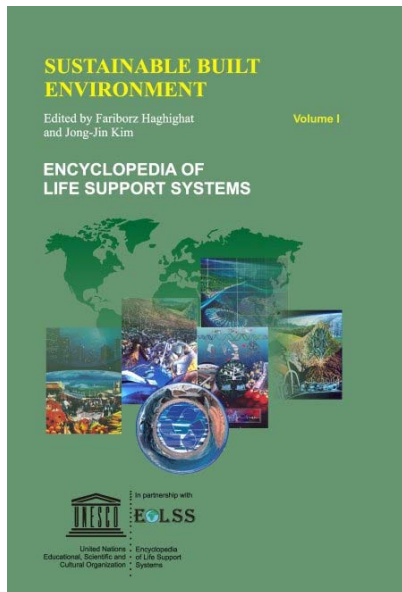


# CONTENTS

## THE SUSTAINABLE BUILT ENVIRONMENT



### **The Sustainable Built Environment - Volume 1**

**No. of Pages:** 490

**ISBN:** 978-1-84826-060-3 (eBook)

**ISBN:** 978-1-84826-510-3 (Print Volume)

### **The Sustainable Built Environment - Volume 2**

**No. of Pages:** 472

**ISBN:** 978-1-84826-061-0 (eBook)

**ISBN:** 978-1-84826-511-0 (Print Volume)

For more information of e-book and Print Volume(s) order, please [click here](#)

Or [contact : eolssunesco@gmail.com](mailto:eolssunesco@gmail.com)

# CONTENTS

## VOLUME I

<b>The Sustainable Built Environment</b>	<b>1</b>
Jong-Jin Kim, <i>College of Architecture and Urban Planning, University of Michigan, USA</i>	

1. Introduction
  - 1.1. Environmental impacts of building
    - 1.1.1. Shortage of building materials
    - 1.1.2. Noise, vibration, dust, and traffic disruptions
    - 1.1.3. Food wastes
    - 1.1.4. Water pollution
    - 1.1.5. Disruption of natural scenery
    - 1.1.6. Disappearing green spaces in urban areas
  - 1.2. Environmental impact of economic development
  - 1.3. Building and the environment
2. Sustainable built environments
  - 2.1. Economy of resources
    - 2.1.1. Building materials
    - 2.1.2. Energy
    - 2.1.3. Water
    - 2.1.4. Consumer goods
    - 2.1.5. On-site natural resources
  - 2.2. Life-cycle design
    - 2.2.1. Three Phases of building materials
      - 2.2.1.1. Pre-Building Phase
      - 2.2.1.2. Building Phase
      - 2.2.1.3. Post - Building Phase
  - 2.3. Humane design
    - 2.3.1. Human well-being
    - 2.3.2. Coexistence with fellow living organisms
3. Attributes of environmental sustainability
  - 3.1. Pollution prevention measures in manufacturing
  - 3.2. Waste reduction measures in manufacturing
  - 3.3. Recycled content
  - 3.4. Embodied energy reduction
  - 3.5. Use of natural materials
  - 3.6. Reduction of construction waste
  - 3.5. Use of natural materials
  - 3.4. Embodied energy reduction
  - 3.3. Recycled content
  - 3.2. Waste reduction measures in manufacturing
  - 3.1. Pollution prevention measures in manufacturing
  - 3.7. Local materials
  - 3.8. Energy efficiency
  - 3.9. Water efficiency
  - 3.10. Use of non-toxic materials
  - 3.11. Renewable energy systems
  - 3.12. Durability
  - 3.13. Reuse
  - 3.14. Recycling
  - 3.15. Biodegradability
4. Technological innovation and built environments
  - 4.1. Electronic technology in buildings
  - 4.2. Functional shift of built environments

- 4.3. Human interaction
- 5. Information technology and built environments
  - 5.1. Office automation
  - 5.2. Telecommunications
  - 5.3. Building systems
  - 5.4. Building decentralization
  - 5.5. Design intelligence
    - 5.5.1. Team design approach
    - 5.5.2. Bio-climatic built environments
- 6. Future directions

**Urban Design**

**36**

A .Inam, *Taubman College of Architecture and Urban Planning, University of Michigan, USA*

- 1. Introduction
- 2. Meaningful Urban Design
- 3. Teleological
- 4. Catalytic
- 5. Relevant
- 6. Future Directions in Urban Design

