Structural Mechanics

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Harmonization of the Romanian structural design codes with the European codes (Euronorms). National applicable documents

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Summary

Harmonization of the technical base for the Civil Engineering Design and the classes, quality and performances of the materials, equipments and broadly the construction products must assure the growing mobility of the designers and/or the project work, the elimination of the technical and commercial barriers inside the construction industry, the equal treatment inside all the European countries of various structural systems, materials and products.

The translation of the structural Eurocodes and the draw up of the CR (Romanian Codes) are very important operations and must be duplicated by a large action of dissemination and explanation to make them known to the engineers that should apply or work collateral with these norms. The DANs (National Appliance Documents) must be send to investigation for a 2 years period and enter in application with a temporary code status, simultaneously with the existent national Codes.

KEYWORDS: Euronorm, Eurocode, Romanian Design Code

1. THE EUROPEAN ECONOMIC INTEGRATION

The idea of co-operation and afterwards the European economic integration was born in 1923, at the same moment with the Pan-European Movement; it has quickly evolved after the IInd World War by the foundation of a large number of organizations having various missions (co-operation, defense, economic assistance etc) as follows: the European Federal Union (1946), the European League for Economic Co-operation (1947), the Marshall Plan (1948-1952), the Organization for European Economic Collaboration (1948), the Occidental European Union (1948), NATO (1949), the European Council (1949, center at Strasbourg), the European Community for Coal and Steel (1951), the European Community for Atomic Energy (EURATOM, 1957).

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The conditions for the set up and the governing principles of the **European Economic Community**, **EEC**, or the **European Union**, **EU** – briefly, have been stated by the Rome Treaty in 1957. The agreement became operative in 1959. The activities of this organization are coordinated by 3 units: the European Parliament, the European Union Council and the European Commission. The **European Union Council** is the main institution for the decision inside the European Union; it groups following a certain schedule the representatives of the membership countries at the ministry level (Foreign Affairs, Finances, Education – Teaching, Research, Public Works and Communications etc.).

The main **objectives** of UE are: the promotion of a continuously, harmonious end equilibrated development of the membership countries, **the set up of a Common Market**, **the harmonization of the laws** in order to make possible the function of the Common Market, the elimination of the charges, the free motion of goods, persons, services and capital, the creation of new working places etc.

Starting with 1985, the EU Foundation Treaty has been modified and completed by series of decisions of the EU Council in the view of the creation of the **European Single Market** or **Common Market**. Under these circumstances it was set up the basis for the initiation of the harmonization process of the rules and technical codes at the Community level, as a premise for the elimination of the existent restrictions concerning the free circulation of goods and services.

The Common Market inside EU rose officially in 1993, occasion in which the harmonization of the prescriptions that existed in the membership countries and their transformation upon new bases in Euronorms became urgent and necessary. The constructions market as part of the internal market of EU – in which the competition must act freely – has an important percentage, therefore it results the importance granted to the system of construction prescriptions, for the purpose of good proceedings that belong to this branch.

2. THE HARMONIZATION OF THE TECHNICAL PRESCRIPTIONS REGARDING THE CONSTRUCTION DOMAIN

The harmonization of the technical base for i) Civil Engineering Design and ii) the classes, quality and performances of the materials, equipments and broadly the construction products must assure the growing mobility of the designers and/or the project work, the elimination of the technical and commercial barriers inside the construction industry, the equal treatment inside all the European countries of various structural systems, materials and products.

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A state member of EU or associated to, must be able not just to create opportunities for the production of goods in accordance to the community provisions but also to guarantee that all the products introduced into this market – projects, materials, equipments etc. – meet the codes. This means that all the membership states have to embrace the suitable legislation and the set up of all the necessary structures, techniques etc. to apply effectively the new legislation. These structures – testing laboratories, research institutes, metrology institutes etc. – must gain the trust of the entire EU.

From the law perspective, the harmonization measures of the system and the technical provisions were stated mainly by the means of two documents of the EU Council, as follows:

- The Public Works Directive, 89/440/EEC;
- The Directive for the Construction Products (DPC), 89/106/EEC.

These Directives are establishing both the functioning principles of the construction market and the criteria for the set up of the technical codes, also the way to correlate/ interpret the laws, codes and the decrees from the membership countries. The importance of the Directives consists of the fact that are based on a **new, modern approach** of the entire activity inside the constructions domain, that marks the provision for a product or a class of products (materials, elements, structures, buildings as a whole, installations and equipments, projects etc.) of a number of **main demands** or **essential requirements**. These six **essential requirements** are:

a) Strength and stability,
b) Exploitation safety;
c) Fire safety,
d) Hygiene, human health, the environment restoration and protection;
e) Thermal and hydro- insulation, energy reduction and heat retention;
f) Protection against the noise.

