A Hybrid Approach to the Representation and Processing of Design Standards

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ABSTRACT

This thesis presents an environment for the modelling and processing of structural design standards. This environment is known as SADA, an acronym for Standards Automated Design Assistant. SADA addresses many of the drawbacks conventionally associated with design standards and existing models of design standards. A study of existing standards models and design standards was carried out, which resulted in the identification of a number of key issues, including:

- structural design standards are ambiguous and are therefore subject to interpretation;
- structural design standards generally address standard or routine design contexts, existing standards models fail to recognise this;
- existing models are generally opaque in nature:

  (i) it is not clear to the user how the standards have been modelled
  (ii) processing of the standard is a 'black-box' activity, furthermore;
  (iii) users have no control over the modelling or processing activities.

SADA consists of four main modules, each consisting of several components:

- Code Information Base;
- Processing Module;
- Dependency Network Generator;
- Design Case Base.

Each module performs its designated tasks contributing to the overall functionality of SADA. Numerous standards can be encapsulated and browsed in a hypertext manner within the SADA model. SADA supports the production of designs within the scope of the standards contained in the model. Standard and non-standard contexts are distinguished. A procedural approach is adopted for the production of standard or routine designs. Case Based support is provided for handling non-standard designs. A conformance checking facility is provided for designs produced within SADA, and independently. An applicability checking feature

ensures standards are not applied out of context. Various features giving the user control over the modelling and processing of the standards contained in SADA have been implemented.

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Terminology

provision: provisions are the smallest quantity of information found within a code i.e. the last classification division made in a code. The term *clause* has also been used in some existing work

requirement: a requirement imposes certain criteria or conditions upon a design. A requirement may be an entire provision or a subsection of a provision. Not all provisions contain requirements.

data items: data items are variables to which the standard refers within its text

basic data items: a data item for which no explicit expression is provided in the standard that defines its value, its value is obtained from the design being evaluated or from general knowledge of the domain

derived data items: a data item for which an explicit logical or mathematical expression for deriving its value is provided within the text of the standard

Design Entity (DE): the term design entity has been adopted to describe the object that is being designed.

design context: a design context is a description of a design in terms of its attributes.

Code Limitation: statements made within a code which place restrictions on the scope of its application

standard design: the term standard design is used to denote routine designs. For example, considering the design of reinforced concrete beams a standard design would be beams with a rectangular or flanged cross section.

non-standard design: the term non-standard design refers to non routine designs. Again consider the design of reinforced concrete beams a non-standard design would be a beam with an irregular cross section such as trapezoidal.

module: within the context of this thesis module refers to the various *top level* components of the SADA module i.e. Code Information Base, Processing Module etc.

component: refers to the various elements of each of SADA's modules i.e. Provision Retrieval Component, Conformance Checking Component.

Abbreviations

WWW or Web	World Wide Web.
SGML	Standarised General Mark-up Language.
HTML	HyperText Mark-up Language.
ES	Expert System
KBS	Knowledge Base System
CBR	Case Base Reasoning
DNG	Dependency Network Generator
CIB	Code Information Base
SADA	Standards Automated Design Assistant
CE	Code Entity
DE	Design Entity
CL	Code Limitation
ULS	Ultimate Limit State
SLS	Serviceability Limit State