued for consultation the draft Decision of Council of Ministers "For approval of Eurocodes as national building codes" (07/2023).
Bosnia and Herzegovina	All 58 EN Eurocodes Parts are NA are published by GDS as Bosnian standards (BAS Standards) *(http://eurokodovi.ba/?page_id=57)*. Only EN 1992 & EN 1996 are incorporated in the federal Rulebook on technical regulations.
Kosovo[1]	All 58 EN Eurocodes Parts are published by KSA as Kosovo standards (SK Standards) due to the cooperation with General Directorate of Standardization of Albania *(https://aks.rks-gov.net/standard/index.php?national_committee_id=25&item_from=0)*. NAs aren't elaborated, and Eurocodes aren't incorporate in the NRF.
Montenegro[1]	Government of Montenegro brought decision for mandatory application of the Eurocodes for the building's construction through different Rulebooks *(http://www.mrt.gov.me/rubrike/zakonska-regulativa/131438/Zakonska-regulativa-iz-oblasti-gradevinarstva.html)*. For each structural material design is regulated by corresponding group of nationally adopted EN standards and related NAs. National regulations for design of structures were effective till August 1, 2020.
North Macedonia[1]	Officially adopted on 02.09.2020 as national codes for design of construction works with 4-year coexistence period with the current national regulations. [*Official Gazette of the Republic of North Macedonia no. 211 dated 02.09.2020*]
Serbia	Officially adopted on 26.12.2019 as national codes for design of construction works with 1 (+1) year coexistence period with the current national regulations. *(https://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/ministarstva/pravilnik/2019/89/2/reg)*

