National BIM Standard - United States®
an initiative of the National Institute of Building Sciences buildingSMARTalliance®

National BIM Standard - United States® Version 3

3 Terms and Definitions

CONTENTS

3.1 Scope of Terms and Definitions

This section of NBIMS-US™ Version 3 provides a core glossary for a BIM vocabulary. It includes concepts defined in previous versions of NBIMS-US™, V1 and V2, as well as additional concepts that have been approved through the Version 3 consensus process. Unless otherwise stated, definitions assume a general context of Building Information Modeling, and/or Building Information Management, encompassing all stakeholders and lifecycle phases.

The glossary is not exhaustive. Source information has been added for most definitions in this edition of NBIMS-US™ Terms and Definitions to assist users to explore concepts in greater depth. In some cases, definitions have been refined from those given in previous versions of NBIMS-US™. Concepts, and terms used in machine interpretable languages and schemas (e.g. used within IFC, COBie, etc.) and specialized terms that apply in the context of specific sections of NBIMS-US™ V3 are not included here. These application specific terms require the user to explore NBIMS-US™ sections and other source materials for definitions. For example, please refer to the glossary terms from IFC4x4 that appear in Subsection 3 of the Exchange Requirements chapters.

The NBIMS-US™ terms and definitions core glossary will continue to evolve as the use of BIM becomes more ubiquitous in managing the life cycle of the built environment. Users are encouraged to suggest terms for inclusion in future glossary editions or comment on existing definitions to the NBIMS-US Terminology Subcommittee at www.nationalbimstandard.org/comment.

3.2 Additional items

All terms and definitions from NBIMS-US™ Version 1 and Version 2 as well as new terms have been extensively reviewed and approved by NBIMS-US Project Committee.

3.3 Terms and definitions

NBIMS-US™ V1 and V2 glossaries included Organizations, Digital Formats and Citations. The NBIMS-US Terminology Subcommittee separated these items into three lists and they have been included as terms and entities that are self-defined. For the purposes of this document, the following terms and definitions apply.

3.3.1
organizations and selected programs
various organizations and programs cited by authors and used as supportive documentation.

3.3.2
XML and digital formats
various digital formats cited by authors used in the AECOO industry.

3.3.3
citations
referenced standards and publications cited by authors.

3.4 Glossary

3.4.1 Terms

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Building Information Modeling, Model or Management [BIM3 (cubed)]	BIM is a term which represents three separate but linked functions: Building Information Modeling: Is a BUSINESS PROCESS for generating and leveraging building data to design, construct and operate the building during its lifecycle. BIM allows all stakeholders to have access to the same information at the same time through interoperability between technology platforms. Building Information Model: Is the DIGITAL REPRESENTATION of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life cycle from inception onwards. Building Information Management: Is the ORGANIZATION & CONTROL of the business process by utilizing the information in the digital prototype to effect the sharing of information over the entire lifecycle of an asset. The benefits include centralized and visual communication, early exploration of options, sustainability, efficient design, integration of disciplines, site control, as built documentation, etc.– effectively developing an asset lifecycle process and model from conception to final retirement.	http://www.buildingsmart.org/resources/terms-and-definitions
Association	In context of Business Process Modeling, an association is a named relationship between two or more objects. It can be symbolized by a line and an arrowhead to indicate the direction of flow (where appropriate). See BIM Project Execution Planning Guide for more detail.	http://bim.psu.edu/
Attribute	1. In general, attributes represent the characteristics of objects. E.g. Attributes defined by a building element class may be Name, Length, Weight, Price, etc. The attribute values of a specific building element of a specific building may be Name = 'Wall-123', Length=6500.0, Weight=7300, etc. 2. In EXPRESS, (See Standards Section - EXPRESS) an attribute of an entity type has a name and data type, and they represent characteristics of an entity type and relationships between entity types.	The buildingSMART Glossary of Terms

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Authoritative Source	An information source considered the authority for that type of information, It is usually managed by an association that has as its charter sustaining that data.	
BIM Best Practice	BIM techniques, methods, and processes that provide consistent results superior to those achieved by other means.	See John Messner' s PDF file
BIM Deliverables	Information (a package of data or models in numerous formats) to be provided to another party in connection with a BIM-related service over the facility's life-cycle.	http://bim.psu.edu/ Penn State University BIM Execution Planning Guide Glossary.
BIM Goals	Objectives used to define and prioritize the potential conflicting values of BIM within a facility or organization.	http://www.oprtool.org/
BIM Implementation	1. The management of work processes and software tools to produce required project information. 2. In BIM software development, the incorporation of features in software, or the form those features take in the software. 3. In an IFC context, an application's capability to create, use, import, and export IFC Project data.	
BIM Life-Cycle Views	The various perspectives of BIM held depending upon facility phase, facility element, AECOO discipline, and Level of Development. These different views often create unneeded semantic conflict while well-defined and accepted terms for all phases could be achieved.	TBD
BIM Process Map	A diagram showing how BIM will be applied on a project. The BIM project execution plan proposes two levels of process maps: BIM overview map and detailed BIM use process maps that define associated activities and information exchanges.	2009, Messner, John I., Planning the BIM Execution Process, The Pennsylvania State University
BIM Project Execution Plan (BIM PxP Plan)	The plan that results from the BIM Project Execution Planning Procedure. The plan describes how BIM will be implemented and which goals or BIM Uses will be pursued.	2010, Project Execution Planning Guide, V2.0
BIM Project Execution Planning Procedure (PxP Procedure)	An approved NBIMS-US™ process for planning the execution of BIM on a project. It consists of four primary steps: 1) identify BIM Goals and BIM Uses, 2) design BIM Project Execution Process, 3) develop Information Exchanges, 4) define supporting infrastructure for BIM	http://buildinginformationmanagement.wordpress.com/2012/05/17/national-bim-standard-united-states-nbims-us-version-2-v2-released-may-2012/

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
	Implementation. Guidelines and templates make these Planning and Design life cycle processes reusable.	or http://www.nationalbimstandard.org/
BIM Use	A method of applying building information modeling during a facility's life-cycle to achieve one or more specific objectives. May also be referred to as a BIM "Use Case".	2013, March 19 - http://prezi.com/inbum61b3ljt/copy-of-copy-of-bim-use-ontology /, 2010, Project Execution Planning Guide, V2.0
Bit preservation	A baseline preservation approach that ensures the integrity of digital objects and associated metadata over time in their original form, even as the physical storage media which houses them evolves and changes.	National Digital Stewardship Alliance, NDSA Glossary, 2013
Business process	Documented organizational workflows and activities accomplished in some order via open and interoperable information exchange standards and associated technology in support of facility lifecycle management. See Business Process Modeling Notation and Information Delivery Manuals in Standards.	As revised using, http://www.wbdg.org/pdfs/NBIMSv1_p1 . Pdf , pg. 13, http://www.wbdg.org/pdfs/NBIMSv1_p1 .pdf See Figure 2.1-4 on page 21,
Business Rules (BR)	Business rules formally describe an organization's policies and procedures by connecting specific conditions to specific actions. In BIM Modeling, Business rules are appended to static concepts to provide context specific rules for how the concept must be applied.	http://www.brcommunity.com/sbvr_introduction.php also see Halls' http://www.omg.org/news/meetings/tc/mn/special-events/br/Hall-BR.pdf
Change Management	Change Management is a consulting methodology used to modify an organization's business processes and/or its social - technical systems. There are many types of Change Management strategies, having evolved from the so called "Business Re-engineering" movement, the Total Quality Management movement, and Information Technology initiatives. Typically, if a business process is found to be flawed by auditors, or in need of improvement, a "root cause analysis" of the problem is attempted, and then adjusts the business process based on the resulting models	BIG BIM, little bim: Understand the cultural changes implicit in moving to BIM - http://www.amazon.com/BIG-BIM-little-bim-Edition/dp/0979569923 ; The Whole Building Design Guide has a document - http://www.wbdg.org/pdfs/integratebim_harris.pdf
Characteristic (property)	BIM is about Objects such as Walls, Doors, Windows, and other physical things that have parameters (properties) such as height, relative location, component parts, that are important to downstream decisions. (Object -Concepts that cannot be defined using other concepts; meaning is provided through a description). Characteristics can be categorized into the following property types (in alphabetic order): behavior, environmental influence, function, measure, property, and unit. (See	http://docs.buildingsmartalliance.org/MVD_COBIE/.

