Improvement of Structural Life Management System(SLMS) for N.P.P. Structures

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1. Introduction

The first investigation on the degradation mechanism and establishment of systematic inspection procedure for nuclear power plant (NPP) structures in Korea were conducted through a research project performed from 1993 to 1996[1)].

Accordingly, the Structural Life Management System (SLMS) was developed in 1998. Currently, SLMS is still operating for the lifetime management of NPP structures.

However, the function of currently operating SLMS is focusing essentially on the management of degradation data detected during periodical inspections. Such limited function is today stressing the necessity to supplement its functions by improving the inefficiency of D/B due to the huge volume of data as well as by reflecting additional requirements.

Accordingly, this research intends to develop a system improving the former SLMS so as to accommodate to the various demands of the users like integrated D/B system exploiting web-server, integrity assessment and durability management.

2. Major features of the SLMS II

2.1 System flow

The data input in the system are inspection and examination records, detailed history of the structure, repair data, etc. All the input data are stored temporary for reliability check prior to storage in the main D/B. The so-filtered data are then stored in the main D/B with respect to their specificity and exploited for the generation of objective-oriented D/B.

In addition, once all types of information related to design and construction of the structure as well as inspection and repair data that have been input on screen in a definite form, data processing and storage are executed systematically in the computer so that users can inquire or output them in hard copy or on an output station in diversified forms when necessary. The operating program has been built to enable various search and application through link with the integrated D/B.

Fig. 1 depicts the composition of the services provided by the SLMS II.

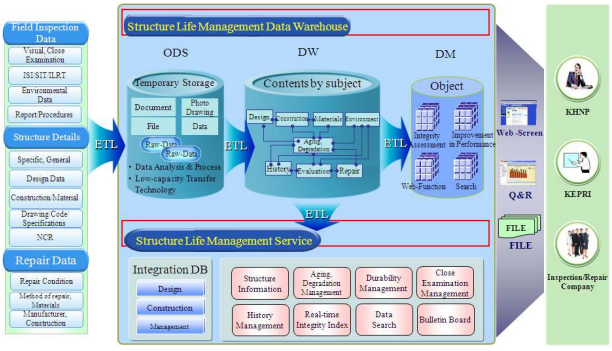

Fig. 1. System flow of SLMS II

2.2 Major features

As shown in Fig. 2, the main screen is a web window providing a pull-down menu at the top giving access to each management domain. Links to useful relevant sites are provided at the bottom of the screen. Users can do the management work by clicking the top menu what they want. Major features of each items are as followed.

The history management D/B is composed of 8 topics that are basic, NCR/FCR, drawings, procedures, codes, reports, configuration, and ISI/SIT.[2)] The history management D/B secures data the history records of the power plant from the

Fig. 2. Main screen

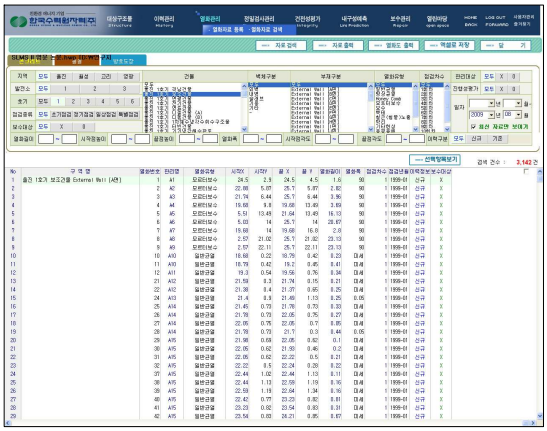

Fig. 3. Search result window

Fig. 4. Example of structure information

start of its construction to its design, construction, completion and commercial operation stages as well as data related to all types of test and inspection. All these data being digitalized in the database are efficiently and systematically managed so as to supply overall information of the structure necessary for its maintenance. Based on these data, the history management D/B is supporting the lifetime management D/B.

Close inspection management is basically done with reference to the NPP unit. The areas of close inspection are classified roughly into concrete and steel inspection. The managed close inspection items are the chloride content, carbonation depth, ultrasonic wave speed, half potential, NDT strength test, differential settlement, membrane thickness, torque value of bolt, etc.

The data search program provides basic search function together with additional and new options in order improve the exploitation efficiency of SLMS. The selectable options are itemized to offer more effective and concrete search functions. The search options of input data can be set and output by NPP unit, structure, degradation search by member and by level of degradation (class I, II, III). Search can be done by combining all types of search items.

During the input of degradation and close inspection data, SLMS II provides an integrity assessment function computing automatically the integrity index of the structure and members. For this assessment function, input is not only done by simply providing the size and coordinates of the degradation during the input and storage of the data but also by classifying the degradation state level of efflorescence, scaling/spalling, rebar exposure and crack. The close inspection data table is generated to be fully compatible with the integrity assessment program so as to achieve a D/B system enabling data like the quantity of chlorides, differential settlement and carbonation depth to support the assessment.

SLMS intends to predict the service life of the structure based on field inspection data. The degradation mechanism applied for the service life prediction involves carbonation and chloride penetration. Lifetime prediction is based on measured values from periodic inspections.

3. Conclusions

A new Structure Life Management System (SLMS) II has been developed to respond to evolving and new needs that emerged during the decade following the development and operation of the first SLMS for NPP in 1998. The new SLMS is featured by the possibility of centralized control through web-server, the securing of data stability through the use of stable D/B and the improved maintenance efficiency through systematic digitalization of synthetic history records and items of the structure necessary for its maintenance apart from simple degradation data. In addition, the exploitation of field monitoring data related to carbonation and salt attack opens the opportunity to manage long-term durability of the structures. Another feature is the possibility to compute the integrity indices of the structure or members instantaneously with the input of degradation data or close inspection records using an integrity assessment program.

SLMS II is expected to be a valuable and helpful system for the life management of NPP structures that will contribute to the enhancement of the overall safety of NPP structures.

REFERENCES

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