# CONTENT

**CHAPTER 1. FOUNDATIONS AND STANDARDS OF DIGITAL INFRASTRUCTURE IN CONSTRUCTION** ..... 107
1.1. Introduction. BIM Standards, Guidelines, and Regulatory Frameworks ..... 107
1.2. Architecture of Digital Infrastructure in Construction Projects ..... 107
BIM Maturity Levels: From Fragmented Data to Integrated Delivery ..... 111
BIM Dimensions: Expanding the Scope of Digital Construction ..... 112
Level of Development (LOD): A Structured Path to Model Maturity ..... 114
From LOD to LOIN: Defining the Level of Information in BIM ..... 118
1.3. Data as a Lifecycle Asset: From Design to Decommissioning ..... 120
Data in BIM: Fundamentals ..... 120
Types and Formats of Data in BIM ..... 121
Data Across the Lifecycle ..... 125
1.4. Integrating Smart Systems into BIM: IoT, SCADA, and BMS Synergies ..... 130
Internet of Things (IoT): The Foundation of Smart Infrastructure ..... 130
SCADA Systems in BIM Workflows: Toward Real-Time Operational Intelligence ..... 132
The Role of BMS in BIM-Enriched Environments ..... 135
Digital Twins for Real-Time Asset Management ..... 140

**CHAPTER 2. SMART SYSTEMS, CLOUD WORKFLOWS, AND COLLABORATION IN BIM** ..... 143
2.1. Cloud-Based BIM Platforms and Connected Workflows ..... 143
Cloud-BIM Approaches for Data Flow Integration ..... 144
Cloud-based BIM: Challenges, Advantages and Mitigation Strategies ..... 145
2.2. BIM Information Models and Environments: PIM, AIM, CDE, and BEP Explained ..... 148
The Role of the Common Data Environment (CDE) and BIM Execution Plan (BEP) in Digital Construction Workflows ..... 149
Bridging Design, Construction, and Operation through Information Models ..... 153
2.3. Role Definition in BIM Teams: Ensuring Collaboration and Accountability ..... 154
BIM Manager ..... 155
BIM Coordinator ..... 156
BIM Specialist (Author, Modeler) ..... 157

**CHAPTER 3. DIGITAL PLATFORMS IN BIM ENVIRONMENTS** ..... 160
3.1. BIM Tools overview ..... 160
3.2. BIM applications ..... 160
3.2.1. Authoring Tools ..... 160
3.2.2. Coordination (Checking) Tools ..... 166
3.2.3. Construction & Field Tools ..... 169
3.3 Collaboration Platforms ..... 174
3.4 Data Structure and Management Tools ..... 176

**CHAPTER 4. DATA EXCHANGE AND INTEROPERABILITY** ..... 178
4.1. Exchange formats overview ..... 178
4.2. Data formats ..... 178
4.2.1 Industry Foundation Classes (IFC) ..... 178
4.2.2 BIM Collaboration Format (BCF) ..... 181
4.2.3 Construction Operations Building Information Exchange (COBie) ..... 182
4.2.4 Data Sheets and Product Data Templates (PDTs) ..... 182
4.2.5 Semantic services ..... 183
4.3 Methodologies and specifications for information exchange ..... 185
4.3.1. Information Delivery Manual (IDM) ..... 185
4.3.2. Model View Definitions (MVDs) ..... 185
4.3.3. Information Delivery Specification (IDS) ..... 186
4.3.4. Software certification ..... 189

GLOSSARY ..... 191

СПИСОК ВИКОРИСТАНОЇ ЛІТЕРАТУРИ ..... 191

REFERENCES ..... 197