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
	also Property) - IFC - MVD relies upon "characteristics"	
Classification	Systematic (hierarchical, networked, or faceted) arrangement of Objects or Processes in groups or categories according to established criteria within a specific domain. Problems may arise, such in AECOO - when multiple domains use classification systems without attention to harmonization of terms into a consistent and complete framework or ontology.	Miriam-Webster
Completeness	In information management, a measure of the degree to which an information package satisfies a specified requirement for subject matter, quantity, semantics, logical, and related qualities explicitly requested. (See Quality Assurance process and performance within Software Engineering disciplines - McConnell's Construx.com for example).	NISTIR 7417 page 76
Component	Within the broader context of buildings or physical infrastructure: 1: A building element which uses industrial products that are manufactured as independent until capable of being joined with other elements. (Harris) 2: any subsystem, subassembly, or other system designed for use in (or integral with) a structure or part of a structure, which can include electrical, fire protection, mechanical, plumbing, and structural systems and other systems affecting health and safety. (NEC 545.3) 3. In Software and Ontology engineering, a module or smart object that is designed to be re-used. See Component Assembly Mechanisms in OASIS.	David Webber - OASIS http://docs.oasis-open.org/cam/v1.1/os/OASIS-CAM-Specification-1_1-015-060107.html
Concept	As defined in the building smart Data Dictionary (bSDD), Concept is an idea about an object described both by a set of names and definitions in multiple languages and also by relating ideas to each other (See bsDD).	http://www.ifd-library.org/index.php?title=Main_Page
Constraint	In BIM planning, one or more owner or regulatory performance requirements that must be coherently achieved over the facility life cycle. See Trade Off Analysis.	http://www.oprtool.org/ for a NIBS Study, and the MIT Trade space Analysis at http://web.mit.edu/professional/short-programs/courses/tradespace_exploration_system_design.html
Construction Delivery Method	See Project Delivery Method	
Context	A context, in IFD, is a grouping of relationships that exists between concepts	http://www.iso.org/iso/catalogue_detail.htm?csnumber=55691 ($250 US?)

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
	which drives analysis and assessment.	
Coordinate Systems	A facility exists or is planned to exist in a space represented by 3 geospatial coordinates: Longitude, Latitude, and Altitude. The position of facility components in 3D modeling software exist as a point, line, or plane from a known location (0,0,0), represented in x, y, and z coordinates.	2012, http://whatis.techtarget.com/definition/coordinates OGC and Spatial relationships - see http://www.opengeospatial.org/
Cost - Avoidance, (Interoperability)	According to a NIST study (NISTR 7417), the categories of costs that are typically incurred to minimize technical, software, and/or data interoperability problems. For example the lack of using an information management strategy .	http://fire.nist.gov/bfrlpubs/build07/PDF/b07015.pdf
Cost of Organizing Information, Information Cost	The cost incurred to obtain the information and make it available for use. For example cost of acquiring information about prices, quantities and qualities of items, products, and/or services. Also more broadly to include the costs of information that falls into the category of documentation.	Adapted from 2012, http://www.linfo.org/information.html
Cost Schedule	A time frame for the tracking of project cost elements, at the detailed line unit cost level, following standard project specifications.	See PSU's PxP for general formats. Consider PIM for specifics - http://www.wbdg.org/pdfs/jbim_spring11.pdf
Data	Raw factual bits of unprocessed information. Can be structured, but as an aggregate, has no more meaning than the individual facts alone convey.	http://www.diffen.com/difference/Data_vs_Information
Data Exchange	The process of taking data structured under a source schema to transform and restructure into a target schema, so the target data are an accurate representation of the source data within specified requirements and minimal loss of content. ISO 16739 specifies a conceptual data schema and an exchange file format for Building Information Modeling BIM data. The conceptual schema is defined in EXPRESS data specification language (EXPRESS) as specified in ISO 10303-11. ISO 16739 represents an open international standard for BIM data that is exchanged and shared among software applications used by the various participants in a building construction or facility management project. ISO 16739 consists of the data schema, represented as an EXPRESS schema specification, and reference data, represented as definitions of properties and quantities.	2010, BIM Project Execution Guide V2.0 ISO 16739, ISO 10303-11, ISO 16739 ($175) http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=51622

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Data Models	In software engineering, the term data model is used in two related senses: 1) a description of the objects represented by a computer system together with their properties and relationships; these are typically "real world" objects such as buildings, walls, windows, spaces, suppliers, customers, and orders. 2) a database model, means a collection of concepts and rules used in defining data models: for example the relational model uses relations and tuples, while the network model uses records, sets, and fields. IFC is a Data Model. http://www.buildingsmart.org/standards/ifc	http://www.buildingsmart.org/standards/ifc . and http://en.wikipedia.org/wiki/Data_model
Data object	A description of the objects represented by a computer system together with their properties and relationships; these are typically "real world" objects such as products, suppliers, customers, and orders. In the second sense, covered by the article database model, it means a collection of concepts and rules used in defining data models: for example the relational model uses relations and tuples, while the network model uses records, sets, and fields mechanisms to show how data is required or produced by activities. They are connected to activities through associations. See Document Object Model (Standards)	http://www.w3.org/TR/DOM-Level-3-Core/introduction.html
Data Richness (Complexity)	In BIM, a measure of the data content of a model; it's suitability for a particular BIM use. Related to Level of Development (LOD) and the BIM Context (often geospatial factors)	http://www.opengeospatial.org/domain/built
de facto standards	Formats, methods, or thresholds that may have originated from any source, but have been made publicly available and are supported by multiple vendors and products. See also De Jure standards.	Adapted from NBIMS-US™ V2
de jure standards	Standards maintained by an official standards organization, such as International Organization for Standardization (ISO) or International Telecommunications Union (ITU).	NBIMS-US™ V2
Design-Bid-Build	A project delivey method which involves owner, architect, and contractor in three phases of work accomplished in a linear sequence: The owner contracts with an architect for design, then employs documents produced by the architect to secure competitive bids from contractors, and then, based on an accepted bid, contracts with the contractor for construction of the building.	The Architect's Handbook of Professional Practice, 13 ed. page 49