**Sustainable Community Development and Urban Design**

**55**

A . Loukaitou-Sideris, *Department of Urban Planning, University of California—Los Angeles, USA*

- 1. Introduction
- 2. Search for Sustainability in the Inner City
- 3. The Byzantine-Latino Quarter: Integrating Urban Design and Community Development
  - 3.1. The Context and History of the Neighborhood
  - 3.2. The Process of Collaboration: Towards a Sustainable Plan of Action
  - 3.3. Reclaiming Small Urban Spaces
    - 3.3.1. Cleaning the streets as an exercise in community development
    - 3.3.2. Eliminating negative landmarks
    - 3.3.3. Trashcan containers as canvas for public art
    - 3.3.4. Decorating building facades
    - 3.3.5. Greening the neighborhood
    - 3.3.6. Forging an identity: Linking the past with the future
- 4. The Problems of Forging Sustainable Development in the Inner City
- 5. Conclusion: Rethinking Sustainable Urban Design

**Urban Infrastructure and Morphosis**

**72**

S. D. Luoni, *School of Architecture, University of Florida, USA*

- 1. Introduction
- 2. Material Flows
- 3. Mobilization Versus Civilization: The Stresses of Movement
- 4. Building Recombinant Ecologies
  - 4.1. The Shared Street Concept
  - 4.2. Hydric Parks and the Management of Water
    - 4.2.1. Stormwater Treatment
    - 4.2.2. Wastewater Treatment
  - 4.3. Ecologies as Urban Fabrics: Solving for Pattern
    - 4.3.1. Site as Generator of Energy
- 5. Conclusion: New Theaters of Public Life

**Urban Renewal****94**U. Greinacher, *College of Design, Architecture, Art, and Planning, University of Cincinnati, USA*

1. Introduction
2. Background
3. Monterey's Transformation from a Derelict Industrial Landscape into a Prime Tourist Attraction
  - 3.1. Lessons Learnt
4. The Making of Savannah's Historic Downtown
  - 4.1. Lessons Learnt
5. New York: Manhattan's Chinatown
  - 5.1. Lessons Learnt
6. Conclusion

**Zoning and Regulatory Policies****114**A. Garvin, *Professor, Yale University, and Commissioner, New York City Planning Commission, USA*

1. Introduction
2. Private Land Use Regulation
3. The Police Power
4. Land Use Regulation Strategies
5. Comprehensive Zoning
6. New York City Zoning Resolutions of 1916 and 1961
7. Land Use
8. Density
9. Bulk
10. Building Placement
11. Open Space
12. Variances
13. Village of Euclid, Ohio v. Ambler Realty Co.
14. Incentive Zoning
15. Exactions
16. Special Districts
17. Growth Management
18. Smart Growth and Sustainable Development
19. Environmental Review
20. The National Environmental Policy Act of 1969
21. Land Use Regulation as a Planning Strategy

**Emerging Issues in Building Design****137**Raymond J. Cole, *School of Architecture, University of British Columbia, Canada*

1. Introduction
  - 1.1. Changing Context
  - 1.2. Sustainability
2. Environmental Context
  - 2.1. Green and Sustainable Buildings
  - 2.2. Climate Change
  - 2.3. Clean Energy
  - 2.4. Material Resources
    - 2.4.1. Materials Production
    - 2.4.2. Materials Use
3. Technological Context
  - 3.1. Direct Technologies
  - 3.2. Indirect Technological Advance
    - 3.2.1. Demobilization
    - 3.2.2. Dematerialization

4. Social and Cultural Context
  - 4.1. World-Views
  - 4.2. Space-Time
  - 4.3. Automated and User Control
5. Conclusions

### **Environmentally Friendly Building Materials**

162

David Rousseau, *Archemy Consulting Ltd., Vancouver, B.C, Canada*

1. Introduction
2. The global role of building materials
  - 2.1. Global scale of resource use
  - 2.2. Demand created by global urbanization
3. Material environmental life-cycle: resource extraction; manufacturing; transportation; use
  - 3.1. Extraction
  - 3.2. Manufacturing
  - 3.3. Transportation
  - 3.4. Installation and use
  - 3.5. Reuse/recycling or disposal
4. Material Assessment Methods
5. Other economic factors
6. Material economic life cycle
  - 6.1. Building materials and local economies
7. Broad categories of materials
  - 7.1. Low Tech-to-High Tech
  - 7.2. Labor Content
8. Specific types of materials
  - 8.1. Wood products and other plant fiber
  - 8.2. Minerals
  - 8.3. Metals
  - 8.4. Petrochemicals
9. Summary global trends
10. Healthy Materials

