

Design Science and Innovation

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Pranab Kumar Nag

Office Buildings

Health, Safety and Environment

 Springer

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*Dedicated to my ~88-year-old mother, and
in fond memory of my father.*

Preface

Office, the word stems from the Latin officium, has been transformed today to an organizational space—an entity of organizational symbolism, denoting spatial environment in which humans perform work, physical environment in and around an organization, and built environment referred to as architecture and urban locale. Relentless urbanization and anthropogenic activities and unprecedented growth of population base in office and other building typologies raise interest among public authorities, owners, and facility managers to make the infrastructure facility eco-friendly, human-friendly, and energy-friendly. In recognition of this need, from all allied academic and professional disciplines, source materials on building facilities have been researched and knowledge base developed, in order to create office buildings for effective human use. The underlying premise is to achieve a healthy office environment in which the surroundings contribute to productivity, comfort, and a sense of health and well-being of the occupants. Failure to respond effectively to the primary issues can raise negative publicity about the building.

This book, *Office Buildings: Health, Safety and Environment*, is an outcome of the author's years of interdisciplinary comprehension relating to an office building (non-industrial, non-residential), indoor workplace, and environmental assessment. The document is a convergence of the knowledge base of building science, environmental science, behavioural and health sciences, bringing insights of solution-oriented concepts applicable to buildings, and objective assessment encapsulating occupants' perspectives. The focus has been placed on the green building concepts for its sustainability to the future needs, since the building stocks today virtually bulldozed the natural resources and are responsible for emitting one-third of the total greenhouse gas emissions.

Sustainability of buildings can be achieved through a multi-pronged approach involving the adoption of bioclimatic architectural principles and energy-efficient building systems, and more importantly, addressing occupants' expectations and requirements. The effort has gone into conceptualizing and optimizing the content of the book, incorporating assimilated ideas, findings, and experiences of contemporary researchers and international agencies. Literature search strategy included electronic searching of databases, such as ScienceDirect, PubMed, Google

Scholar, and Sage as well as manually searching key-relevant journals, proceedings, standards on building design and assessment, indoor environment quality, ergonomics, health, building-related regulatory standards, energy codes, and guidelines. Source materials that were published, approximately since 1990, were scrutinized, culled, compiled, and embodied herewith, with reference to the strength and consistency of evidence on the specific domain. In other words, studies with well-designed experiments, observational studies, controlled intervention studies, and statistical validity were considered most persuasive in selecting the body of the materials. Simple narratives were grossly omitted, unless they offered specific information of value. Many proprietary documents on building assessment schemes were included despite their usual brevity in the public domain. Lists of software and simulation tools on the assessment of bioclimate, ventilation, air quality, lighting, and energy consumption were compiled for ready reference to the readers. In order to make this book understandable to a broad audience, as expected in the multi-disciplinary composition of materials, potentially unfamiliar numerical and statistical methodologies have generally been avoided.

In spite of mushrooming of skyscrapers in our cities and towns, the vast majority of building facilities continue to be of smaller and medium dimensions that are operated through small- and medium-level construction agencies and developers. These operators may not be well privileged to undergo elaborate monitoring, evaluation, and accreditation due to their lack of resources as well as knowledge constraints. I hope that this book may serve as a handy reference to students and professionals in building design, architecture, urban biophysics, environmental health, and ergonomics and an inspiration to reinvigorate the zeal of professionals and policymakers to innovate our building concepts and practices.

Major part of the book was done during my tenure at the Ramakrishna Mission Vivekananda University. I express my deep gratitude to Swami Atmapriyananda, Vice Chancellor of the university, for extending kind support, and thus making possible the project to come to fruition. Apart from my own passionate commitment to the publisher, the single most important influence on the book has been that of my wife, Anjali, who displayed enviable patience with pulsating outbursts and remained an active intellectual partner in keeping me focused at trying times. A special note of thanks is owed to my students (Jayshree Sen and Tandra Mondal) for their whole-hearted involvement in preparing illustrations, and checking the body of texts and references. Thanks are due to my students, Dr. Varsha Chourashia, Dr. Kishore Madwani, and Dr. J. B. Vyas, and my colleagues from Regional Occupational Health Centre, Bangalore, namely Dr. Ravichandran and Dr. Raghavan, for helping me with critical source materials that were included herewith. I am indebted to the entire team of Springer for their untiring effort in making this publication possible.

How This Book Is Organized

This book is divided into six topics, identified as Part I to VI. Part I: *Office and Office Space* marks introductory concept of office and office space (Chap. 1) and associated spatial and behavioural attributes in office design (Chap. 2), directed towards all users of the book. Part II: *Building and Office Work-Related Illness* primarily addresses the health issues of building occupants, namely sick building syndrome and other illnesses arising from the conditions of the indoor environment (Chap. 3), and contemporary office menace of work-related musculoskeletal disorders that manifest in epidemic proportions among office goers (Chap. 4). Part III: *Office Ergonomics* brings the discussion on the fundamentals of ergonomics in relation to work design in the offices (Chap. 5) and objective ergonomics analysis of computer workstation users (Chap. 6). Strategic requirements and guidance of office lighting and visual performance in office work (Chaps. 7 and 8) are directed for better application of ergonomics at offices and improving working conditions.