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Design-Build	A project delivery method in which the owner contracts with a single entity-the design-builder-with an early cost commitment during design development.	The Architect's Handbook of Professional Practice, 13 ed. page 50
Detailed BIM Use Process Maps	A comprehensive BIM process map that defines the various sequences to perform a specific application of BIM or BIM use. These maps also identify the responsible parties for each process, reference information content, and the information exchanges, which will be created and shared with other processes.	5.3 BIM Project Exec Planning Guide
Digital Rights Management (DRM)	A system for authorizing the viewing or playback of copyrighted material on a user's computer or digital music player. Examples include copyrighted music and with Apple's FairPlay and Microsoft's Windows Digital Rights Manager being the two predominant DRM systems.	Refined from Version 1 - http://www.wbdg.org/pdfs/NBIMSv1_p1.pdf
Disciplines	Practice areas and specialties of the actors (participants) that carry out the processes and procedures that occur during the life cycle of a construction entity.	OmniClass Table 33 (Disciplines)
Element	A major component, assembly, or construction entity part which, in itself or in combination with other parts, fulfills a predominating function of a construction entity. See IFC and MVD use of term.	http://docs.buildingsmartalliance.org/MVD_COBIE/ .
Early Design	1. In the context of a BIM Execution Plan, the identification of project performance and BIM goals, and the types of information that team members will require and have available in order to achieve those goals; typically includes development of specific methods for generating the quantity, quality, and format of information needed to make informed, intelligent and timely decisions. 2. A buildingSMART International (bSI) project AR-9, pursuant to providing IFC capabilities to support early design processes in concert with bSI projects PM-3 and FM-9; integrated into IFC2x2 addendum 1 (Release July 2004).	1. As revised from Open Geospatial Consortium http://zeroemissiondesign.com/uploads/BPEA_Final_Demo_Presentation.pdf 2. http://www.buildingsmart-tech.org/future-extensions/ifc_extension_projects/completed/ar-5-early-design-1
Exchange Requirement (ER)	A non-technical description of the information needed by a business process to be executed, as well as the information produced by that business process.	NISTIR 7417 page 76

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Exchange Requirements Model (ERM)	The data model addressing requirements for a single industry process is known as an Exchange Requirements Model (ERM).	http://www.slideshare.net/manuvenugopal/ontologybased-approach-for-bim-exchanges
Facility	A structure (such as a hospital or fire department) that is built, installed, or established to serve a particular purpose	Merriam-Webster
Facility Management (FM)	1. A profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology. 2. Integration of processes within an organization to maintain and develop the agreed services which support and improve the effectiveness of its primary activities.* *Taken from EN 15221-1 October 2006 (English version).	http://www.ifma.org/know-base/browse/what-is-fm-
Floor (Story)	An enclosed horizontal division of a building characterized by structural surface capable of supporting loads imposed upon it by occupants. It is sometimes referred to as a "story". See also "Interstitial Space".	5.4.3.3 Ifc Building Storey in http://docs.buildingsmartalliance.org/MVD_COBIE/
Formal Registry	Identifies all file formats stored in an archive and their properties, and automates the assignment of preservation strategies. Sometimes combined with a Repository of reusable model elements as a solution to very large data models. XML repositories are being replaced by ontology repositories in some domains.	http://www.w3.org/wiki/Ontology_repositories
Functional Part (FP)	A unit of information within an exchange requirement that may be fully described and modeled in its own right.	As adapted from NBIMS-US™ V2
Gateway	In process mapping, a gateway is used to control the divergence and convergence of sequence flows. A gateway can also be seen as equivalent to a decision in conventional flowcharting.	BIM Project Execution Plan
Geospatial Information Systems (GIS)	A geographic(al) information system (GIS) captures, stores, analyzes and manages data and associated attributes which are spatially referenced to the Earth. In the strictest sense an information system capable of integrating, storing, editing, analyzing, sharing and displaying geographically-referenced information. A building and each of its elements has GIS references - in 3 planes. Thus the increasingly large interest in improving BIM - GIS linkages. The OGC works closely with buildingSMART alliance® - NIBS in the BIGie project.	http://www.nibs.org/?page=buildingSMART alliance_gisbimie

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Group	In BIM process mapping, a group represents a category of information. This type of grouping does not affect the sequence flow of the activities within the group. The category name appears on the diagram as the group label. Groups can be used for documentation or analysis purposes.	NBIMS-US™ V2 or 4.11 Group Assignment a http://docs.buildingsmartalliance.org/MVD_COBIE/
Handover Plan	A documented process that results in providing an information quality management framework that describes the information handover in terms of scope, contents, constraints, coding, timing, and procedures. Part of a BIM implementation or execution plan.	Adapted from NBIMS-US™ - V2
Harmonization	Comparison and normalization of two or more similar standards including issues such as scope, specifications, guidance or implementation.	Adapted from NBIMS-US™ - V1
IFC Certification Procedure (IFC 4x4)**	Certification testing is a process for testing software's conformance with a given IFC release specification and its subsets, defined as views. The aim of the certification testing is to promote quality in IFC implementations and demonstrate to end-users that the software passing the certification implements the IFC specification in a consistent way, hence being able to exchange IFC product data with other certified software unambiguously. The buildingSMART IFC Software Certification procedure is intended to promote consistent and reliable implementations of the IFC specification by many software vendors across multiple software applications. The consistency aimed at by the certification program will help drive rapid evaluation, deployment and acceptance of the IFC standard for the exchange and sharing of Building Information Models. In 2010 buildingSMART developed the new IFC Certification 2.0 procedure to significantly improve quality assurance and service to participating software companies. It cancels and replaces the old IFC Certification 1.0 procedure that had been used 2001-2010.	http://www.buildingsmart-tech.org/certification/details
Implementation Plan	The alignment of work processes and software tools to produce and deliver the required handover information. Can apply to BIM implementation within a single organization, or across multiple organizations.	Adapted from NBIMS-US™ V2
Information	Data that has been interpreted, translated, or transformed to reveal the underlying	The buildingSMART Glossary of Terms

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
	meaning. See also: data	
Information Accuracy	How close the information or information model is to an actual or planned result and associated requirements. Factors impacting accuracy include the level of detail and the level of precision expected at different phases of the BIM Facility Life Cycle. The "build it first digitally" approach requires a very complete and very precise model for all systems included before the project enters physical construction. Information accuracy is developed during the design of project becoming more specific.	Adapted from National BIM Standard - United States™ Version 2 ; See Also GSA http://www.gsa.gov/graphics/pbs/BIM_Guide_Series_02_v096.pdf
Information assurance (IA)	The practice of managing information-related risks. More specifically, IA practitioners seek to protect the confidentiality, integrity and availability of data and their delivery systems. These goals are relevant whether the data are in storage, processing, or transit and whether threatened by malice or accident. In other words, IA is the process of ensuring that the right people get the right information at the right time.	NBIMS-US™ V1 (per column F)
Information Delivery Manual (IDM)	A standard for processes specified when certain types of information are required during the construction of a project or the operation of a built asset. It also provides detailed specification of the information that a particular user (such as, architect or building services engineer) needs to provide at a point in time and groups together information that is needed in associated activities: cost estimating, volume of materials and job scheduling are natural partners. (See BPMN, Event, Gateway, IFC, Lane, Pool). Term originally developed by the Norwegian buildingSMART organization.	As revised from NBIMS-US™ V1, NBIMS-US™ V2
Information Exchange (IE)	Packages of information passed from one party to another in a BIM process, or the act of passing such information. Can be a deliverable. Parties involved agree upon and understand what information content and format will be exchanged.	As revised, NBIMS-US™ V2
Information Packages	Facility information required to be delivered at each phase and step in the BIM Life Cycle.	http://www.wbdg.org/pdfs/NBIMSv1_p1.pdf Figure 5.2-8, page 102
Information Quality (IQ)	Information quality (IQ) is a term to describe the contents of information systems. Pragmatically defined as: "The fitness of the information provided for its intended use"	Wikipedia; Since COBie and BIM are designed to define what data is needed where, review https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=10&ved=0CHUQFjAJ&url=http%3A%2F%2Fprojects.buildingsmartalliance.org%2Ffiles%2