### **Resource Conscious Building Design Methods**

186

C. J. Kibert, *Rinker School of Building Construction, University of Florida, USA*

1. Introduction
2. Resource-Efficiency and Sustainable Construction
  - 2.1. Resource-Efficiency as a Key Concept of Sustainable Construction
  - 2.2. Resource-Efficiency Economics
3. Ecology as the Basis for Resource Efficient Design
  - 3.1. Ecological Concepts
  - 3.2. Industrial Ecology as a Starting Point
  - 3.3. Rules of the Production-Consumption System
  - 3.4. The Golden Rules of Eco-Design
  - 3.5. Construction Ecology
4. Resource-Efficient Strategies for Building Design
  - 4.1. Materials Selection
  - 4.2. Energy Strategies
  - 4.3. Water, Wastewater, Stormwater
  - 4.4. Land Use
  - 4.5. Landscape as a Resource
5. Case Study
  - 5.1. Design and Construction
  - 5.2. Use and Refurbishment

- 5.3. Demolition/End Use
6. Conclusions

### **Intelligent Buildings**

209

Show-Ling Wen, *Department of Architecture and Urban Design, Chinese Culture University, Taipei, Taiwan*

Chiang-Pi Hsiao, *Architecture and Building Research Institute (ABRI), Taipei, Taiwan*

Ching-Tzu Chen, *College of Environmental Design, Chinese Culture University, Taipei, Taiwan*

1. Introduction
2. Development of Intelligent Buildings
  - 2.1. Background
  - 2.2. Emergence of Intelligent Buildings
3. Current Developments of Intelligent Building
  - 3.1. What are Intelligent Buildings?
  - 3.2. Current Developments in Intelligent Building
4. Design of Intelligent Buildings
5. Future Developments of Intelligent Buildings

### **Homes for People with Multiple Chemical Sensitivities**

226

J. Wasley, *Department of Architecture, University of Wisconsin-Milwaukee, USA*

1. Introduction
2. Defining Multiple Chemical Sensitivity (MCS)
3. A History of Indoor Air Quality Problems
4. Indoor Air Pollutants
5. The Design of Dwellings for people with MCS
  - 5.1. Introduction
  - 5.2. Programming: Determining Individual Standards
  - 5.3. Health and Climate
  - 5.4. Site Selection
  - 5.5. Site Design
  - 5.6. Architectural Plan
  - 5.7. Exterior Envelope Assemblies
  - 5.8. Materials and Finishes
  - 5.9. Ventilation
  - 5.10. Combustion Safety
  - 5.11. Construction Practices
6. Case Study: Barrhaven Community Housing for the Environmentally Hypersensitive
7. Current Trends and Issues for the Future
  - 7.1. Introduction
  - 7.2. Current Trends
  - 7.3. Work Remaining
  - 7.4. MCS, Health and the Future of Green Building

### **Environmental Standards**

260

Robert Lowe, *Professor of Energy and Sustainability in the Built Environment, Leeds Metropolitan University, UK*

1. Introduction
2. Theoretical approaches to setting environmental standards
3. Environmental standards from classical times to 1970
4. Acid Rain - the development of the first international environmental standards to regulate trans-boundary pollution
5. Development of global environmental standards - ozone depletion and CFCs

6. Climate Change
7. Conclusions

### **Environment, Energy and Health in Housing Design**

278

L. Morawska, *International Laboratory for Air Quality and Health, School of Physical and Chemical Sciences, Queensland University of Technology, Brisbane, Australia*

M. Jamriska, *International Laboratory for Air Quality and Health, School of Physical and Chemical Sciences, Queensland University of Technology, Brisbane, Australia*

1. Introduction
2. A system: human, house and the environment
  - 2.1. Housing and its impact on human health and well-being
  - 2.2. Key elements of design and operation of healthy houses
  - 2.3. The effect of housing on the environment
3. Challenges in implementation of system approach
  - 3.1. The complexity
  - 3.2. Sustainable development
  - 3.3. Lack of combined responsibility and short term economic gains
4. Directions for the future
  - 4.1. HVAC systems – directions
  - 4.2. Information technology tools

### **Health and Comfort in Buildings**

306

Jan Sundell, *International Center for Indoor Environment and Energy, Technical university of Denmark, Lyngby, Denmark*