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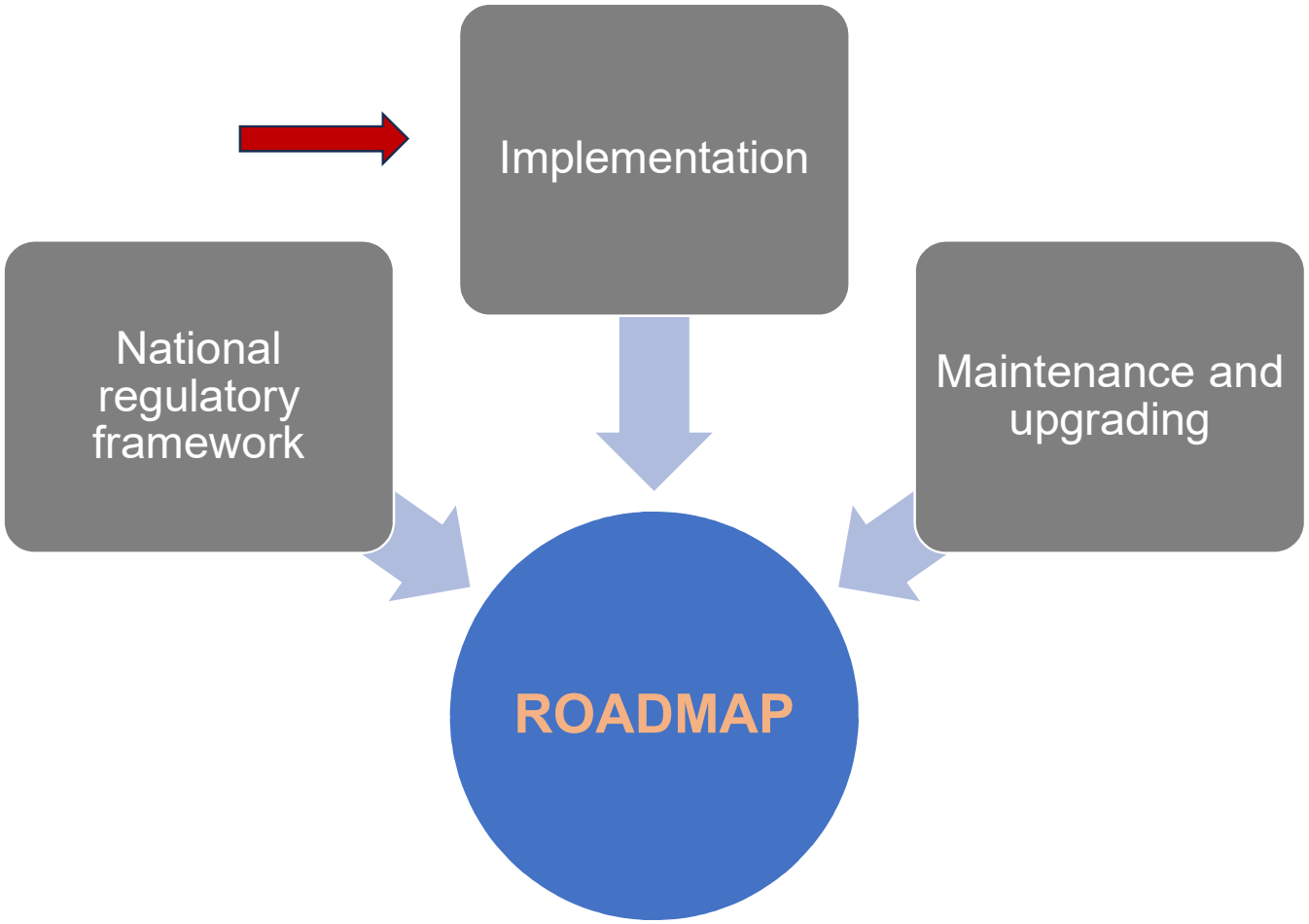
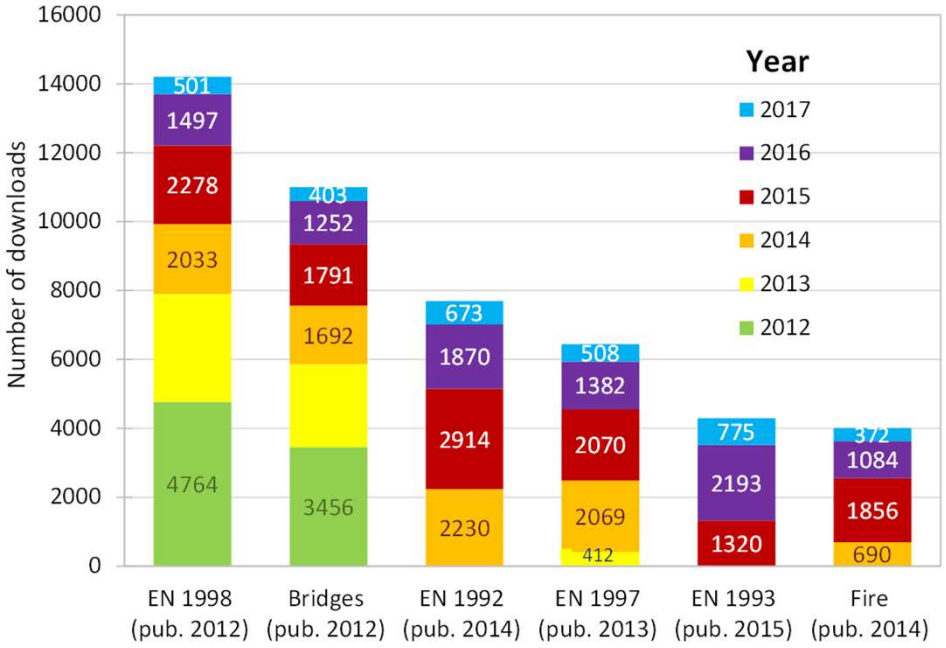
NRF – official implementation

JRC support for the Eurocodes in the Balkans (2018)



