

ADAPTATION OF SECOND GENERATION EUROCODES AND SEISMIC SAFETY REQUIREMENTS FOR BUILDINGS AND STRUCTURES IN UZBEKISTAN

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Annotation: *This paper discusses the adaptation process of second-generation Eurocodes, particularly Eurocode 8 (EN 1998) on earthquake-resistant design, to the conditions of Uzbekistan. It outlines the historical background of the first and second generations of Eurocodes, the national efforts for implementation supported by the TAIEX grant, and the roadmap for harmonization with local seismic conditions. The study emphasizes the transition from linear to nonlinear seismic analysis, development of Nationally Determined Parameters (NDPs), and modernization of the seismic hazard map in compliance with Eurocode methodology. These measures aim to enhance the seismic safety, competitiveness, and sustainability of Uzbekistan’s construction sector.*

Keywords: *Eurocode 8; Second-generation Eurocodes; Seismic design; Uzbekistan; Nationally Determined Parameters (NDP); Nonlinear analysis; Structural safety; TAIEX; Earthquake engineering; Building codes harmonization.*

Introduction

In 1975, the European Community Commission launched the Eurocode Programme aimed at developing, promoting, and establishing a unified set of technical rules for the design of buildings and civil engineering works across member states.

Eurocodes are a collection of European standards developed by the European Committee for Standardization (CEN) for the structural design of construction works within the European Union. Today, Eurocodes are applied in more than 40 countries worldwide.

2. First generation of eurocodes

Eurocodes are parametric normative documents, meaning they are not applied directly but are adapted through Nationally Determined Parameters (NDPs) considering each country’s geological, climatic, and seismological characteristics.

The first generation of Eurocodes consists of ten main parts:

EN 1990 – Basis of structural and geotechnical design;

- EN 1991 – Actions on structures;
- EN 1992 – Design of concrete structures;
- EN 1993 – Design of steel structures;
- EN 1994 – Design of composite steel and concrete structures;
- EN 1995 – Design of timber structures;
- EN 1996 – Design of masonry structures;
- EN 1997 – Geotechnical design;
- EN 1998 – Design of structures for earthquake resistance;
- EN 1999 – Design of aluminium structures.

To implement Eurocodes, more than 1,400 Nationally Determined Parameters (NDPs) must be developed to ensure compliance with national regulations and conditions.

3. Second generation of eurocodes

The second generation of Eurocodes consists of 11 codes and 74 parts. Since 2023, the European Committee for Standardization (CEN/TC 250) has been developing this new generation. Its main goals are to simplify the current Eurocodes, adapt them to digital design systems, and enrich them with new scientific and technical advancements. The full set of second-generation Eurocodes is planned to be finalized by September 2027 and officially implemented across Europe from March 2028, replacing the first generation (EN 1990–EN 1999).

Key features of the second generation include:

- Simplified and clearer structure of normative documents;
- Compatibility with automated and digital design tools;
- Applicability beyond the European Union, supporting international interoperability in structural design.

New additions in the second generation:

- EN 19100 – Design of glass structures (officially adopted as an EN standard);
- EN 19101 – Design of fibre-polymer composite structures (under review);
- EN 19102 – Design of tensioned membrane structures (under review).

4. Implementation of eurocodes in Uzbekistan

To fulfill the requirements of the Presidential Decree PF-5963 (March 13, 2020) and the Cabinet of Ministers Resolution No. 231 (April 23, 2024) on aligning construction regulations with international standards, the Scientific Research Institute for Technical Regulation and Standardization under the Ministry of Construction and Housing and Communal Services has initiated the implementation of Eurocodes in Uzbekistan in cooperation with design organizations and experts.

Advantages of Implementing Eurocodes:

Supporting Uzbekistan’s policy for accession to the World Trade Organization (WTO) and protecting national interests;

Attracting domestic and international investors by removing regulatory barriers;

Enhancing the competitiveness and export potential of the construction industry;

Facilitating the full integration of Building Information Modeling (BIM) in Uzbekistan;

Developing a modern and harmonized national construction standardization system.

Uzbekistan is officially among 41 countries in the International NDP Database, where each member uploads its National Annex reflecting local geological, seismological, and environmental parameters.

5. TAIEX grant project

The Scientific Research Institute for Technical Regulation and Standardization has received the TAIEX (Technical Assistance and Information Exchange) grant funded by the European Union.

The project consists of three stages:

EU experts conduct seminars and training sessions in Uzbekistan;

Uzbek specialists visit EU countries for practical training;

Support for the legal adoption of Eurocodes in Uzbekistan.