1. History of buildings and health
  - 1.1. Environmental issues
2. Health effects
  - 2.1. Developing countries
  - 2.2. Developed countries
    - 2.2.1. Cancer
    - 2.2.2. Allergy
    - 2.2.3. Other hypersensitivity reactions
    - 2.2.4. Airways infections
3. Indoor exposures associated with health effects
  - 3.1. Air quality
  - 3.2. Odor
  - 3.3. Chemical compounds
  - 3.4. Particles
  - 3.5. Micro-organisms
  - 3.6. The "Lamp-Post Effect"
  - 3.7. Temperature, and relative humidity
  - 3.8. Environmental Tobacco Smoke
  - 3.9. Radon
  - 3.10. Allergens
  - 3.11. Allergens from mites
  - 3.12. Allergens from furry animals
4. Building factors associated with health effects
  - 4.1. Building constructions and materials
    - 4.1.1. Emissions from materials
  - 4.2. Damp buildings
  - 4.3. Ventilation
  - 4.4. Cleaning
5. Economy
6. Future

**Thermal Comfort in Housing and Thermal Environments****326**

Fariborz Haghighat, *Department of Building, Civil and Environmental Engineering, Concordia University, Montreal, Canada*

1. Introduction
2. Thermo-regulatory system
3. Heat balance
  - 3.1. Sensible heat loss
  - 3.2. Evaporative heat loss
  - 3.3. Heat loss by evaporation
  - 3.4. Metabolic rate
4. Global thermal comfort
5. Local thermal comfort
  - 5.1. Radiant asymmetry
  - 5.2. Draught
  - 5.3. Warm or cold floors
  - 5.4. Vertical air temperature difference
6. Thermal comfort predictive models
  - 6.1. Simplified models
  - 6.2. Detailed models
7. Thermal Environment for Elderly and Physically Handicapped Persons
  - 7.1. Physically handicapped persons
  - 7.2. Elderly persons
  - 7.3. Patients
  - 7.4. Other ailments
8. Social-political understanding of the issue

**Solar Heating and Passive Cooling****348**

M. Santamouris, *Group of Building Environmental Studies, Department of Physics, University of Athens, Panepistimioupolis, 157 84, Athens, Greece*

1. Introduction
2. Passive solar heating - recent progress
3. Passive cooling

**Natural, Mechanical and Hybrid Ventilations****361**

H. Yoshino, *Department of Architecture and Building Science, School of Engineering, Tohoku University, Sendai 980-8579, Japan*

F. Haghighat, *Department of Building, Civil and Environmental Engineering, Concordia University, Montreal, Canada*

1. Introduction
2. Mechanisms of airflow
  - 2.1. Natural ventilation
    - 2.1.1. Ventilation due to wind effect
    - 2.1.2. Ventilation due to buoyant effect
  - 2.2. Mechanical ventilation
3. Airtightness and ventilation
4. Ventilation design
  - 4.1. Calculation of ventilation requirement
  - 4.2. Ventilation Airflow Path
5. Ventilation Systems
  - 5.1. Natural ventilation system
    - 5.1.1. Opening area and location of ventilation inlet
    - 5.1.2. Passive ventilation system
  - 5.2. Mechanical ventilation systems



- 5.2.1. Mechanical supply and exhaust system
- 5.2.2. Centralized mechanical exhaust system
- 5.2.3. Central mechanical supply system
- 5.3. Hybrid ventilation systems
- 6. Predictive models
  - 6.1. Thermal buoyancy
  - 6.2. Wind pressure
  - 6.3. Mechanical ventilation systems
  - 6.4. Total pressure
  - 6.5. Flow equation
    - 6.5.1. Small openings
    - 6.5.2. Duct components
    - 6.5.3. Large openings
- 7. Solution methods and airflow network
- 8. Conclusions

**Lighting: Fundamentals, Practice, and Integrated Systems** **384**  
 Gary Steffy, *Gary Steffy Lighting Design Inc. South State, Suite 12, Ann Arbor, Michigan 48104, USA*

- 1. Introduction
- 2. Lighting Practice
  - 2.1. Illuminances
  - 2.2. Luminances
  - 2.3. Color Characteristics
  - 2.4. Power and Energy Budgets
  - 2.5. Initial and Life- cycle Costs
  - 2.6. Maintenance
- 3. Design Approaches
- 4. Daylighting
- 5. Fenestration Control
- 6. Integrating Electric Light
- 7. Architecture
- 8. Lamps
- 9. Current Practice Trends
  - 9.1. Residential settings
  - 9.2. Hospitality settings
  - 9.3. Work settings
  - 9.4. Institutional settings (e.g., schools, hospitals, care homes)
- 10. Future Trends