JRC Publication database

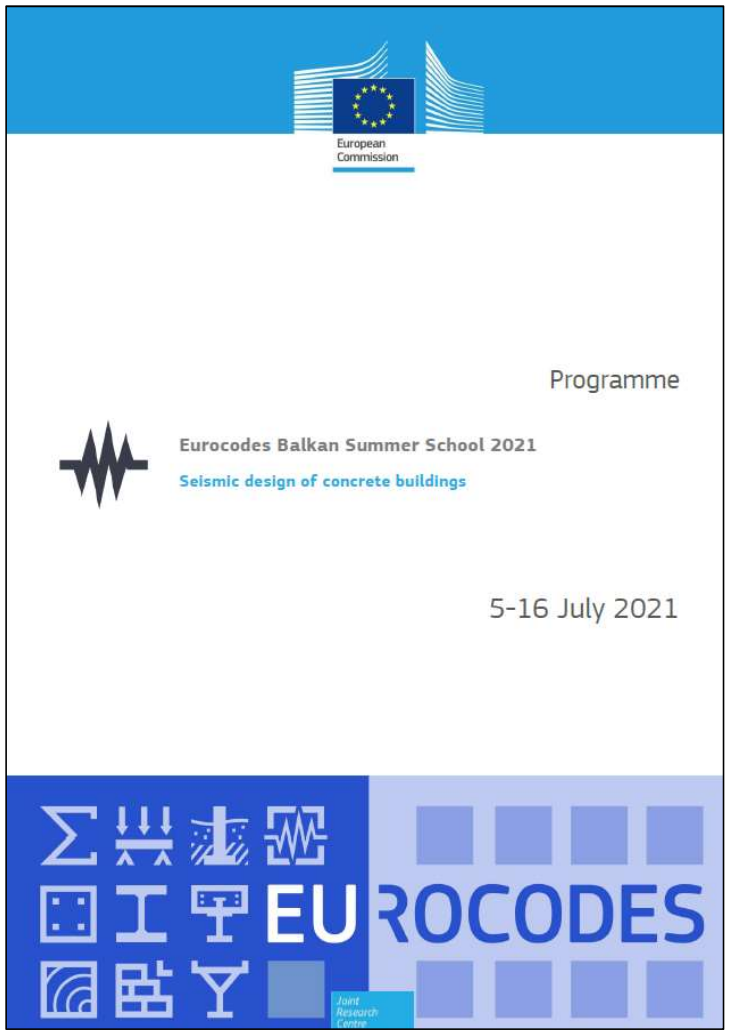
https://eurocodes.jrc.ec.europa.eu/learning-corner



JRC Reports with worked examples

- Searchable database with more than 500 publications in 16 languages
- JRC reports on the Workshops with worked examples > 45 000 downloads
  - ✓ Reports with worked examples
  - ✓ Lectures/presentations
  - ✓ Promotion material
  - ✓ Background documents
  - ✓ Material on 2nd generation Eurocodes

JRC support for the Eurocodes in the Balkans (2021)