In relationship with the six requirements, six documents were elaborated, named **(Interpretative Documents, ID**) named ID1...ID6 that stand out the design, products and construction demands. According to these documents, the legislation must refer mainly to the:

A) Technical provisions for the construction design;
B) Codes pertinent to the material and product quality used for the constructions;
C) Provisions that state the way of elaboration of the technical agreements for new products, equipments, materials, procedures etc.

The EU Council ordered that the elaboration of the European system of provisions and technical codes should be the task of 3 of the most important standardization institutions: (Comité Européen de Normalisation, CEN), the European Committee

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of Electro technique Standardization (CENELEC) and the European Institute for Standardization in Telecommunications (ETSI). Now there are more than 5000 European Codes. It is expected that in the end the Euronorms will replace completely the National Codes. The publishing of the stated provisions is mainly performed by the Secretariat of the Free Exchange European Association (AELE).
This paperwork will present only the works regarding the harmonization of the technical design provisions (as stated previously at pct. A), namely Structural Euronorms.

3. HARMONIZED DESIGN CODES STRUCTURAL EURONORMS

On the basis of the Interpretative Document no. 1 (ID1) with respect to the exigency „a) strength and stability" it was stated that the commitment of the harmonized design provisions or the structural Euronorms (so-called EUROCODES) must be the task of a **Technical Committee, (TC)** from the frame of the European Standardization Committee (CEN) named **CEN/TC 250 Structural Eurocodes**, by having the following mission: „The standardization of the rules and structural design methods for buildings and engineering structures by taking into account the connections between the computational provisions, the material behavior, the building technology and control".

The initiative of elaboration of international codes for the design of the strength structures appeared in 1974 and it is set on the co-operation between technical-scientific and professional organizations, having a well-known activity in the European and international field. These organizations are:

- IABSE International Association for Bridge and Structural Engineering
- CIB Conseil International du Bâtiment
- RILEM International Association of the Testing and Research Laboratories for Materials and Constructions
- CEB Euro – International Committee for Concrete
- FIP International Federation for Pre stressed Concrete
- ECCS European Convention for Constructional Steelworks
- JCSS Joint Committee on Structural Safety
- ISSMFE International Society for Soil Mechanics and Foundation Engineering

The basic rules for the structural calculus have been elaborated in the frame of JCSS. On the basis of the hazard concept safety conditions and serviceability conditions were developed, by considering the structural reliability criteria.

These conditions assured the common base of the computational codes, thus creating the opportunities for the elaboration of the Structural Eurocodes. A harmonization process was followed for the frame principles of the codes inside the membership countries regarding the building materials, the building methods, building classes and engineering constructions.

In the Interpretative Document no. 1 (ID1) there are also mentioned:

- Eurocodes will serve as reference codes, being submitted to the authority appointment of the membership countries and have the goals:
  - The supply of essential checking criteria for the structures of the buildings and engineering works;
  - The insurance of the technical-juridical basis of the specific building contracts and building works and engineering services;
  - The insurance of the frame necessary to set up the technical provisions for the materials and products used in the construction industry.
- Under the prerogatives of a coherent system and comprehensive in laws the EUROCODE Program supplies various design methods and several other specific design elements important in practice, covering all the building types and engineering works made of various building materials.
- Eurocodes should also rely on the reference codes of International Organization for Standardization, ISO.

The EUROCODE Program (EC) endows nine Codes as follows:

EUROCODE 1 (EC1)	Basis of design and actions on structures.
EUROCODE 2 (EC2)	Design of concrete structures (general rules, RC structures, pre cast concrete, pre stressed concrete, plain concrete).
EUROCODE 3 (EC3)	Design of steel structures
EUROCODE 4 (EC4)	Design of composite steel and concrete structures
EUROCODE 5 (EC5)	Design of timber structures
EUROCODE 6 (EC6)	Design of masonry structures
EUROCODE 7 (EC7)	Geotechnical design
EUROCODE 8 (EC8)	Design provisions for earthquake resistance of structures
EUROCODE 9 (EC9)	Design of aluminum structures

The provisions of a Eurocode are structured on items/paragraphs that might be: **basic principles** and **application rules**.

The **basic principles** are consisting of:

- General definitions and declarations that do not allow alternative;
- Demands, models and analytical methods that do not permit alternatives besides those especially stipulated.

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The **application rules** are unanimously acknowledged rules that follow the principles and fulfill their requests.

The principles are recognized after P letter denomination that follows the item number or the paragraph. Other paragraphs or items (without P) represent application rules.

An Eurocode appliance always needs the obey of the principles while the application rules having a recommendation status can be replaced, in several special cases, by rules or equivalent methods if one demonstrates that these are paying respect to the basic principles; in this way it is provided a larger flexibility for application, allowing alternatives inside the code.

In the first step of the code elaboration these were partially or entirely published as **Temporary European Norms** or **Pre-norms**, abbreviated as **ENV**. Thus, the Ist part (that usually refers to fundamental/general requirements) of EC2, EC3, EC4 and EC5 was published in ENV format in 1992. The Ist part of EC1 and EC8 was published in ENV version in 1994.

