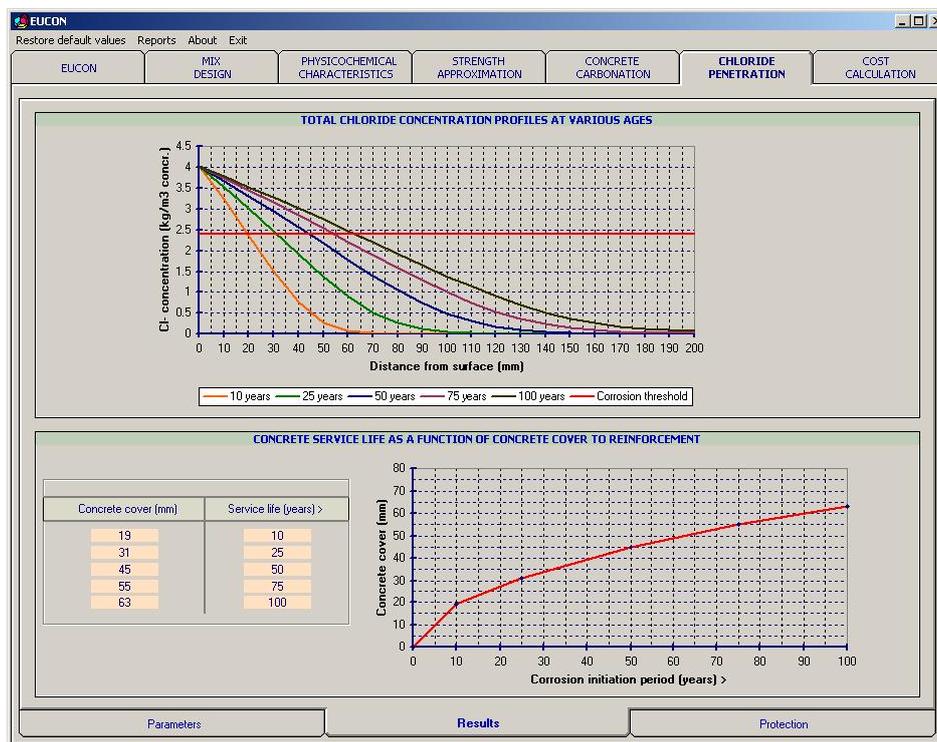


EUCON:

A SOFTWARE PACKAGE FOR ESTIMATION OF CONCRETE SERVICE LIFE

The User Manual



by

Vagelis G. Papadakis

Chemical Engineer, PhD

Maria P. Efstathiou

Software Engineer, MSc

Patras, Greece, 2005

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Foreword

Deterioration of concrete in service may be the result of a variety of mechanical, physical, chemical or biological processes, with the *corrosion of steel reinforcement* to be the most serious durability problem of the reinforced concrete structures. Over the past 50 years, an enormous amount of energy has been expended in laboratory and field studies on *concrete durability*. The results of this research are still either widely scattered in the journal literature or mentioned briefly in the standard textbooks. Moreover, the theoretical approaches of deterioration mechanisms with a predictive character are limited to some complicated mathematical models not widely applicable in practice.

A significant step forward is the present development of a *software package for computer estimation of the concrete service life* - EUCON[®]. This package is based on the most reliable mathematical models and is strengthened by adequate experimental data. The present work is the *user manual* of the EUCON[®] package and it aims to help essentially and to orient correctly the program user.

In the beginning, a *mix design strategy* to fulfil any requirements on strength and service life is presented. The *chemical and volumetric characteristics* of concrete are first estimated and the *service life of the concrete structure* is then predicted, based on fundamental models described analytically in the *theoretical background* [1]. The prediction is focused on the basic deterioration phenomena of the reinforced concrete, *carbonation and chloride penetration*. Aspects on *concrete strength* and *production cost* are also considered. The computer results enable mixture proportions to be accurately specified and concrete performance reliably predicted. The work structure presented herein is in full compliance with the new *European Standards for cement: EN 197 and concrete: EN 206*. The programming language used was the Microsoft[®] visual basic version 6.0.

The experimental research and mathematical modelling has been carried out mostly by Dr. Vagelis G. Papadakis as a part of various research projects, during the last 20 years. Mrs. Maria P. Efstathiou developed the computer program based on the above theoretical background. The *General Secretariat for Research and Technology, Ministry of Development*,

Greece, provided financial support for the present work through the PRAXE Programme (02-PRAXE-86).

Vagelis G. Papadakis

Maria P. Efstathiou

January 2005

Dr. Vagelis G. Papadakis holds a diploma in Chemical Engineering (1986) from the University of Patras, Greece, and a Ph.D. on the subject of carbonation and durability of concrete from the same institution (1990). He has a 20-year experience on scientific and demonstration projects on durability and technology of concrete, authored many papers and awarded by the American Concrete Institute (Wason Medal for Materials Research- 1993). He worked as a Researcher at the Danish Technological Institute, Building Technology Division, Concrete Centre (1997-1999) on supplementary cementing materials in concrete, holding an EU-fellowship (Marie Curie Grant). He was head of Concrete Technology Laboratory of TITAN Cement company S.A., Greece (1999-2000). During 2001-2006, he was head of “V.G. Papadakis & Associates – Building Technology and Durability” an innovative firm placed in “Patras Science Park S.A.”, and, in parallel, a Research & Development Consultant in “Patras Science Park S.A” in the field of development, promotion and exploitation of Innovation. At the present (2007-) he is an Associate Professor in the Department of Environmental and Natural Resources Management, University of Ioannina, Greece.

Mrs. Maria P. Efstathiou, Software Engineer, holds a BSc in Computer Information Systems, from the American College of Greece (Deree College), and an MSc in Software Engineering Methods from the University of Essex, UK. She is specialized in numerical analysis, design and development of software applications in chemical and material engineering. During 2001-2006, she was a member of staff of the unit “V.G. Papadakis & Associates – Building Technology and Durability”, Patras Science Park S.A., Greece. At the present, she is a Research Associate in “Patras Science Park S.A” and in management committee of “Regional Innovation Pole of Western Greece”.

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