BA-Cortex: Learning tools for EC2

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ABSTRACT: The project named BA-Cortex relates more particularly to the “Eurocodes 2: Design of concrete structures – Part 1-1: General rules and rules for buildings”. The objective of the project is to build an educative tool accessible to everyone via a website. The didactic tool presents different training, dimensioning and project modules. It synthesizes a basic teaching for reinforced concrete and pre-stressed concrete, examples of calculation and project situations.

1 INTRODUCTION

Eurocodes must be popularized for various communities: civil engineering teachers and students, professionals of the companies and design offices.

In France, the number of people (table 1) having to be quickly formed with the Eurocodes related to the concrete construction is very important. However, few training courses are accessible. Those are often very expensive what limits the number of participants. Few books (Thonier 2006), (Calgaro 2005) or traditional formation tools are available whereas application of Eurocodes in European Communities, and more particularly in France is started.

In order to produce a tool of teaching assistance and of self-formation, a group of teachers and professionals of the construction has been constituted under the impulse of the federation “Ecole Française du Béton” (EFB) and the Numerical University for Industry and Technology (UNIT). This project is a first in the world of the Civil Engineering teaching in France.

This project named BA-Cortex relates more particularly to the “Eurocodes 2: Design of concrete structures – Part 1-1: General rules and rules for buildings”. The objective of the project is to build a freely accessible formation tool (free of charges) on the web and consultable by everybody: www.ba-cortex.com.

Online studies, released from the time contingencies of the synchronous course, are particularly adapted for the individualized training and for a continue self-evaluation.

<table>
<thead>
<tr>
<th>Table 1. Number of peoples dealing with Eurocodes related to the concrete in France.</th>
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</thead>
<tbody>
<tr>
<td>Pupils and students</td>
</tr>
<tr>
<td>Teachers</td>
</tr>
<tr>
<td>Engineers and technicians</td>
</tr>
<tr>
<td>Architects</td>
</tr>
<tr>
<td>Others peoples in links with construction act</td>
</tr>
</tbody>
</table>

The tool was thus developed so that learner can adapt its rate of formation, carry out its choice freely, discover the content according to its own study plan, find sufficient stimulating exercises and carry out tests of self-evaluation possibly criticized by a teacher.

This collaborative work, based on innovative partnership between teaching and professional experts, is described in this paper and the tool architecture is presented. The reader can connect himself on the website to discover the contents.

2 BA-CORTEX OBJECTIVES

The BA-Cortex tool can be used in basic student training or as support for continuous training activities (including self-training).

So, BA-Cortex is devoted to:

- the students and the teachers of specialized trainings of the colleges, universities, engineer schools and architecture schools.
the technicians and the engineers of Civil Engineering of building enterprises and design or architect offices who must familiarize themselves with the use of Eurocodes.

all the concerned professionals requiring an actualization of their knowledge.

Two types of deliverables are expected:

– some deliverables linked to the theoretical training about reinforced concrete and pre-stressed concrete. The main equivalent time of training is about 60 hours.

– some deliverables linked to the practical as concrete structure dimensioning and project studies. The structure is then analysed pieces by pieces (slab, beams, column...). The main equivalent time of training is about 60 hours.

Three distinct training levels (and then distinct contents levels) are proposed to the learners:

– Beginners (as college),

– intermediate (of technician, with raise-engineer),

– expert (engineers and experts).

The selection of the training level is made by learners, at the moment of its connection to the tool. The change of training level required to come back to the BA-Cortex project open file.

The content of BA-Cortex relates more particularly to the following text:

– Some recall of Eurocodes 0: bases for the calculus of structures.

– Specific data for concrete structures from Eurocodes 1: Actions on structures.

– Eurocodes 2: Design of concrete structures – Part 1-1: General rules and rules for buildings (including French national annexes). The national annexes define the conditions for application of the European standard. It makes it possible to take account of the geographical, geological or climatic characteristics as well as levels of protection specific to each country.

– Calculation methods provided by French professional recommendations (FFB, 2007).