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
		F%3Fartifact_id%3D3866&ei=G-TVUfOsG4OCiwKy6oHoBQ&usg=AFQjCNEHnobiM1CKbickJwJDtJFJKKfOKA&sig2=B2Ittzx5xZFu4CDZxKLfTg&bvm=bv.48705608,d.cGE
Information Technology Infrastructure Library (See also SOA) (ITIL)	The Information Technology Infrastructure Library (ITIL) is a set of practices for IT service management (ITSM) that focuses on aligning IT services with the needs of business. ITIL underpins ISO/IEC 20000 (previously BS15000), the International Service Management Standard for IT service management, although differences between the two frameworks do exist. ITIL describes processes, procedures, tasks and checklists that are not organization-specific, used by an organization for establishing integration with the organization's strategy, delivering value and maintaining a minimum level of competency. It allows the organization to establish a baseline from which it can plan, implement, and measure. It is used to demonstrate compliance and to measure improvement. The acronym ITIL is a registered trademark of the United Kingdom's Cabinet Office.	ITIL Process Maps - http://en.it-processmaps.com/products/itil-process-map.html
Information Value-Chain	An effort to visualize the reduction of waste by using IDM or similar documenting tools, an organization's complex and linked internal and external workflows are made explicit. By understanding the factors behind waste and eliminating them, greater profit, lower cost, and higher customer satisfaction will result. See Lean Workflow	http://www.informationvaluechain.com/
Integrated Project Delivery (IPD)	Integrated Project Delivery (IPD) is a collaborative project delivery approach that utilizes the talents and insights of all project participants through all phases of design and construction.	AIA
Internet Protocols	Methods by which data are sent from one computer to another on the Internet.	http://www.w3.org/People/Frystyk/thesis/TcpIp.html
Interoperability	Interoperability is the ability of diverse systems and organizations to work together (inter-operate). The term is often used in a technical systems engineering sense, or alternatively in a broad sense, taking into account social, political, and organizational factors that impact system to system performance.	Wikipedia - See AIA http://network.aia.org/TechnologyinArchitecturalPractice/Home/BIMStandards
Interoperability Costs	Avoidable costs incurred when information technology management problems due to lack of communication/consistency prevent timely completion of a project or extend the length of time a facility is not in normal operation. A NIST Report (GSR 04-867)	http://fire.nist.gov/bfrlpubs/build04/PDF/b04022.pdF , Aug. 2004; and 2007, General Buildings Information Handover Guide: Principles, Methodology and Case Studies, pg.8

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
	estimates that over $15.8 Billion dollars are wasted each year because of inadequate information management.	
Lane (Swim Lane)	A way to graph the sequence of activities in a "Pool" of related workflows. Both physical as well as data flows within and between departments.	See OMG's BPMN Standard, or http://www.visual-paradigm.com/product/lz/tutorials/bpmn2.jsp
Lean Construction	A production management-based approach to project delivery applied to BIM design and delivery, The performance of the planning and control systems are studied, measured and improved.	http://www.leanconstruction.org/
Level of Development[1]	Level of Development is the degree to which the element's geometry and attached information have been thought through—the degree to which project team members may rely on the information when using the model.	BIMForum "2013 Level of Development Specification", Part 3.1
Level of Precision	The closeness of agreement within individual results.	http://www.colorado.edu/geography/gcraft/notes/error/error.html
Life-cycle Assessment (LCA)	1. A compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. 2. A tool used to understand the energy use, other environmental impacts, and costs associated with all life cycle phases of the building: procurement, construction, operation, and decommissioning. Its use requires a set of guiding principles, which consider the unique character of each "building" design, complexity in defining systems, and related decisions.	1. International Standard ISO 14040. 2. Adapted from AIA Guide to Building Life Cycle Assessment in Practice, 2010.
Life-cycle Costs (LCC)	The sum of the present value of investment costs, capital costs, installation costs, energy costs, operating costs, maintenance costs, and disposal costs, over the lifetime of the product, product, or measure	Sustainable Federal Facilities: A Guide to Integrating Value Engineering, Life-Cycle Costing, and Sustainable Development. Washington, DC: The National Academies Press, 2001.

[1] The Level of Development Definitions for LODs 100, 200, 300, 400, and 500 are produced and copyrighted by the American Institute of Architects as part of AIA Contract Document G202™–2013, Building Information Modeling Protocol Form. The American Institute of Architects reserves all rights. The definition for LOD 350 was developed by the BIMForum working group. Copyright © 2013. The BIMForum and the American Institute of Architects. All rights reserved. AIA has licensed the use of the AIA Level of Development Definitions for their inclusion in the NBIMS-US™. Any additional use requires AIA's prior written permission and is not covered by any license granted by NIBS.

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Life-cycle Stages (LCA)	Four (4) areas considered as components of life-cycle assessment (LCA): 1) Materials Manufacturing: Removal of raw materials from earth, transportation of materials to the manufacturing locations, manufacture of finished or intermediate materials, building product fabrication, and packaging and distribution of building products 2) Construction: All activities relating to the actual building project construction 3) Use and Maintenance: Building operation including energy consumption, water usage, environmental waste generation, repair and replacement of building assemblies and systems, and transport and equipment use for repair and replacement 4) End of Life: Includes energy consumed and waste produced due to building demolition and disposal of materials to landfills, and transport of waste materials. Recycling and reuse activities related to demolition waste also can be included and have a "negative impact."	AIA Guide to Building Life Cycle Assessment in Practice, 2010
Meta Model	A meta-model is an explicit UML Diagram of the constructs and rules needed to build specific models within a domain of interest. A meta-model can be viewed from three different perspectives: • as a set of building blocks and rules used to build models & ontologies • as a model of a domain of interest, (modules for distributed ontologies) and • as an instance of another model and this where the model views come into play	http://espace.library.uq.edu.au/eserv/uq:72501/Object_management_group_ontology.pdf
Metadata, Administrative	Data necessary to allow a repository to manage information objects, such as when, how and by whom a resource was created and how it can be accessed. Elements in administrative metadata can overlap with technical and preservation metadata because it shares the same purposes, i.e., to make the resources accessible in the future. Sometimes technical and preservation metadata are also added as administrative metadata.	http://www.library.illinois.edu/dcc/bestpractices/chapter_12_administrativemetadata.html
Metadata, Structural	Data indicating how compound information objects are put together. Example: how pages are ordered to form chapters.	http://www.niso.org/publications/press/UnderstandingMetadata.pdf Understanding Metadata: Page 3

