Computerized integrated knowledge base system for high-performance concrete: An overview

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SUMMARY

The rapid growth of computer-based systems such as simulation models, databases, and artificial intelligence decision-support systems, coupled with developments in information technology, have facilitated the development of computer-integrated knowledge systems which have the potential for representing virtually all scientific and engineering knowledge of concrete and making the knowledge readily available to those needing it. Such integrated systems are being developed for high-performance concrete.

1 COMPUTER-INTEGRATED KNOWLEDGE SYSTEMS

A computer-integrated knowledge system (CIKS) is a computerized intelligent system of integrated knowledge bases providing the knowledge needed for solving complex problems (1). The term 'knowledge base' denotes any entity that contains knowledge including models, databases, images, handbooks, guides, and standards and codes. Integration means that knowledge and data flow seamlessly (automatically) across interfaces, i.e., from one knowledge base to another. A CIKS can be developed to solve problems which may require the use of databases or a wide spectrum of knowledge ranging from the experience of experts in the form of heuristics, to fundamental knowledge and factual data that is contained in either locally or globally distributed databases.

1.1 *Application to high-performance concrete*

The conceptual CIKS for high-performance concrete shown in Figure 1 incorporates an expert system along with models and databases. It maps a methodology for designing a concrete mixture design to obtain a specific service life (1). First, an expert system and mathematical models are used to define the necessary material properties required by the concrete to give the desired service life. Then, distributed databases are searched to determine if existing mixture designs can be found which will give the necessary material properties at an acceptable cost. If such a mixture design is found, it is specified. If not, a new mixture must be formulated. Several methods can be used, possibly in combination, to formulate a new mixture that is more likely to give the required properties. The new mixture can be tested either by models or standard test methods, or a combination. If the new mixture gives the required properties, it is specified; if not the process is repeated. Note that data on each new mixture designed are 'banked' into the database for further reference by those who have access to the system.

An operational, prototype CIKS that can provide an estimate of the service life of reinforced concrete, in which the most probable mode of degradation is chloride-induced corrosion, has been developed (2). It includes numeric and literature databases, ACI guidelines for proportioning concrete mixture for ordinary and high-strength concretes, simulation and service life models, and

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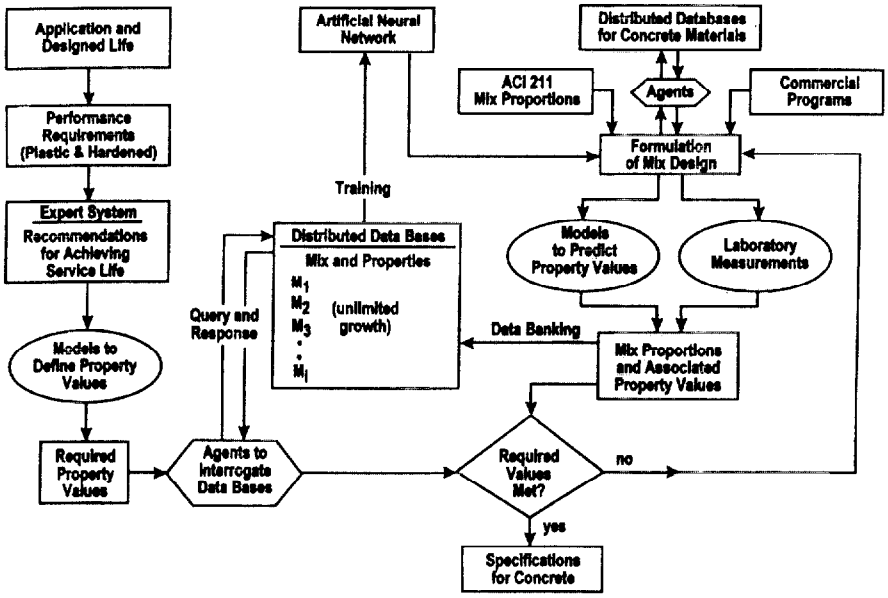

Figure 1. Conceptual CIKS for designing mixes for high-performance concrete.

guidance on analyzing experimental results. It is is available on the Internet at: http://ciks.cbt.nist.gov/~bentz/welcome.html.

REFERENCES

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