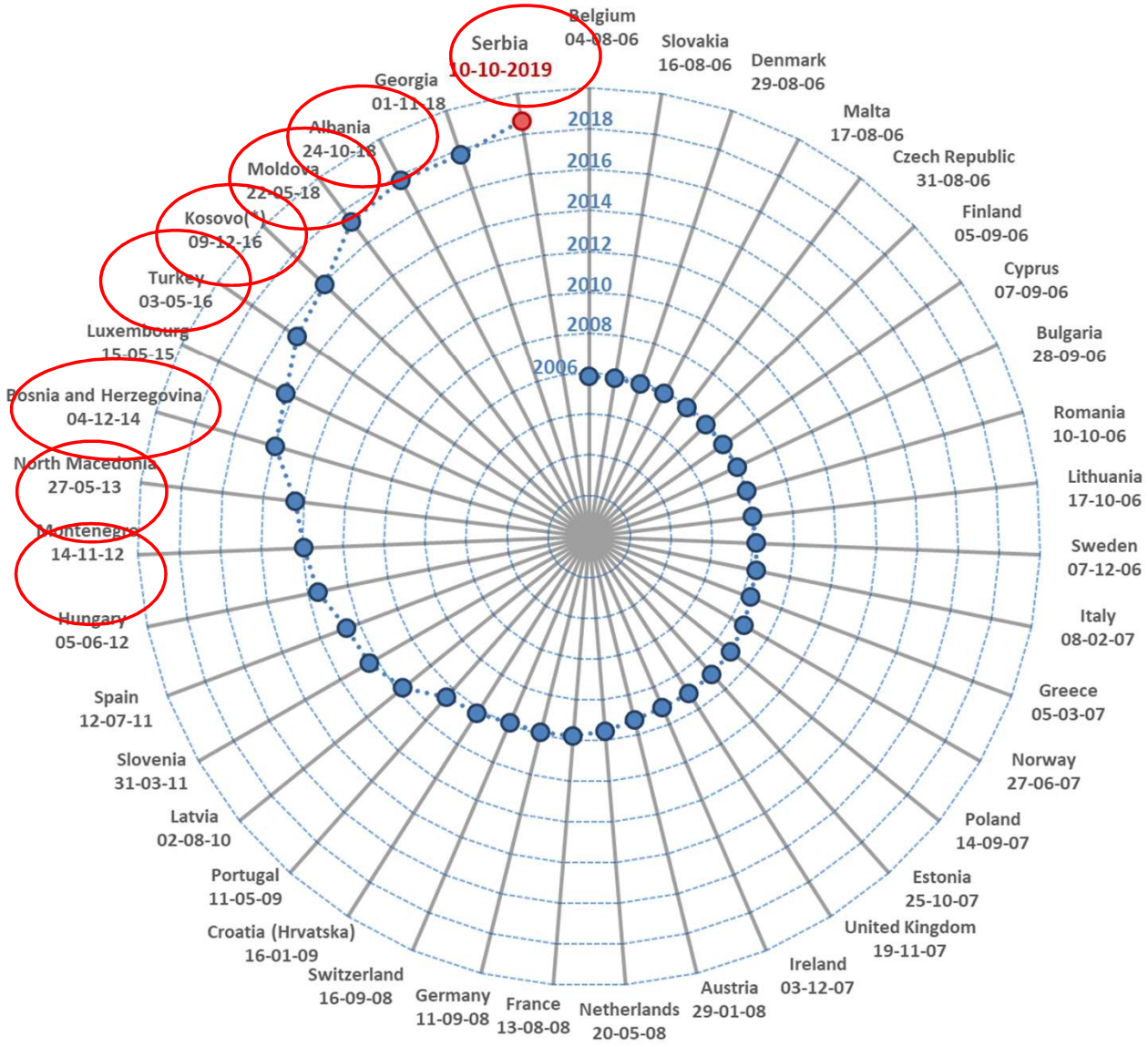


The aim of the Summer School was to provide an overview on seismic design procedures for typical multi-storey reinforced concrete buildings.

The programme are focus on the:

- **practical use of EN 1998 for the seismic design of RC buildings**, along with the relevant parts from EN 1990 (Basis of Design), EN 1991 (Actions on structures), EN 1992 (Design of concrete structures) and EN 1997 (Geotechnical design aspects).
- **hands-on the simulation of seismic response** of concrete buildings, explaining various analysis methods, design verifications and use of appropriate software is included.
- overview of the **evolution of the Eurocodes** towards the publication of their second generation, expected by 2026, with particular focus on aspects related to the seismic design of reinforced concrete buildings

Presentation (open to all participants)	Lecture with worked examples (open to all participants)
Keynote Lecture (open to all participants)	Worked examples (group assignments) (restricted to full participants)



Source: Dimova, S. et al., 59th Meeting of CEN/TC250 virtual, 20-21.05.2021

JRC NDPs database

last registered country: Malaysia, 10.01.2023

EU MS = 27

EFTA MS = 2

Others = 10

Total = 39

Eurocodes – challenges and opportunities for WBR

2013

- **Awareness of the Eurocodes – what, why, when, where – JRC within E&I Action**
- **Building institutional capacities for adoption of Eurocodes (NRB, TC, subcommittees, pool of experts)**
- **Translation of Eurocodes and publishing as national standards**
- **Elaboration of National Annexes and publishing**

2015

Eurocodes – challenges and opportunities for WBR

2015

- **Implementation of Eurocodes – parallel with national codes/stand alone**
- **Continuation, update and improvements of curriculums at universities**
- **Continuing training of engineers in practice in application and implementation of Eurocodes**
- **Maintenance of the existing Eurocodes – revisiting of NDPs due to daily engineering practice**

2023

- **Cross-border harmonization of seismic hazards, snow, wind and thermal maps**
- **Raising awareness of general public on importance of application and implementation of Eurocodes in construction sector**
- **Keep pace to Eurocode 2G**

202x

- **Eurocodes Community of Practice in the Balkan Region (Dimova et al., 2018)**

Framework for adoption and implementation of the Eurocodes (or who is doing what?)

Standardization

Publishing of the Eurocodes as National Standards (voluntary)

National Standardization Body,
(liaison with CEN)
Responsible Technical Committee, Task Force etc.

Regulation

Decision for mandatory implementation of the Eurocodes as national design structural codes

National Regulatory Authorities, (relevant Ministries, National Councils etc.)

Implementation

Training of existing and education of prospective structural engineers

Academia
Research centers
Engineering Chambers
Institution of Engineers
Industry and business sector
Regional and bilateral initiatives
EU Commission – JRC Ispra
.....