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
		National Information Standards Organization
Mitigation Costs	Costs of activities responding to interoperability problems, including scrapped materials costs.	http://fire.nist.gov/bfrlpubs/build07/PDF/b07015.pdf
Model View Definition (MVD)	A specification for data exchange. All the myriad data included in a Building information model (BIM), must be broken down into discrete packages to facilitate information exchange between the different parties involved in design, construction, and operation of a facility. These packages are specified by Model View Definitions (MVD's). The optimal specification ties the data terms back to the overarching IFC model. From a technical process perspective a MVD defines a subset of the IFC schema that is needed to satisfy one or many "Exchange Requirements" and provides implementation guidance (or implementation agreements) for all IFC concepts (classes, attributes, relationships, property sets, quantity definitions, etc.) used within this subset. It thereby represents the software requirement specification for the implementation of an IFC interface to satisfy the exchange requirements. Model View Definitions are either defined within buildingSMART International, or by other organizations and interest groups. MVD's defined externally are not considered as buildingSMART MVD's until they are submitted to buildingSMART International, reviewed by the buildingSMART teams and finally accepted.	http://www.buildingsmart-tech.org/specifications/mvd-overview
Model View Definition MVD	An IFC View Definition, or Model View Definition, MVD, defines a subset of the IFC schema that is needed to satisfy one or many Exchange Requirements of the AEC industry. The method used and propagated by buildingSMART to define such Exchange Requirements is the Information Delivery Manual, IDM (also ISO/DIS 29481). An IFC Model View Definition defines a legal subset of the IFC Schema (being complete) and provides implementation guidance (or implementation agreements) for the IFC concepts (classes, attributes, relationships, property sets, quantity definitions, etc.) used within this subset. It thereby represents the software requirement specification for the implementation of an IFC interface to satisfy the exchange requirements.	http://www.buildingsmart.org/standards/mvd

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Object	A collection of data, behaviors, and attributes or properties that is handled in computer applications (and by users) as a single unit with relationships to other objects. May refer either a class or an instance of a class.	buildingSMART Glossary of terms (revised for use here), buildingSMART International.
Ontology	In computer science and information science, an ontology is a formal data model that represents a domain (such as Architecture or Engineering or Construction or Facilities Management) and is used to reason about the specialized objects in that domain, the relations between them, and then make inferences and conclusions.	http://ontolog.cim3.net/OntologySummit/2013/communique.html
Overview Map	A high-level BIM process map that illustrates the relationship between BIM uses which will be employed on the Facility. Each of the BIM Uses then gets its own lower level Process Map. See also Process Guidance Map in Penn State PxP Guides and NBIMS-US™ V2	http://www.omg.org/spec/BPMN/2.0/PDF / http://www.nationalbimstandard.org/
Owner/Architect/Engineer/Contractor/Operations (OAEC or A/E/C/O or AEC or AECOO)	Acronyms used to describe, as a group, the principal actors/stakeholders during a facility's life cycles.	NBIMS-US™ V1
Owner's Performance Requirements Tool (OPR) Tool	Developed and managed by the National Institute of Building Sciences in partnership with the Department of Homeland Security/Science and Technology Directorate to help building owners identify priorities and prepare a performance plan for a project by selecting targets for each of the attributes identified as comprising high performance by the Energy Independence and Security Act of 2007 (EISA). The OPR Tool, establishes a performance-based plan for the owner to provide to the design team at the beginning of project programming. The OPR Tool allows the owner to develop several scenarios for a project to help select the optimal combination of performance levels for Energy, Environmental, Safety, Security (including Blast, Ballistic and CBR protection), Sustainability, Durability, Operational and Cost Effectiveness attributes to meet their needs. In this way, the Owner can communicate goals for multiple project objectives to the design team allowing for performance based design instead of prescriptive solutions.	http://oprtool.org/about.aspx
Owner's Project Requirements OPR	Owner's written documentation of the functional requirements of the "facility" and the expectations of how it will be used and operated. They include project and design goals, budgets, limitations, schedules,	Adapted from ASHRAE GPC-1, 2001.

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
	owner directives and supporting information. They include necessary information for all disciplines to properly plan, design, construct, operate, and maintain systems and assemblies. Associated with each objective or requirement in the OPR are one or more performance metrics or criteria	
Pool	In context of IDM, the symbol representing an entire BIM use or process. This symbol simply "contains" a number of swim lanes within which specific departments or actors perform tasks and exchange data as required.	NBIMS-US™ V2, PxP diagram; or BPMN section from OMG
Practice Guidelines	BIM Practice guidelines are content and diagrams that aid a project team or organization in the DESIGN of IT requirements needed to effectively implement the information exchange standards of IFC, IDM, MVD, and BSDD for their specific project. At any point in time the team may consider BEST Practice guidelines as abstracted from successful case studies (for example, Chapter 9 sections in the BIM Handbook, 2011).	NBIMS-US™ V2 - Practices sections http://www.nationalbimstandard.org/
Precision	In BIM parameter estimating, the accuracy [1] of a measurement system is the degree of closeness of measurements of a quantity to that quantity's actual (true) value. The precision [1] of a measurement system, also called reproducibility or repeatability, is the degree to which repeated measurements under unchanged conditions show the same results.[2] Although the two words precision and accuracy can be synonymous in colloquial use, they are deliberately contrasted in the context of the scientific method. A measurement system can be accurate but not precise, precise but not accurate, neither, or both.	https://en.wikipedia.org/wiki/Accuracy_and_precision
Product	Component or assembly of components intended for permanent incorporation into a physical facility or digital entity.	Page 103, Figure 5.2-9 http://www.wbdg.org/pdfs/NBIMSv1_p1.pdf
Property	See Characteristic	
Reliability	1. Quantitatively, The probability that the system or component will perform its intended function for a specified period under stated conditions. Period can be measured in cycles of use or duration. 2. Qualitatively, a measure of aggregated accuracy, certainty, and precision that	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CDEQFjAA&url=http%3A%2F%2Fwww.everyspec.com%2FUSN%2FNAVSEA%2Fdownload.php%3Fspec%3DNAVSHIPS_0900-002-3000_1964.045819.pdf&ei=vmyiUe7fA8S8iwKenIHIAQ&usg=AFQjCNEe5CuFMcvXNtu0Q8PWCnKyKHRBGg&sig2=6v8fg1tGNpvOSXdbxyvF2Q&bvm=bv.4700

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
	may be assumed of a unit of information.	8514,d.cGE (Warning: This an 800 page pdf. It appears to have been scanned, but is searchable)
Roadmap	The overall implementation strategy document used to set the definition, direction, sequence and usually milestones for an initiative. For example, the FIATECH Capital Facilities Technology Roadmap at http://www.fiatech.org/projects/roadmap/cptri.htm.	NBIMS-US™ V1 Figures 2.1-4; 2.2-2' 5.2-9
Role	A position charged by contract or job description with certain authorities and responsibilities during the life cycle of a construction project; may be filled by an individual or an organization. Examples include: Owner, Construction Manager, and Operating Engineer.	OmniClass Table 34 = Roles; 33 (Organizational Disciplines), V1 Refined http://www.omniclass.org/
Schema	A formalized model for structuring information.	See sections 5,6,& 7 - http://docs.buildingsmartalliance.org/MVD_COBIE/
Semantic Interoperability	The ability of computer systems to transmit data with unambiguous, shared meaning. A requirement to enable machine computable logic, inferencing, knowledge discovery, and data federation between information systems. Semantic interoperability is therefore concerned not just with the packaging of data (syntax), but the simultaneous transmission of the meaning with the data (semantics). This is accomplished by adding data about the data (metadata), linking each data element to a controlled, shared vocabulary. The meaning of the data is transmitted with the data itself, in one self-describing "information package" that is independent of any information system. It is this shared vocabulary, and its associated links to an ontology, which provides the foundation and capability of machine interpretation, inferencing, and logic.	http://en.wikipedia.org/wiki/Semantic_interoperability
Sequence Flow	In a process mapping, a connecting object that shows the order in which activities are performed. A Sequence Flow is represented with a solid graphical line. Each Flow has only one source and only one target. A Sequence Flow can cross the boundaries between Lanes of a Pool but cannot cross the boundaries of a Pool. (See: Lane, Pool)	http://glossary.businessprocessincubator.com/index.php/8219/sequence-flow Business Process Model and Notation specification 2.0