**Acoustics in the Built Environment** **405**  
 Richard Guy, *Department of Building, Civil and Environmental Engineering, Concordia University, Montreal, Quebec H3G 1M8, Canada*

- 1. Introduction
  - 1.1. Equal Loudness Level Phon and (A) and (C) Weighting
  - 1.2. The dB
  - 1.3. The Sone
  - 1.4. Bandwidths of sound, octave and third octave
  - 1.5. Addition , subtraction and average of dB
- 2. External propagation
  - 2.1. Atmospheric absorption and dispersion
  - 2.2. Velocity of sound with temperature
  - 2.3. Barriers
- 3. Community sources of sound
  - 3.1.  $L_{Aeq}$ , (T),  $L_n$  and  $L_{dn}$

- 3.2. Road traffic, Railway and Aircraft Noise
- 3.3. Occupational noise exposure
- 3.4. Ear protection
- 4. Noise intrusion
  - 4.1. Noise intrusion at the façade
  - 4.2. Sound reduction index
  - 4.3. The simple wall
  - 4.4. The sound transmission class (STC)
  - 4.5. Double leaf walls or panels
  - 4.6. Flanking transmission
  - 4.7. Combination of insulation values
  - 4.8. Floors and Ceilings
- 5. Indoor noise assessment (Background)
  - 5.1. NC & PNC Curves
  - 5.2. RC Curves
- 6. Indoor noise assessment (Quality)
  - 6.1. Reverberation time or liveness
  - 6.2. Early Decay Time
  - 6.3. Running Liveness or Reverberance to Early Sound Ratio
  - 6.4. Speech intelligibility
  - 6.5. Clarity and Center Time
  - 6.6. Lateral Energy Fraction
  - 6.7. Assessment of Acoustic Quality in the Future

**Index** **423**

**About EOLSS** **429**

## VOLUME II

**Culture, Management Strategies, and Policy Issues in the Sustainable Built Environment** **1**  
 Nadia Boschi, *Virginia Polytechnic Institute and State University, USA*

- 1. Introduction
- 2. Culture and its role in sustainable development
  - 2.1. Sustainable development and the built environment
  - 2.2. The social and cultural context of health
  - 2.3. Protecting and promoting health
- 3. Conservation and management of the built environment
  - 3.1. Tools for Management of the Built Environment
  - 3.2. Awareness of the need to preserve
  - 3.3. Public participation
  - 3.4. Economics of preservation
  - 3.5. International support and local practices
- 4. New perspectives for the built environment

**The Built Environment: Economics and Management Strategies** **33**  
 Rocco Curto, *Polytechnic of Turin, Italy*

- 1. Enhancing Architectural and Environmental Assets
- 2. The Economic Strategies for Enhancement
  - 2.1. The Public Strategies
  - 2.2. The Private Strategies
  - 2.3. The Mixed Public-Private Strategies

3. Choosing the Destination in the Conservation of Property of Historical and Architectural Interest
4. Managing the Architectural Property and the Activities
5. The Contribution of Economics and Evaluation

**Built Environment, Health and Ethics of Intervention** **55**  
 Lars Molhave, *Department of Environmental and Occupational Medicine, University of Aarhus, Building 260, Vennelyst Boulevard 6, DK-8000 Aarhus-C, Denmark*  
 Michal Krzyzanowski, *WHO European Centre for Environment and Health, Bilthoven Division, P.O. Box 10, 3730 AA De Bilt, Netherlands*

1. Background
2. Conclusions and recommendations
  - 2.1. Conclusions
  - 2.2. Recommendations
3. Statements on the right to healthy indoor air
  - 3.1. Introduction
  - 3.2. Principles
4. Commentary

**Cultural Conservation in the Built Environment** **68**  
 Gabriella Guarisco, *Architectural Restoration at the Department of Architectural Construction of Politecnico di Milano, Italy*

1. Introduction: keywords in the scientific-philosophical research of the 20th century
2. Alois Riegl and *Der moderne Denkmalkultus* (The modern cult of monuments) (1903)
3. Keywords in the conservation of architectural works
4. Why and what is conserved?
5. Restoration vs Conservation
6. The conservation project
7. Scope of the conservation project
8. State of the art and cultural progress