3 BA-CORTEX WORKGROUP

The partners involved in the teaching tool development are teachers of Civil Engineering from the college, bachelor or university levels. They represent all the most important places of the French Civil Engineering formation. Engineers and experts reinforce the “think tank” (figure 1). Nearly 35 peoples are thus associated within the project, under the coordination of a Management committee (figure 2).

The members of the workgroup are voluntary. Their production is not paid. The creation of this
support of a company specialized in the website development is thus necessary. MediaCD company was selected for this purpose, taking into consideration its competence for the development of e-learning tools: www.mediacd.fr.

A financial grant was found in order to support the financial cost due to MediaCD company works and to the periodical meetings of the workgroup. The grant is provided by the federation “Ecole Française du Béton” (EFB) and the Numerical University for Industry and Technology (UNIT). EFB is a foundation founded by cement industry in partnership with the French ministry of teaching and the Professional Federations intended for the formation. The foundation centralizes resources on concrete topics and is a creator and diffuser of teaching supports. UNIT is an association linked to the French ministries of teaching and research. This association provide financial grant annually for project dealing with learning tools based on use of numerical teaching resources.

4 TOOL ARCHITECTURE

4.1 Notion of module

The didactic tool presents different separate modules. The total content synthesizes a basic teaching for reinforced concrete and pre-stressed concrete, examples of calculation and project situations. The three training levels are considered for each module. Then, the contents of the modules are adapted to each level. Three types of modules are presents: notional modules, application modules and project modules.

The choice of a modular architecture permits a progressive teaching approach. Each learner can create its teaching course and advance at its rate in the training and the appropriation of the modules contents. This architecture facilitates self-tuition or a targeted consultation of the data.

The architecture of the project, its modularity and its evolutionary character will allow an uninterrupted update and a progressive enrichment of the whole of the formation by addition of complementary modules taking into account the standards evolutions.

A specific module is also integrated, which constitutes deliverable of self evaluation. This module is constituted with a whole of questions relating to the content of each other module.

4.2 Notional modules

Those modules deal with various traditional chapters of the teaching of the reinforced concrete and the pre-stressed concrete: calculations of the actions, structural analysis, dimensioning of the sections... (table 2).

In the notional modules, the learner follows a main screen which unrolls the contents of the course. This

<table>
<thead>
<tr>
<th>Table 2. Detail of notional modules contents.</th>
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</thead>
<tbody>
<tr>
<td><strong>NOTIONAL MODULES</strong></td>
</tr>
<tr>
<td>ACTIONS</td>
</tr>
<tr>
<td>MATERIALS</td>
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<tr>
<td>SLS</td>
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<tr>
<td>ULS</td>
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<tr>
<td>BUILDING AND ENVIRONMENT</td>
</tr>
<tr>
<td>STRUCTURAL ANALYSIS</td>
</tr>
<tr>
<td>SECTION DIMENSIONING OF LONGITUDINAL REINFORCEMENT</td>
</tr>
<tr>
<td>DIMENSIONING OF TRANSVERSAL REINFORCEMENT</td>
</tr>
<tr>
<td>DEFLECTION AND CRACKS</td>
</tr>
<tr>
<td>ELEMENT UNDER COMPRESSION</td>
</tr>
<tr>
<td>(continued)</td>
</tr>
</tbody>
</table>

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Table 2.  (continued)

<table>
<thead>
<tr>
<th>NOTIONAL MODULES</th>
<th>TOPICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HORIZONTAL ELEMENTS</td>
<td>Beams, solid and flat slabs design, Curtailment of the longitudinal tension reinforcement, End element conditions, Sill conditions, Node conditions, Design procedures detailing</td>
</tr>
<tr>
<td>PARTICULAR ELEMENTS</td>
<td>Short consoles, Shallow foundations, Piles caps, Deep beams, Instability of slender beams</td>
</tr>
<tr>
<td>PRECASTING PRODUCTS</td>
<td>Design factors, Design procedures linked with assembling, Junctures</td>
</tr>
<tr>
<td>PRE-STRESSED ELEMENTS</td>
<td>Post-tensioning prestress, Pre-tensioning prestress, Anchorages and anchored devices, Design procedures detailing, Prestressed steel relaxation losses, Transfer of prestress</td>
</tr>
</tbody>
</table>

Table 3.  Detail of application and project modules contents.