Each Eurocode or part of a Eurocode published in an ENV format must be accompanied by a National Appliance Document (DAN) in order to be able to perform the responsibility upon the basic requirements by the country membership authorities. These documents will be written and used together with the ENV experimental version of the specific European Norm ENV, having the following functions:

- the harmonization of Norms by setting several connections between the ENV and national provisions;
- the correlation of the ENV with the structural safety protection level existing in that country;
- the setting of the numerical values of the ENV for several amounts (safety coefficients, action intensity – wind, snow, earthquake, temperature variations etc.). In ENV these amounts are emphasized by including inside square brackets [ ]. The authorities of each country will replace the square braced values with effectively applicable values at the national level;
- the set up of alternatives to the application rules paying respect to the basic principles.

The second and the last step refers to the conversion of the Pre- norms into European Codes, EN, that will become valid/compulsory in the EU membership countries, the corresponding National Codes and standards following to be retired from use after a stated period. The appliance of the EN provisions will open the market of the design companies that will we able to co- operate with the foreign building companies for projects all over Europe. It is expected the EUROCODE Norm package to become operational in 2005-2007, having the status of unique European Codes after a decision at the political level of EU.

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4. CONSIDERATIONS CONCERNING THE HARMONIZATION OF THE ROMANIAN CODES TO THE STRUCTURAL EUROCODES. NATIONAL APPLICABLE DOCUMENTS

The responsibility for the correctly structural behavior is mainly in the charge of state. For this reason, the state responsible authorities must be involved in the conception/design activities, the building process and construction service. The state implication is materialized in the fact that the above mentioned activities must roll on according to the juridical technical prescriptions that must be obeyed unconditionally.

In our country the technical provisions regarding the constructions have been treated uniformly in the frame of the Ministry of Public Works and Land Planning, MLPAT, now Ministry of Public Works, Transportation and Dwelling, MLPTL, under the co-ordination of the General Technical Direction. There were set up the Technical Committees for the specializations that on the basis of the 10/1995 law regarding the construction quality and the corresponding Application Rules; these Committees have the following duties in order to accomplish the six requirements:

- The draw up of the technical prescriptions for the components of the quality system in constructions;
- Technical agreement for products, procedures and equipments;
- The compliance authentication for the quality of the products used in constructions.

In November 1997 MLPAT launched the Romanian Codes Program – CR for the „Draw up of the technical prescriptions concerning the civil and industrial engineering structures during the 1997-2000 and the harmonization with the technical prescriptions from EU".

The CR Program elements were defined in principle according to the 1-9 Eurocodes, the basic idea is those to become National Applicable Documents (DAN) i.e. the content of an ENV Eurocode to be transferred entirely to the Romanian version with the adjustments corresponding to our country. Thus EC1 in the ENV format would become CR1 – Basic elements for the design (the fundamentals of design) and actions on constructions, EC2 – ENV to CR2 – Design of concrete structures and so on.

Some drawbacks in the co-ordination of the CR Program and the limit of the founding made it run discontinuously and it was not possible to follow the European evolution of the EUROCODE. From this reason instead of appearing the Romanian translation of the Eurocodes together with the corresponding DANs there were draw up several Codes that have neither the name of the chapter from the original Eurocode nor of the CR Program. For instance, in the Construction Bulletin vol. No. 19-20 from 2001 it was published the Code NP 042-2000 titled

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„The computational checking of the steel members and joints" which is in fact the ENV 1993-1-1 of EC3:"The calculus and design of steel structures", part 1.1. „ General rules and provisions for buildings". The same ambiguous situation it is present at the computation of the structures subjected to seismic actions (EC8 and P100), the computation of the timber structures (EC5 and the NP 005-1996 and NP 019-1997 Codes) etc.

The translation of the structural Eurocodes and the draw up of the CR Codes are very important operations and must be duplicated by a large action of dissemination and explanation to make them known to the engineers that should apply or work collateral with these norms. The DANs must be send to investigation for a 2 years period and enter in application with a temporary code status, simultaneously with the existent national Codes.

References

1. EUROCODE 1 (EC1). *Basis of design and actions on structures*, 2002.
2. EUROCODE 2 (EC2). *Design of concrete structures (general rules, RC structures, pre cast concrete, pre stressed concrete, plain concrete)*, 1996.
3. EUROCODE 3 (EC3). *Design of steel structures*, 2001.
4. EUROCODE 4 (EC4). *Design of composite steel and concrete structures*, 2001.
5. EUROCODE 5 (EC5). *Design of timber structures*, 2000.
6. EUROCODE 6 (EC6). *Design of masonry structures*, 2001.
7. EUROCODE 7 (EC7). *Geotechnical design*, 2000.
8. EUROCODE 8 (EC8). *Design provisions for earthquake resistance of structures*, 1999.
9. EUROCODE 9 (EC9). *Design of aluminum structures*, 2000.
10. P100-2006. *Romanian Aseismic Design Code. Provisions for buildings*, 2006.

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