

Contents

Chapter 1: Interoperability between BIM Applications 1

1.1 Interoperability: Ability to Exchange Data between Applications..... 2

1.1.1 Platform-to-tool Data Exchange..... 2

1.1.2 Tool-to-tool Data Exchange..... 3

1.1.3 Platform-to-platform Data Exchange..... 3

1.2 Common Exchange Formats in AEC Applications..... 4

1.2.1 Image (Raster) Formats..... 4

1.2.2 2D Vector Formats 4

1.2.3 3D Surface and Shape Formats..... 4

1.2.4 3D Object Exchange Formats..... 5

1.3 ISO – STEP in Building Construction..... 6

1.4 BuildingSMART and IFC..... 6

1.5 Industry Foundation Class (IFC)..... 7

1.6 What BIM Information is Exchanged	9
1.7 Conclusion	11
Chapter 2: Principles of Project Organization	13
2.1 Composition of data	14
2.2 Commissioned contract vs. project.....	14
2.3 Drawings and plans.....	15
2.4 Projections and levels.....	16
2.5 Specialization	18
2.6 Construction works	20
2.7 Versions, variants and revisions.....	22
2.7.1 Version	22
2.7.2 Revisions	23
2.7.3 Variants.....	23
2.8 Conclusion.....	23
Chapter 3: BIM Development in a BIM Immature Industry	25
3.1 Introduction.....	26
3.2 BIM Maturity	26
3.2.1 Bew-Richards BIM Maturity Model.....	27
3.2.2 Succar's Stages of Maturity.....	28
3.2.3 Integrated Design and Delivery Solutions	29
3.3 BIM Maturity Assessment Framework	31

3.3.1 Collaborative Processes.....	31
3.3.2 Enhanced Skills.....	32
3.3.3 Integrated Information and Automated Systems	33
3.3.4 Knowledge Management.....	33
3.4 Conclusions.....	35
Chapter 4: Process Modeling for BIM Execution Plan and Information Delivery Manual.....	37
4.1 Current State in Process Modeling for BIM.....	38
4.2 Process modeling languages in BIM Project Execution Plan.....	38
4.2.1 BIM Overview Map.....	40
4.2.2 BIM Use Maps.....	42
4.3 Process modeling for Information Delivery Manual.....	42
4.3.1 Process Maps within Information Delivery Manuals	42
4.3.2 Common Problems with Process Maps in Information Delivery Manuals.....	45
4.4 Conclusions.....	45
Chapter 5: BIM Monetary Benefits Evaluation.....	47
5.1 BIM adoption.....	48
5.1.1 Contractors’perceived ROI	48
5.1.2 New technology implementation.....	48
5.1.3 Dynamic model of the productivity	50
5.2 ROI assessment for BIM implementation	52

5.2.1 Introduction to ROI calculation	52
5.2.2 ROI calculation case	52
5.2.3 Additional improvements regarding BIM implementation	55
Chapter 6: BIM and Web Services: Overview of Web Protocols	57
6.1 Web Services	59
6.1.1 Architecture and Protocols.....	60
6.2 Simple Object Access Protocol (SOAP).....	60
6.3 Representational State Transfer (REST).....	61
6.4 Modern RPC Protocols and Frameworks.....	62
6.4.1 Apache Thrift.....	63
6.4.2 Protocol Buffers (protobuf, PB).....	65
6.4.3 Apache Avro.....	65
6.4.4 GraphQL.....	65
6.5 Current Use of Web Protocols in BIM	66
6.5.1 BIM Collaboration Format (BCF) and BCF REST API	66
6.5.2 BIM Service Interface Exchange (BIMSie).....	67
6.6 Conclusion	67
References.....	69