<table>
<thead>
<tr>
<th>APPLICATION and PROJECT MODULES</th>
<th>PRINCIPAUX THEMES TRAITES</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPLICATION MODULES</td>
<td>Structural analysis design of sections : Bending without axial force, SLS design, SLS stress and strains verifications, ULS design, Bending with axial force : SLS design, SLS stress and strains verifications, ULS design, Minimum reinforcement areas, non-weakness condition, Longitudinal reinforcement, Curtailment of the longitudinal reinforcement, Design procedures detailing, Sections choice, Links positions, Calculation of deflection, Crack control</td>
</tr>
<tr>
<td>PROJECT MODULES</td>
<td>Project synoptic walk-through, Associate structural analysis beams, Continuous beams slabs, Continuous slabs, Corbels, Deep beams, Strip and pad footings, Piles caps, Columns, Walls</td>
</tr>
</tbody>
</table>

Screen is made up of a succession of pages containing short texts and the illustrations. The user selected his rate of course and can retrogress in the screen. Each page of screen offers specific references towards segments of notional modules or dimensioning. The called data appear on a new window. The windows of called data can also include connections towards other segments of notional or dimensioning modules.

4.3 Application and project modules

The application modules are composed of exercises of application associated with a correction and accompanying notes and comments. Calculus methods to evaluate the section of reinforcement bars in concrete slabs or beams are exposed. Column case is also studied as foundations, short beams...

With the project modules, the learner is placed in situation of project. The elements of the structure of a building are identified. The analysis of each element corresponds to a project module. A first stage allows the calculation of the actions acting on the studied building Appyling Eurocodes 1. A situation plan of the project including the architectural and technical data is provided. The materials used and their properties are reviewed at the same time from a technical and normative point of view. Then, various modules detailing the study of the structural elements become accessible in an order chosen by learner (table 3).

Some links give directly access to the application modules presenting the principles of dimensioning or the studied structural element or to the associated notional contents.

4.4 Other contents

Different other content are present in BA-Cortex. They constitute a toolbox. As example, some part of references texts (standard or technical descriptions...) are directly accessible from notional modules. Each module is illustrated with supports documents. These documents allow to the learner how to obtain precise details on the teaching contents on the optimisation of dimensioning, technology and additional information for a more precise analysis. Toolbox is also composed of constructive principles, interactive diagrams, pictures and movies or the justification of certain formulas used in Eurocodes.
5 PROJECT DURATION AND COURSE

The course of the project is two years long (2007 and 2008). During the first year of the project the workgroup have a meeting quite each two months. During the first meeting, the architecture and the scenario of each module is proposed. The redaction of the module is realized by small teams of writers working in a collective way. Text are presented during meetings and read and corrected by the experts and by members of management committee to ensure the homogeneity of all the content in parallel, the definition of a graphic charter is carried out in conformity with the selected architecture. The validation of this choice is finalized in July 2007. First content of notional modules are deliverable in June 2007. Then the content is numerized. To follow the evolution of the content, MediaCD use a pilot website accessible for each workgroup member.

More content are added each month. A first public version of the content is already available (figure 4). This content corresponds essentially to notional modules. This content will soon evolve with the addition of applications and project modules.

6 CONCLUSIONS

The initial configuration of the project must be completed in the early 2009. This project is a first in the world of the Civil Engineering teaching in France. We hope that the synergy initiated for this project stays persistent.

Figure 3. Links between BA-Cortex contents.

Some other documents gather technical data necessary to comprehension of the behaviour of reinforced concrete and pre-stressed concrete, behavior of the material concrete.

Figure 4. Presentation of BA-Cortex: www.ba-cortex.com.

The project BA-CORTEX being based on a very large base of knowledge will make it possible to standardize and accelerate the acquisition and the appropriation of competences of the various actors of the world of construction and teaching and thus to allow to the French community members to reach the European requirements level.

BA-Cortex proposes some answers to meet the need of education methods evolution, of a fast diffusion of knowledge and of formation for all the actors of the construction world.

The content of BA-Cortex is written in French. However, the modular aspect of it construction must facilitate translation and adaptation to the use in other countries.

REFERENCES