Part IV: *Building Bioclimate—Indoor Environment Quality* is directed to all building stakeholders to take cognizance of the risk factors of indoor environmental quality, with emphasis on bioclimatic (thermal environment) building design (Chap. 9), in-depth knowledge and understanding of the characteristics of IEQ (Chap. 10), international acceptance of guidelines in assessing IEQ performance in buildings (Chap. 11), and the likely panacea of remedial to indoor air quality through ventilation intervention in office buildings (Chap. 12). An IEQ index is essentially a profile of building conditions from the perspective of primary bioclimatic, air quality, lighting, and acoustic characteristics. Assessment guidelines will help professionals to reveal potential indoor environmental issues and identify building areas that require special attention to prevent problems in the future.

Part V: *Building Energy Systems—Standards and Codes* focuses on the energy performance of buildings, with reference to a variety of lighting systems applied in offices (Chap. 13), and national and international building-related energy standards and codes (Chap. 14). Part VI: *Green Office Building* brings contemporary perspectives in building sustainability, embodying many proprietary assessment schemes (Chap. 15) practised globally, and exploring category, criteria, and credit rating of buildings (Chap. 16).

Some structured checklists and questionnaires for building post-occupancy evaluation and assessment of health and safety issues are included, for readers to know what type of information can be collected. Building professionals are welcome to reproduce the questionnaires for use or modify elements to reflect conditions in a particular building project; however, any modification may require a thorough understanding of the interacting factors. Some guidance points were moved up and down from basic principles to practical hints, within a chapter and across chapters. This approach was intentional to allow easy flow of information for readers to comprehend the subject matter effectively and use in suitable intervention

in building projects. Communication between building management and building occupants is a critical element in innovating building concepts and practices to the stated objectives. Aspiring that if even a tiny portion of the composition is found to be useful to those concerned in creating a sustainable building, the author will feel gratified and well repaid of his labour.

Kolkata, India

Pranab Kumar Nag, Ph.D., D.Sc.

Contents

Part I Office and Office Space

1	The Concept of Office and Office Space	3
	Concept of Office	3
	The Emergence of Office Building	4
	Evolution of Office Workspace Design	8
	Open Office Planning	11
	Knowledge Work	12
	Collaborative Work	14
	Office Design and Architectural Implications	16
	References	23
2	Spatial and Behavioural Attributes in Office Design	29
	Introduction	29
	Spatial Characteristics of Workplace	30
	Psychosocial Constructs of Work Environment	36
	Innovative and Collaborative Workplaces	40
	Questionnaire for Workplace and Workspace Analysis	42
	References	46

Part II Building and Office Work-Related Illness

3	Sick Building Syndrome and Other Building-Related Illnesses	53
	Introduction	53
	Questionnaire Survey	54
	SBS Epidemiology	56
	Gender Difference in SBS	62
	Chronic Fatigue Syndrome	63
	Environmental Stressors Associated with SBS	65
	Fungi in Buildings and Health Impacts	70
	Quantitation of Fungi	72

Fungi and Respiratory Symptoms	74
Mycotoxins and SBS	75
Fungal VOCs and SBS	76
Respiratory Illness in Buildings	77
Asthma and Asthma-Like Disorders	77
Other Office Environment Exposures	83
Airborne Transmission of Pathogens	84
SBS: Intervention and Management	85
Building Ventilation—Health Relationships	86
Ventilation and Pathogen Infection Control	89
Preventing Infection by Sunlight	90
References	91
4 Musculoskeletal Disorders: Office Menace	105
Introduction	105
Nerve-Related Disorders	107
Tendon-Related Disorders	110
Bursa-Related Disorders	112
Circulatory Disorders	113
Muscle-Related Disorders	115
References	125
Part III Office Ergonomics	
5 Fundamentals of Office Ergonomics	129
Introduction	129
A Brief Note on Ergonomics	130
Systems Approach	135
Risk Factors in Computer Work	138
Ergonomics Survey at Workplaces	140
References	146
6 Ergonomics of Computer Workstation	149
Introduction	149
Biomechanics of Sitting	150
Kinematics: Sitting Posture	152
Kinetics: Stress and Strain in the Spine	153
Ergonomics in Seat Design	154
Balans Chairs	159
Human–Seat–Desk Interface (HSDI) Analysis	160
Placement of Desktop and Laptop Computers	165
Keyboard Design	167