6. Eurocodes planned for development in 2025–2026

In 2025–2026, Uzbekistan plans to develop 25 parts of the 5 most commonly used Eurocodes, focusing primarily on reinforced concrete structures, which dominate local construction.

№	№	Code	Title
1	1	<u>EN 1990:2023</u>	Basis of structural and geotechnical design
2	2	EN 1991-1-1:2025	Actions on structures – Densities, self-weight, and imposed loads on buildings
	3	<u>EN 1991-1-2:2024</u>	Actions on structures – Actions on structures exposed to fire
	4	EN 1991-1-3:2025	Actions on structures – Snow loads
	5	EN 1991-1-4	Actions on structures – Wind actions
	6	EN 1991-1-5:2025	Actions on structures – Thermal actions
	7	EN 1991-1-6	General actions Actions during execution
	8	EN 1991-1-7	Actions on structures – Accidental actions
	9	EN 1991-1-8	Actions from waves and currents on coastal structures
	10	EN 1991-1-9:2025	Actions on structures – Atmospheric icing

	11	<u>EN 1991-2:2023</u>	Actions on structures - Traffic loads on bridges
	12	EN 1991-3	Actions on structures - Actions induced by cranes and machinery
	13	EN 1991-4	Actions on structures - Silos and tanks
3	14	<u>EN 1992-1-1:2023</u>	Design of concrete structures - General rules and rules for buildings
	15	<u>EN 1992-1-2:2023</u>	Design of concrete structures - Structural fire design
	16	EN 1992-4	Design of concrete structures - Design of fastenings for use in concrete
8	17	<u>EN 1997-1:2024</u>	Geotechnical design – General rules
	18	<u>EN 1997-2:2024</u>	Geotechnical design – Ground properties
	19	EN 1997-3:2025	Geotechnical design – Geotechnical structures
9	20	<u>EN 1998-1-1:2024</u>	Design of structures for earthquake resistance – General rules and seismic actions
	21	EN 1998-1-2	Design of structures for earthquake resistance - Buildings
	22	EN 1998-2:2025	Design of structures for earthquake resistance - Bridges
	23	EN 1998-3	Design of structures for earthquake resistance – Assessment and retrofitting of buildings and bridges
	24	EN 1998-4	Design of structures for earthquake resistance – Silos, tanks, pipelines, towers, masts and chimneys
	25	<u>EN 1998-5:2024</u>	Design of structures for earthquake resistance – Foundations, retaining structures and geotechnical aspects

7. Adapting seismic safety requirements for Uzbekistan

The EN 1998 (Eurocode 8) of the second generation is divided into three main groups.

General principles and geotechnical aspects:

EN 1998-1-1 – Seismic actions and general rules;

EN 1998-5 – Geotechnical design.

Design of New Buildings and Structures

EN 1998-1-2 – Buildings;

EN 1998-2 – Bridges;

EN 1998-4 – Silos, tanks, pipelines, towers, chimneys.

Assessment of Existing Buildings and Structures

EN 1998-3 – Assessment and retrofitting.

Proposed Adaptation Solutions for Uzbekistan

Revising the national seismic hazard map according to Eurocode methodology using 475-year (10% probability in 50 years, for ordinary buildings) and 975-year (5% probability in 50 years, for essential facilities) return periods;

Developing national soil classification (A–E) based on Eurocode system adapted to local geological conditions;

Updating seismic design coefficients and stability conditions for foundations and retaining structures;

Transitioning from linear elastic analysis (as used in ShNQ 2.01.03–19) to nonlinear analysis, which allows modeling of plastic deformation, cracking, and energy dissipation;

Nonlinear analysis reflects the true seismic response of structures, offering improved reliability for high-risk and complex structures.

Conclusion

The adaptation of the second-generation Eurocodes, particularly Eurocode 8 (EN 1998), to Uzbekistan’s national construction framework marks a crucial step toward the internationalization and modernization of the country’s engineering standards. By aligning with European methodologies, Uzbekistan not only strengthens the seismic safety and resilience of its buildings and structures but also enhances its integration into the global construction market.

The ongoing development of Nationally Determined Parameters (NDPs) and the revision of the national seismic hazard map will allow more precise and reliable structural design adapted to local geological and seismic conditions. Moreover, the shift from linear elastic to nonlinear seismic analysis represents a scientific and technological advancement that ensures realistic assessment of structural performance under strong earthquakes.

The support of international initiatives such as the TAIEX program further accelerates capacity building, expert training, and the legal adoption of Eurocodes in Uzbekistan. These efforts collectively contribute to creating a safe, sustainable, and competitive construction environment, bringing Uzbekistan closer to global engineering best practices and improving public safety in seismically active regions.

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