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Service Life	The expected serviceable lifetime, or the acceptable period of use of a product. It is the time that any manufactured item can be expected to be 'serviceable' or supported by its manufacturer.	http://en.wikipedia.org/wiki/Service_life
Space	Basic unit of the built environment delineated by physical or abstract boundaries and characterized by function. A part of the built environment that is marked off in some way. It is usually a component forming a larger, more significant construction entity. An abstract architectural concept.	http://www.omniclass.org/tables/OmniClass_13_2006-03-28.pdf Page 2
Spatial Program Validation (SPV)	An open IFC-based BIM information exchange that enables designers and building owners to assess the performance of a building design in satisfying spatial program requirements defined by the owner of the building.	http://www.nationalbimstandard.org/nbims-us-v2/pdf/NBIMS-US2_c4.3.pdf Page 1: Introduction
Specification	1: An explicit set of requirements to be satisfied by a material, design, product, or service. Often abbreviated "spec". 2: A formal comprehensive document outlining requirements for a particular product or process. In a construction context, Specifications in North America form part of the contract documents that accompany and govern the construction of a building. The guiding master document is the latest edition of MasterFormat. It is a consensus document that is jointly sponsored by two professional organizations: Construction Specifications Canada and Construction Specifications Institute.	http://en.wikipedia.org/wiki/Specification
Standard Practice	Techniques, methods and processes that are commonly and typically used by reasonably qualified practitioners in their field.	See NBIMS-US™ V2
Structural Metadata	See: Metadata, Structural	
Structured Information Form	Data in a structured form that are machine-interpretable without human intervention.	IBM Watson and Apple's SIRI of interest http://www-03.ibm.com/innovation/us/watson/
Syntax	When referring to a programming language or command, a set of rules that are associated with the language or command. When referring to an error, a syntax error is an error that is encountered when the programmer or individual who wrote the code has not followed the rules of the language, causing the program to fail.	computerhope.com

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Syntax Validation	A process to define and verify the arrangement, parameters, and values in a data set conform to specified requirements.	NBIMS-US™ V2
System	1. Generally, a combination of smaller components organized to function as a whole, 2. Applied to the built environment, the primary elements which together define the shape, utility, and comfort of a built environment, typically classified by discipline, and/or major component such as Architectural, Structural, Mechanical, and Electrical, or HVAC, Roofing, Fire Protection, etc.	http://140.194.76.129/publications/design-guides/DG_1110-3-122_sec/DG_1110-3-122_Sections/c-5.pdf
Taxonomy	One of several ways to organize the structure of topics and subtopics for the purpose of retrieval and information exchange. A taxonomy is a tree structure with one root and several branches having unique and common properties. An example is IFC hierarchy, with the controlled vocabulary of floors, walls, etc.. The alternative to a hierarchy is a network structure.	Page 48 - http://www.wbdg.org/pdfs/NBIMSv1_p1.pdf
Thesaurus	1. Another way to organize the hierarchical structure of topics and subtopics. A Thesaurus is different from a Taxonomy in that topics are defined, their synonyms are defined, and an effort is often made to show the kinds of relationships between terms. A Taxonomy may be combined with a Thesaurus to create a Taxo-Thesaurus, as the World Bank has done to make document management more accurate and less expensive. Commitments may be made to use a specific controlled vocabulary or ontology for a domain of interest. 2. A way of organizing subject matter. Differs from a Taxonomy in that topics are grouped with their synonyms or references and these groupings ordered a in non-hierarchical way by name of the topic, rather than being organized as topics and sub-topics in conceptually related groupings. May be combined with a Taxonomy to create a Taxo-Thesaurus. The World Bank has created such a system.	http://ontolog.cim3.net/cgi-bin/wiki.pl?OntologTaxoThesaurus#nidNXZ (Denise Bedford, World Bank, R Smith, Tall Tree Labs)

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Type	A generic term, synonymous with Category or "Class" dealing with distinctly different kinds of things. In context of Information Technology, Information Architecture, and Object Oriented Programming, a Type has more specific features. See OASIS Standard for Darwin Information TYPING Architecture for an example of how NBIMS-US™ data and types of information might be architected. http://docs.oasis-open.org/dita/v1.2/spec/DITA1.2-spec.html	buildingSMART Glossary of Terms
Unstructured Information Form	Information is data recorded in some Form (Document or Display). Unstructured Information is Data that cannot be readily machine interpreted. Data, in context of BIM, is said to exist in one of two forms: Structured Data or Unstructured Data. The distinction is usually made on the basis of "Machine Readability". "Unstructured Information Form" is data that's traditionally been thought of as non-machine (computer) readable. However, recent technology development by IBM (See Watson vs. Jeopardy), Apple (See Siri), and others (Kayvium) strongly indicate that this distinction is disappearing in specific sectors as information tools for reading and interpreting massive amounts of unstructured text evolve and are commercialized for trustworthy use in construction law, environmental case law, construction liability and similar knowledge bases.	http://www-03.ibm.com/press/us/en/pressrelease/7822.wss
Usability	1: capable of being used by target users to achieve their goals and the metrics for evaluating the design and execution process (See Usability Testing). 2: convenient and practicable for use to achieve the observable results specified in some contract requiring explicit effectiveness, efficiency, or other performance criteria.	http://www.merriam-webster.com/dictionary/usability and http://www.usability.gov/basics/index.html
Validation	A process for certifying the specified quality of a work product. The process of ensuring a work product or a process conforms to defined user needs, industry requirements, and specifications by following a system of quality assurance or testing a statistically relevant set of samples. See BIM Validators at http://www.nationalbimstandard.org/nbims-us-v2/pdf/NBIMS-US2_c4.5.pdf	http://www.merriam-webster.com/dictionary/validate
Validator	A validator is a computer program used to check the validity or syntactical correctness of a fragment of code or document. The term is commonly used in the context of validating HTML, CSS and XML documents or RSS feeds though it	http://en.wikipedia.org/wiki/Validator

TERM (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
	can be used for any defined format or language. See http://www.nationalbimstandard.org/nbims-us-v2/pdf/NBIMS-US2_c4.5.pdf	

END of TERMS

3.4.2 Cited standards

CITED STANDARD (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
AGC Guide to BIM	An early effort to frame the role of BIM across all project sizes and disciplines.	http://www.tpm.com/wp-content/uploads/2013/02/AGC_Guide_to_BIM.pdf
Business Enterprise Architecture (BEA)	The DoD's effort to frame a formal process for information delivery based upon Service Oriented Architecture (SOA) and distributed object oriented modeling. It is now in its 10th version	http://dcmo.defense.gov/products-and-services/business-enterprise-architecture/10.0/classic/index.htm
Business Process Execution Language (BPEL)	Business Process Execution Language (BPEL), short for Web Services Business Process Execution Language (WS-BPEL) is an OASIS standard executable language for specifying actions within business processes with web services. Processes in BPEL export and import information by using web service interfaces exclusively.	http://docs.oasis-open.org/wsbpel/2.0/wsbpel-v2.0.pdf
Business Process Modeling Notation (BPMN)	Business Process Modeling Notation (BPMN) has been adopted by buildingSMART alliance® for all IDM (Information Delivery Manual) functions. It is a method of illustrating business processes in the form of a diagram similar to a flowchart. BPMN was originally conceived and developed by the Business Process Management Initiative (BPMI). It is currently maintained by the Object Management Group (OMG). BPMN provides a standard, easy-to-read way to define and analyze public and private business processes. BPMN provides a standard notation that is readily understandable by management personnel, analysts and developers. The original intent of BPMN was to help bridge communication gaps that often exist between the various departments within an organization or enterprise. BPMN can also help to ensure that XML (Extensible Markup Language) documents designed for the execution of diverse business processes can be visualized with a common notation.	http://www.bpmn.org/