Keyboard Inclination	170
Placement of Keyboard and Mouse	171
Forearm and Wrist Support	173
Scheduling Rest Breaks in Computer Work	175
References	177
7 Strategic Office Lighting	183
Introduction	183
Lighting Design Criteria	184
Luminance Distribution	185
Illuminance and Maintained Illuminance	185
Directionality	190
Energy Efficiency Requirements	190
Visual Comfort Indices	192
Daylighting	192
Building Openings for Good Daylighting	196
Colour in an Office Environment	197
Colour Preference	197
Assessment Methodology	198
Colour Rendering: Metrics and Indices	199
Discomfort Glare in Office Interiors	202
Assessing Glare	203
References	209
8 Visual Performance in Office	215
Introduction	215
Lighting Conditions and Performance	216
Questionnaire Survey	219
Lighting Regulation for VDT	221
Computer Vision Syndrome	223
Ocular Factors of CVS	223
Guidance on Illuminance Levels	226
References	237
Part IV Building Bioclimate—Indoor Environment Quality	
9 Bioclimatic Approach: Thermal Environment	243
Introduction	243
Bioclimatic Building Design	243
Environmental Warmth and Human Comfort	245
Types of Human Thermal Indices	247
Direct Indices	248

Rational Indices	251
Thermal Perception Index	255
Adaptive Thermal Comfort Standards	257
Simulation Models in Evaluating Building Microclimate	261
Heat Island	264
Wind Comfort	265
Green Roof	267
References	269
10 Characteristics of Indoor Environmental Quality	279
Introduction	279
Sources of Indoor Air Pollutants	280
IEQ Measurement	280
Indoor Contaminant Sources	281
VOCs and Potential Health Effects	288
Standards and Guidelines	296
IAQ Management—Green Building Ratings	302
References	305
11 Assessing IEQ Performance in Buildings	311
Introduction	311
IEQ Criteria and Energy Performance of Buildings	314
Design Input Criteria	315
Issues of Concern	323
The Emergence of IEQ Model	324
Potential of IEQ Models	327
IEQ: Occupants' Performance and Productivity	329
Pollution Control	332
References	335
12 Ventilation in Office Buildings	341
Introduction	341
Natural Ventilation Effects	341
Natural Ventilation Systems	342
Good Practices of Natural Ventilation	344
Ventilation: Mechanical (HVAC System)	346
Ventilation and Airflow Distribution Systems	350
Ventilation Codes and Standards	352
Ventilation Design Recommendations	354
Comparison of the Air Distribution Systems	359
Recommended Levels of Air Change	360
Ventilation Design and Analysis Tools	362
References	363

Part V Building Energy Systems—Standards and Codes

13 Lighting Systems 371

 Introduction 371

 Selecting Light Sources 371

 Fluorescent and Compact Fluorescent Lamps 373

 Halogen Lamps 376

 Halogen Metal Halide Lamps 376

 Mercury and Sodium Discharge Lamps 377

 Induction Lamps 377

 LEDs 377

 Energy Conservation in Lighting 378

 Lighting Controls 378

 Selection and Arrangement of Luminaires 380

 Emergency Lighting 381

 Lighting Standards and Codes 382

 Categories of Standards 384

 Energy and Lighting Software 391

 References 400

14 Energy Performance in Buildings: Standards and Codes 405

 The Magnitude of Energy Consumption 405

 Energy-Related Building Code 406

 Energy-Efficient Product Development 409

 ANSI/ASHRAE/IES 90.1:2016 409

 Compliance with Building Code 412

 ANSI/ASHRAE/IES 90.1—Compliance Evaluation 412

 EN 15193—Energy Requirements for Lighting 423

 Energy Transfer—Building Envelope 424

 ISO 50001:2011, Energy Management Systems 425

 ISO EN 13790:2008—Energy Calculation for Space Heating
 and Cooling 425

 References 430

Part VI Green Office Building

15 Green Building and Assessment Systems 435

 Introduction 435

 Elements of Green Building 436

 Indices of Green Building 439

 Disability and Accessibility Issues 443

 Green Building Incentives 443

 Building Environmental Assessment Systems 445

 BREEAM 447

LEED	449
CASBEE	450
HQE (Haute Qualité Environnementale)—France	452
DGNB	453
Green Star	456
Green Globes	457
LEnSE (Label for Environmental, Social and Economic Buildings)	458
Environmental (Total 400 Points)	459
Eu Ecolabel	461
GPP Criteria	462
SBTOOL	463
References	472
16 Building Sustainability: Credit Rating Criteria	477
Introduction	477
Sustainability Construct	478
CEN/TC 350—Sustainability of Construction Works	480
Environmental Indicators (CEN/TC 350)	481
Social Indicators (CEN/TC 350)	482
BREEAM—Quantitative Valuation	482
References	503
Author Index	507
Subject Index	521

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