**Historic Buildings: Conservation, Management and Policy Issues** **87**  
 Livio de Santoli, *Dept. Fisica Tecnica, University La Sapienza of Rome, Italy*

1. Introduction
2. Conservation and restoration in historical buildings
3. Conservation and restoration including exhibition space and transport
4. Registration and documentation for the identification of cultural property
5. Ecological aspects of building maintenance
6. Indoor environment engineering for heritage conservation
7. Strategy for safety in buildings

**Education and New Technologies to Promote Sustainable Built Environments** **112**  
 Nadia Boschi, *Virginia Polytechnic Institute and State University, Department of Building Construction, 1001 Prince Street, Alexandria, VA 22314, USA*

1. Culture, Existing Building and Sustainability
2. A Call for Better Understanding: The case of Moisture Control
3. Indoor Air Sciences Education: A Tool for Achieving Sustainable Built Environments
  - 3.1. Information and Dissemination
  - 3.2. Professional Education
4. A New Context for Graduate Education
  - 4.1. A Shift from the Industrial Economy to a Knowledge Economy

- 4.2. Information Technology a New Possibility
- 5. Learning Models
  - 5.1. An International Network
  - 5.2. Information Technology: Fundamentals of Indoor Air Science at VA Tech
  - 5.3. Integrated Approach: the case of Hunt's Point community in New York City

**Case Studies Evaluation: Toward Development of a Transferable Model** **135**  
 Kennedy Lawson Smith, *Director, National Main Street Center of the National Trust for Historic Preservation, Washington, DC, USA*

- 1. Introduction
- 2. The Main Street Program
- 3. Essential Elements of a Sustainable, Heritage-Focused Community Development Program
- 4. Case Studies
  - 4.1. Port Gibson, Mississippi
  - 4.2. Watsonville, California
  - 4.3. Burlington, Iowa
  - 4.4. Holland, Michigan
  - 4.5. Roslindale Village – Boston, Massachusetts
  - 4.6. Chinatown – Singapore
- 5. Conclusion

**Using Technology to Improve the Quality of City Life** **157**  
 John Hadjinicolaou, *Department of Building, Civil, and Environmental Engineering, Concordia University, Montreal, Canada*

- 1. Introduction
- 2. Environmental Indices and Indicators
  - 2.1. Development of Indices
- 3. Quality of Life
  - 3.1. Defining Quality of Life
  - 3.2. Quality of Life Index
  - 3.3. Quality of Life Indicators
    - 3.3.1. Ecoindicators – Indicators of Urban Sustainability
    - 3.3.2. Community Indicators
- 4. New Technologies and Quality of Life
  - 4.1. Technology and New Technologies
  - 4.2. Using Technology to Improve The Quality of City Life
- 5. Case studies
  - 5.1. Case Study 1: Quality of Life in Ontario (Provincial Report)
  - 5.2. Case study 2: Charlotte Neighborhood Quality of Life Index
  - 5.3. Case study 3: City Quality of Life
- 6. Concluding Remarks

**Monitoring the Quality of Air** **182**  
 Samia Gamati, *Dept. Building, Civil and Environmental Engineering, Concordia University, Canada*

- 1. Introduction
- 2. Air quality monitoring techniques
  - 2.1. Geographic Information System (GIS)
    - 2.1.1. GIS Overview
    - 2.1.2. Transport and dispersion of contaminants
    - 2.1.3. GIS and air quality monitoring
  - 2.2. Satellite-based monitoring
    - 2.2.1. Remote Sensing

- 2.2.2. Measuring and Monitoring of Air Pollution
  - 2.2.2.1. Global Ozone Monitoring Experiment (GOME)
  - 2.2.2.2. Measurement of AIR Pollution by Satellites (MAPS)
  - 2.2.2.3. Stratospheric Aerosol and Gas Experiment (SAGE I, II and III)
  - 2.2.2.4. Halogen Occultation Experiment (HALOE)
  - 2.2.2.5. Measurements of Pollution in the Troposphere (MOPITT)
  - 2.2.2.6. Differential Absorption Lidar (DIAL)
  - 2.2.2.7. Monitoring Motor Vehicle Pollution Through NASA Satellite Technology
- 2.3. Case Study
  - 2.3.1. Global ozone Monitoring Experiment (GOME)
  - 2.3.2. GOME Instrument
  - 2.3.3. GOME Measurements
  - 2.3.4. GOME Data Validation
  - 2.3.5. GOME Observations
    - 2.3.5.1. Ozone monitoring
    - 2.3.5.2. Bromine oxide monitoring
- 3. Conclusion