CITED STANDARD (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Capability Maturity Model (aka Minimum BIM) (CMM)	The Capability Maturity Model (CMM) is a registered service mark of Carnegie Mellon University (CMU) that formalizes Dept. of Defense Software Engineering practices levels. The term "maturity" relates to the degree of formality and optimization of processes, from ad hoc practices, to formally defined steps, to managed result metrics, to active optimization of the processes. It has since been applied more generically to various technology and business processes, including BIM. Also referred to as "BIM Capability Stages" - The basic ability to perform a task, deliver a service or generate a product. The major milestones to be achieved by teams and organizations as they adopt BIM technologies and concepts, and defined by their minimum requirements.	Succar, Bilal - Handbook of Research on Building Information Modeling and Construction Informatics: Concepts and Technologies, Building Information Modelling Maturity Matrix (chapter), Also - 2013, - http://en.wikipedia.org/wiki/Capability_Maturity_Model
Capital Facilities Information Handover Guide	A report published by NIST in 2006. The first part of two related publications. See also "The General Building Information Handover Guide: Principles, Methodology and Case Studies"	http://kfa-inc.com/kfa12/capital-facilities-
CIMSteel Integration Standard Release 2: Second Edition (CIS2)	Published by The Steel Construction Institute CIMsteel Integration Standards (CIS/2.1), a set of formal computing specifications that allow software vendors to make the engineering applications mutually compatible. See also: http://www.cis2.org/	COST is US $100 – at https://www.aisc.org/store/p-2017-cimsteel-integration-standards-release-2-overview.aspx
Construction Operations Building information exchange (COBie)	COBie is an information exchange specification for the life-cycle capture and delivery of information needed by facility managers. COBie can be viewed in design, construction, and maintenance software as well as in simple spreadsheets. This versatility allows COBie to be used on all projects regardless of size and technological sophistication.	http://www.nibs.org/?page=buildingSMART alliance_cobie

CITED STANDARD (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Data Dictionary-International Framework for Dictionaries (bsDD)	IFD-International Framework for Dictionaries The IFD (ISO 12006-3) standard is developed by ISOTC59/SC 13/WG 6. The IFD standard has many similarities with the EPISTLE4 standard for the Oil and Gas industry. While the IFC standard describes objects, how they are connected, and how the information should be exchanged and stored, the IFD standard uniquely describe what the objects are, and what parts, properties, units and values they have. IFD provides the dictionary, the definitions of concepts, the common understanding necessary for the communication to flow smoothly	http://dev.ifd-library.org/index.php/Ifd:buildingSMART_and_IFD
EXPRESSS (data modeling language)	EXPRESS is a standard data modeling language for product data. EXPRESS is formalized in the ISO Standard for the Exchange of Product model STEP (ISO 10303), and standardized as ISO 10303-11. EXPRESS data model can be defined in two ways, graphically and textually. EXPRESS-G is an iconic language that provides a subset of the lexical modeling capabilities; this is defined in Annex D of ISO 10303-11:1994. EXPRESS-I is another member of the family and is designed for the display of data instances and the specification of abstract test cases. For formal verification and as input for tools such as SDAI the textural representation within an ASCII file is the most important one. The graphical representation on the other hand is often more suitable for human use such as explanation and tutorials. The graphical representation, called EXPRESS-G, is not able to represent call details that can be formulated in textural form.	http://deslab.mit.edu/DesignLab/dicpm/step.html
Global Unique Identifier (GUID)	Unique identification number generated and assigned by a computer.	http://en.wikipedia.org/wiki/Globally_Unique_Identifier
GSA's National 3D-4D-BIM Guidance Program	In 2003, GSA's PBS Office of the Chief Architect (OCA) established the National 3D-4D-BIM Program. The primary goal of the program is to promote the value-added implementation of BIM technologies on design and modernization of Federal projects. BIM is primarily used during preliminary and final concept design to make design information explicit and gain process efficiencies. All major projects that receive design funding in FY2007 and beyond are required to submit a spatial program BIM to GSA prior to final concept presentation. In addition the implementation of various additional BIM technologies above the minimum requirements are encouraged and supported on a project-by-project basis and through an open and collaborative process.	http://www.gsa.gov/portal/content/1022 76

CITED STANDARD (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Industry Foundation Class (IFC)	A neutral and open specification for object-based data models developed by buildingSMART to facilitate interoperability in the building industry. Version 2x3 is In common use for exchange of BIM information by many BIM applications. Version 4 was released for implementation in 2013.	
International Code Council Code Compliance Checking	The objective of the International Code Council (ICC) automated code compliance checking (AC cubed) project (the project) is to develop a format for SMARTcodes and implement an approach to use SMARTcodes to automate code compliance checking using the ICC International Codes and Federal, state and local amendments and additions to those codes. As most all government agencies with authority to regulated building design and construction and use the ICC codes, the availability of ICC SMARTcodes can have significant impacts on US construction, in addition to opening up opportunities to better support building safety efforts in other countries.	http://www.iccsafe.org
International Framework for Dictionaries (IFD)	Former name of the buildingSMART Data Dictionary (bSDD). See entry for the buildingSMART Data Dictionary. Definition edited by bkl20136.06.26	http://dev.ifd-library.org
ISO 4157-1 Construction drawings -- Designation systems **-- Part 1: Buildings and parts of buildings**	This part of ISO 4157 specifies requirements for designation systems and a designation code for buildings, including spaces, building elements and components. (ISO 4157-1:1988)	http://www.iso.org/iso/catalogue_detail.htm?csnumber=26189
ISO 4157-2 Construction drawings -- Designation systems **-- Part 2: Room names and numbers**	This part of ISO 4157 specifies requirements for designation systems for rooms, areas, spaces, and voids in buildings by room names and numbers. It is intended for identification of rooms in the daily use of the buildings. For identification of rooms in a project throughout its life-cycle, i.e. conception, programming, planning, erection, maintenance, remodeling, and demolition phases, see ISO 4157-3. (ISO 4157-2:1988)	http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=26190

CITED STANDARD (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
ISO 4157-3 Construction drawings -- Designation systems **-- Part 3: Room identifiers**	This part of ISO 4157 establishes requirements for designation systems for rooms, areas, spaces, and voids in buildings by room identifiers. It introduces a new designation concept intended for identification of rooms in a project throughout its life cycle, i.e. the conception, programming, planning, erection, maintenance, remodeling and demolition phases. (ISO 4157-3:1988)	http://www.iso.org/iso/catalogue_detail.htm?csnumber=26950
ISO 10303 Standard for the Exchange of Product Model Data	Standard for the computer-interpretable representation and exchange of product manufacturing information. Its official title is: Automation systems and integration — Product data representation and exchange. ISO 10303 can represent 3D objects in Computer-aided design (CAD) and related information.	
ISO 12006-2 Building construction - Organization of information about construction works - **Part 2: Framework for classification of information**	Organization of Information about Construction Works - Part 2: Framework for Classification of Information provides a basic structure of information about construction that is grouped into three primary categories composing the process model: construction resources, construction processes and construction results.	http://webstore.ansi.org
ISO 15926 Industrial automation systems and integration -Integration of life-cycle data for process plants including oil and gas production facilities- Part 1: Overview and fundamental principles	The ISO project similar to ifcs that is more oriented toward the oil and gas and process industry. The work is also being accomplished under TC 184.	http://webstore.ansi.org
ISO/PAS 16739 Industry Foundation Classes, Release 2x, Platform Specification (IFC2x Platform)	The ISO project tile for the Industry Foundation Class (ifc) under Technical Committee 184 of the International Standards Organization	http://webstore.ansi.org

