



Materials Engineering

D. W. S. Ho

National University of Singapore

- 40 Constituents and Properties of Concrete** *C.T. Tam*
Introduction · Constituents of Concrete · Aggregates · Water · Chemical Admixtures · Hydration and Structure of Cement Paste · Mixture Design · Properties of Fresh Concrete · Properties of Hardened Concrete
- 41 Durability of Concrete** *D.W.S. Ho*
Introduction · Permeation Properties · Reinforcement Corrosion · Alkali-Silica Reaction · Sulfate Attack · Acid Attack · Seawater · Physical Attrition of Concrete · Frost Action · Action of Heat and Fire · Design for Durability
- 42 Special Concrete and Applications** *V. Sirivivatnanon, C.T. Tam, and D.W.S. Ho*
Concreting in Extreme Climatic Conditions · Polymer Concrete · High Performance Concrete · Self-Compacting Concrete · High Volume Fly Ash Concrete · Concrete for Sustainable Development
- 43 Wood as a Construction Materials** *John F. Senft*
Introduction · Wood Defects as They Affect Wood Strength · Physical Properties of Wood · Mechanical Properties of Selected Species · Structural Products and Their Uses · Preservatives · Grades and Grading of Wood Products · Wood Fasteners and Adhesives · Where Do Designers Go Wrong? Typical Problems in Wood Construction · Wood and the Environment
- 44 Structural Steel** *Ian Thomas*
Properties and Processes · Service Performance
- 45 Bituminous Materials** *Mang Tia*
Introduction · Bituminous Materials · Bituminous Mixtures

Civil engineers are involved in the design and construction of new facilities as well as the maintenance of existing structures. The decision on the choice of construction materials depends on many factors such as the cost, mechanical properties, durability, ease of construction, aesthetics, etc. The subsequent costs of operation and maintenance are also important factors to be considered in determining the economic viability of the project. Premature deterioration of the infrastructure (e.g., roads, buildings) has serious consequences on the efficiency and profitability of other sectors of economy. Poorly constructed facilities would also affect of quality of life of their users.

To make sound decisions, engineers must be able to assess all the factors that affect the performance of a material and its interactions with the service environment. Durability is related to service life of the structure and engineers are required to optimize between cost and the duration of its intended use. The recent concern on environmental sustainability provides yet another challenge to civil engineers in their proper selection of materials for construction.

It is emphasized that information provided in this section is not intended for material scientists nor meant to make an expert of engineers in the use of materials. It is intended for use by civil engineers and designers in their general practice, who need more than just the basic knowledge to make sound decisions on traditional materials like concrete, steel, timber and bitumen. The section is written based on latest information and generally accepted knowledge. Debates or reviews of this information will not be given as in journal publications. Some references will be given when appropriate. However, in the majority of cases, readers are encouraged to refer to the suggested lists in the “Further Information” sections.