### **Monitoring of Surface Water Quality**

202

Masaharu Fukue, *Department of Marine Civil Engineering, Tokai University, Orido, Shimizu-ku, Shizuoka, Japan*

Yoshio Sato, *Department of Marine Science, Tokai University, Orido, Shimizu-ku, Shizuoka, Japan*

Catherine N. Mulligan, *Research Chair of Environmental Engineering, Department of Building, Civil and Environmental Engineering, Concordia University, Montreal, Quebec, Canada*

- 1. Introduction
- 2. Summary of monitoring of surface water quality
- 3. Water quality and parameters monitored
  - 3.1. Basic parameters
    - 3.1.1. Water temperature
    - 3.1.2. pH
    - 3.1.3. Conductivity
    - 3.1.4. Dissolved oxygen (DO)
    - 3.1.5. Suspended Solids (SS)
    - 3.1.6. Transparency
  - 3.2. Organic pollution indicators
    - 3.2.1. Biochemical oxygen demand (BOD)
    - 3.2.2. Chemical oxygen demand (COD)
    - 3.2.3. Total organic carbon (TOC)
  - 3.3. Eutrophication indicators
    - 3.3.1. Eutrophication
    - 3.3.2. Nitrogen
    - 3.3.3. Phosphorus
    - 3.3.4. Chlorophyll a
  - 3.4. Acidification indicators and specific ions
  - 3.5. Toxic substances
    - 3.5.1. Trace metals
    - 3.5.2. Organic micropollutants
    - 3.5.3. Other environmental indicators
  - 3.6. Test Kits
- 4. Sampling
  - 4.1. Surface water
  - 4.2. Sediments
  - 4.3. Plankton
  - 4.4. Zoobenthos
- 5. Remote sensing
- 6. Examples of monitoring results

7. Future trends
8. Conclusions

### **Monitoring of Soil and Groundwater Quality**

235

C.N. Mulligan *Department of Building, Civil and Environmental Engineering, Concordia University, Canada*

1. Introduction
  - 1.1. Sampling and monitoring
2. Chemical analyses
  - 2.1. Colorimetric indicator tests
  - 2.2. Fiber optic chemical sensors
  - 2.3. Gas chromatography
  - 2.4. Mass spectrometry
  - 2.5. High pressure liquid chromatography (HPLC)
  - 2.6. Atomic absorption spectroscopy
  - 2.7. Immunoassay
  - 2.8. Infrared spectroscopy
  - 2.9. Laser induced fluorescence
  - 2.10. X-ray fluorescence
3. Geophysical technologies
  - 3.1. Electromagnetometry
  - 3.2. Seismic Reflection/Refraction
  - 3.3. Electrical conductivity/resistivity
  - 3.4. Magnetometry
  - 3.5. Ground penetrating radar
  - 3.6. Cross-well radar
  - 3.7. Natural gamma detection
4. Biomonitoring
5. Conclusions

### **Technologies to Improve Waste Disposal**

262

C. N. Mulligan, *Department of Building, Civil and Environmental Engineering, Concordia University, Canada*

1. Introduction
2. Sources and characteristics of waste
3. Technologies for waste management
  - 3.1. Land disposal
    - 3.1.1. Landfill
    - 3.1.2. Landfarming
    - 3.1.3. Deep well injection
  - 3.2. Incineration
    - 3.2.1. Types of incinerators
    - 3.2.2. Environmental concerns
  - 3.3. Recycling
  - 3.4. Composting
    - 3.4.1. Sewage and MSW composting
    - 3.4.2. Hazardous waste composting
    - 3.4.3. Home composting
  - 3.5. Digestion
    - 3.5.1. Anaerobic digestion
    - 3.5.2. Aerobic digestion
  - 3.6. Physical/chemical treatment
4. Newer developments
  - 4.1. Landfill mining

- 4.2. Landfill bioreactor
5. Future directions
6. Conclusions

### **Ecological Engineering in the Urban Environment**

290

John Hadjinicolaou, *Department of Building, Civil, and Environmental Engineering, Concordia University, Montreal, Canada*