Maintenance

Maintenance (following all changes and corrigendum)
2nd generation of the Eurocodes

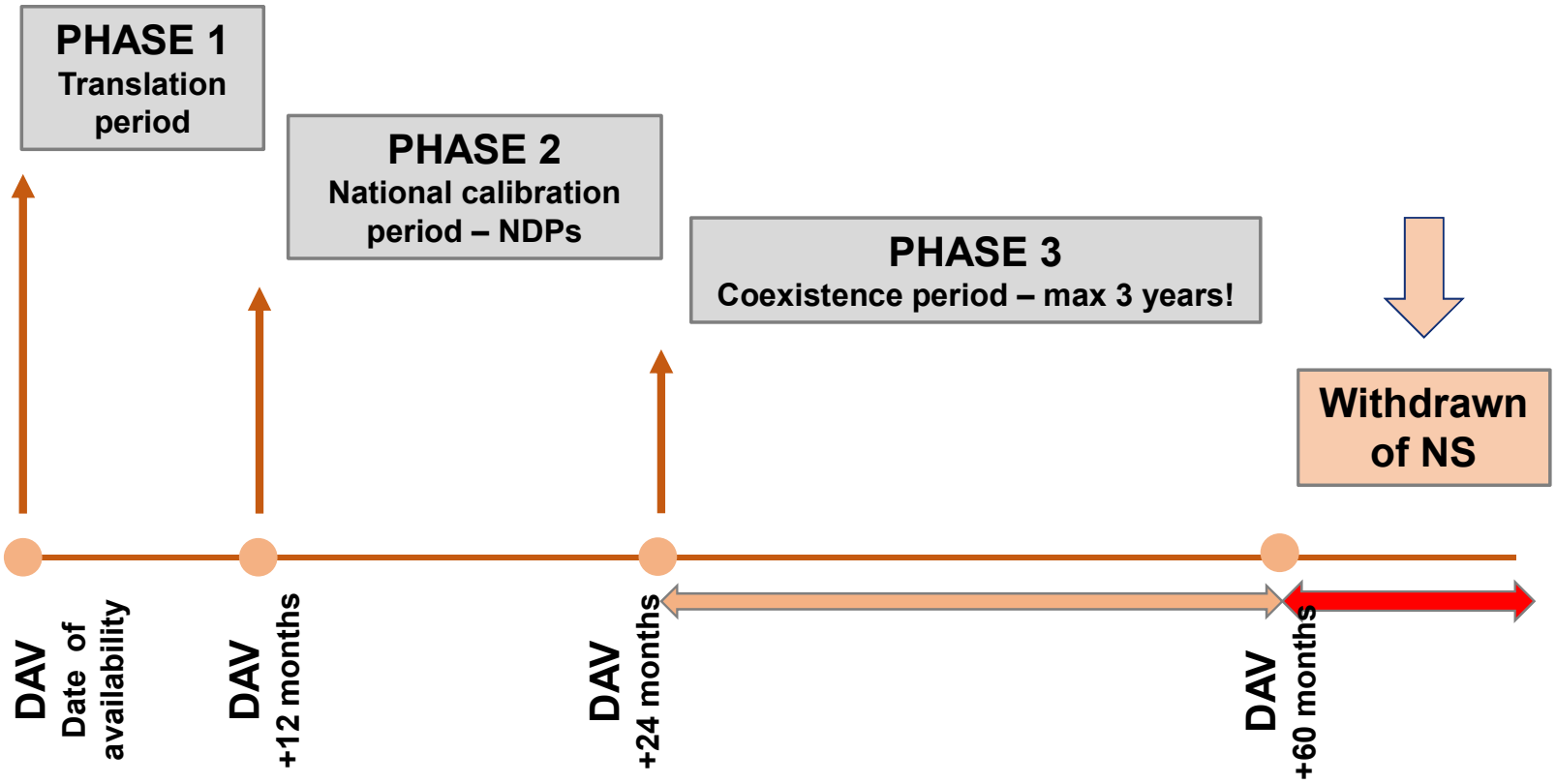
National Standardization Body,
(liaison with CEN)
Responsible Technical Committee, Task Force etc.

Standardization and regulatory framework

National implementation of the EN Eurocode – time schedule

DAV – Date of availability

Date when the CEN has delivered the EN Eurocodes Part to the National Standardisation Body



Residential building in Budva, 12. stories, 2019 (3.2m story hight)

Office building in Podgorica 4. stories, 2020 (4.5m story hight)

Hotel in Budva (6 m story ground floor hight), 2021

Hotel in Herceg Novi, 2020

Residential building in Tivat, 2021

Residential building in Tivat, 2021

Source: J. Frutula, Eurocodes Balkan Summer School, (2021)

Thank you!

Roberta Apostolska

E-READI Eurocodes SNKE

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