1. Introduction
2. Ecological Engineering or Ecotechnology
  - 2.1. Definitions
  - 2.2. Terminology
  - 2.3. Concepts of Ecological Engineering
3. Ecological Engineering methods, principles, and applications
  - 3.1. Ecological Engineering Methods
  - 3.2. Ecological Engineering Principles
  - 3.3. Applications of Ecological Engineering
  - 3.4. Concerns about future applications of Ecological Engineering
4. Ecological Engineering and the Urban Environment
  - 4.1. The Urban Environment
  - 4.2. Sustainable Urban Development
  - 4.3. Unified strategies
  - 4.4. Methods, Approaches and Techniques of urban ecological engineering
    - 4.4.1. "Process Chains Analysis" in Investigating Ecological Engineering of Cities
    - 4.4.2. The "Eco-City"
    - 4.4.3. Scenario Techniques to Analyse Complex Problems of Ecological Engineering
    - 4.4.4. High Resolution Remote Sensing Methods and GIS Applications
  - 4.5. Towards Integration
5. Case studies
  - 5.1. Case Study 1: Ecological Design of Urban Structures
  - 5.2. Case Study 2: Towards The Environmental City Of The 21<sup>st</sup> Century "*A Blue Print For The Future -The M21 Scenarios*"
6. Concluding remarks

### **Economics of the Transportation System**

318

Kenneth Button, *School of Public Policy, George Mason University, USA*

1. Introduction
2. Transportation Economics
3. Transportation Systems
  - 3.1. Transportation Networks
  - 3.2. Economies of Scale, Scope, Density and Market Presence
  - 3.3. Problems of Congestion in the System
4. Allocating the Costs of the Transportation System
5. Expanding Capacity
6. The Economics of Regulation of the Transportation System
7. Conclusions

### **Intermodal and Multimodal Considerations and Developments**

333

Michael D. Meyer, *School of Civil and Environmental Engineering, Georgia Institute of Technology, USA*

1. Introduction
2. Transportation Modes
3. A Multimodal Perspective of the Transportation System

- 3.1. Transportation Infrastructure and Service Strategies
- 3.2. Influencing the Demand for Transportation
- 3.3. Linking Land Use and Transportation
- 4. Intermodal Considerations
  - 4.1. Intermodalism: Focus On Connections
  - 4.2. Intermodalism: Focus On Efficiency and Productivity
- 5. Future Issues and Challenges
- 6. Conclusions

**Transportation System Organization, Management, and Interoperability** **346**  
 Michael D. Meyer, *School of Civil and Environmental Engineering, Georgia Institute of Technology, USA*

- 1. Introduction
- 2. Transportation System Organization
- 3. Transportation System Management
  - 3.1. Coordination of the Construction, Operation and Preservation of Transportation Facilities and Services
    - 3.1.1. Coordinating the Construction Program
    - 3.1.2. Coordinating System Operations
    - 3.1.3. Coordinating System Preservation
  - 3.2. Managing the Demand for Transportation
  - 3.3. Linking Land Use and Transportation System Investment
- 4. Interoperability of Transportation Design and Operations
- 5. Future Issues and Challenges
- 6. Conclusions

**The Air Transportation System in the 21st Century** **365**  
 Thomas E. Nissalke, *Hartsfield International Airport, Atlanta, USA*

- 1. Introduction
- 2. Overview of the Air Transportation System
  - 2.1. Airports
  - 2.2. Air Traffic Control Systems
  - 2.3. Airplanes
  - 2.4. Airlines
- 3. Impacts of the Air Transportation System
  - 3.1. Economic/land use impacts
  - 3.2. Noise Impacts
  - 3.3. Air Emissions
  - 3.4. Ecological Impacts
- 4. Future Issues
- 5. Conclusions

**Intelligent Transportation Systems** **386**  
 Billy M. Williams, *School of Civil and Environmental Engineering, Georgia Institute of Technology, USA*

- 1. Introduction
- 2. ITS Defined
- 3. History of ITS Applications in the World
  - 3.1. History of European Applications
  - 3.2. History of Asian Applications
  - 3.3. History of North American Applications
- 4. A National Architecture for ITS Applications
  - 4.1. ITS Applications for Multimodal System Management



- 4.2. ITS Applications for Freight Movement
- 4.3. ITS Applications for Traveler Information
- 5. Future Issues
- 6. Conclusions

<b>Index</b>	<b>405</b>
<b>About EOLSS</b>	<b>411</b>