CITED STANDARD (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
IT Infrastructure Library	The Information Technology Infrastructure Library (ITIL) is a set of practices for IT service management (ITSM) that focuses on aligning IT services with the needs of business. It is published in a series of five core publications, each of which covers an ITSM lifecycle stage. ITIL underpins ISO/IEC 20000 (previously BS15000), the International Service Management Standard for IT service management. ITIL describes processes, procedures, tasks and checklists that are not organization-specific, used by an organization for establishing integration with the organization's strategy, delivering value and maintaining a minimum level of competency. It allows the organization to establish a baseline from which it can plan, implement, and measure. It is used to demonstrate compliance and to measure improvement.	http://www.itil-officialsite.com/
Leadership in Energy and Environmental Design	A program that provides third-party verification of "green buildings". Building projects satisfy prerequisites and earn points to achieve different levels of certification. Prerequisites and credits differ for each rating system, and teams choose the best fit for the project.	2013, http://www.usgbc.org
Levels of BIM Data "Performance" UK (PAS1192-2)	A Public Specification defining and graphically illustrating a 4 Level categories of BIM Data Performance. This UK project may be relevant to US BIM guidance or standards to the extent that it achieves ISO status. Note that the working criteria & documents that this UK document uses overlaps or is improved upon by US Federal agencies.	http://shop.bsigroup.com/en/forms/PASs/PAS-1192-2/
MasterFormat™	MasterFormat™ is the pre-eminent means for organizing commercial and institutional construction specifications in North America. Initially published in 1963 by the Construction Specifications Institute (CSI) and Construction Specifications Canada (CSC), it has been revised many times since then, and has been used by individuals and companies in all sectors of the construction industry for filing and organizing specifications, product data, and other construction information.	COST - Non Member $169 http://www.csinet.org/masterformat

CITED STANDARD (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
OmniClass™	OmniClass is a multi-class faceted classification system consisting of tables for classifying the built environment throughout its life-cycle. OmniClass has been developed by OCCS Development Committee, an all-volunteer group of individuals and representatives of organizations assembled for this purpose. The Committee's work on OmniClass is administered by the Construction Specifications Institute (CSI) and Construction Specifications Canada (CSC). The OmniClass tables and introduction can be downloaded from http://www.omniclass.org/. A Web Service OmniClass demonstration is available at http://bim-cloud.com/OmniClass.html which illustrates both Cloud Computing platform and multi-table integrated services.	http://www.omniclass.org/
UniFormat™	UniFormat provides a standard method for arranging construction information, organized around the physical parts of a facility called systems and assemblies. These systems and assemblies are characterized by their function without identifying the technical or design solutions that may compose them. Because UniFormat organizes the structures in the built environment by their component elements, a modified version of it was used as a legacy source for the basic organization and contents of OmniClass Table 21-Elements. See also: Construction Specifications Institute. Also: ASTM E1557 - 09 Standard Classification for Building Elements and Related Sitework-UNIFORMAT II	
The General Building Information Handover Guide: Principles, Methodology and Case Studies	The General Building Information Handover Guide: Principles, Methodology and Case Studies (NISTIR 7417))	http://www.wbdg.org/pdfs/nistir_7417.pd f
United States National CAD Standard, V 5 available, at cost, to download http://www.nationalcadstandard. org/ncs5/	The United States National CAD Standard (NCS) is the only comprehensive U.S. CAD Standard for the design, construction and facility management industries. The program's goal is broad voluntary adoption of the CAD Standard by the building design, construction and operation sectors, thereby establishing a common language for the building design and documentation process. Use of NCS eliminates the overhead costs that organizations now incur to maintain proprietary office standards, train new staff, and coordinate implementation among design team members. The 2-D standard plays a crucial role in easing the transition to new BIM software systems and the 3-D object-based standards.	NBIMS-US™ V1

END of CITED STANDARDS

3.4.3 Organizations

ORGANIZATION (ABBREVIATION or ACRONYM)	ROLE IN BIM DOMAIN	SOURCE
United States Army Research Lab (ARL)	The U.S. Army Research Laboratory (ARL) of the U.S. Army Research Development and Engineering Command (RDECOM) is the Army's corporate, or central, laboratory. Its diverse assortment of unique facilities and dedicated workforce of government and private sector partners make up the largest source of world-class integrated research and analysis in the Army.	www.arl.army.mil
Associated General Contractors of America See http://www.agc.org/ (AGC)	A professional association for the construction industry, located in Washington, DC, operating in partnership with its nationwide network of 95 chartered Chapters, AGC provides a full range of services to improve the quality of construction and protecting the public interest. They provide the BIM Forum. See http://bimforum.org/	http://www.agc.org/cs/about_agc
American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)	Advances the arts and sciences of heating, ventilation, air conditioning and refrigeration to serve humanity and promote a sustainable world.	http://www.ashrae.org
BIM Task Force Group – UK	A consortium of AECOO practitioners, academics, and consultants funded by the UK Government to develop guidance documents for the 2016 requirements that all bidders for UK central government contracts achieve at least a "Level 2" BIM Competency. See the PAS 1192-2- 2013 document as a set of diagrams and specifications that could impact US Multinational organizations and future US – UK Harmonization requirements.	http://www.bimtaskgroup.org/pas-1192-22012/
buildingSMART Alliance® (Alliance or buildingSMART alliance®)	buildingSMART Alliance is the home of the North American chapter of buildingSMART, but also the focal point and coordinator for all activities related to BIM in North America. The buildingSMART alliance has a goal of saving $200B annually by 2020.	http://www.nibs.org/?page=builidingSMARTalliance
buildingSMART International™ (bSi)	A neutral, international and unique not for profit organization supporting open BIM through the life cycle. bSi™ is the umbrella organization for over 30 chapters, including buildingSMART alliance®. The mission (Interoperability) is to accelerate the exchange of accurate, useful information on the built environment among all members of the building community throughout the life-cycle of a facility. In 2013 bSi is developing standards under ISO and following two Road Maps (A Strategic 2020 Roadmap and a BIM INFRA Roadmap 2016). Coordination of issues between bSi projects and buildingSMART alliance® projects may be documented on relevant websites.	http://www.buildingsmartalliance.org/index.Php/about/

ORGANIZATION (ABBREVIATION or ACRONYM)	ROLE IN BIM DOMAIN	SOURCE
Construction Engineering Research Laboratory (of the US Army) (CERL)-	Develop and infuse innovative technologies to provide excellent facilities and realistic training lands for the Department of Defense, the U.S. Army and many other customers while also supporting ERDC's research and development mission in geospatial research and engineering, military engineering, and civil works.	www.erdc.usace.army.mil/Locations/ConstructionEngineeringResearch
Construction Specifications Institute (CSI)	CSI is a national association dedicated to creating standards and formats to improve construction documents and project delivery. The organization is unique in the industry in that its members are a cross section of specifiers, architects, engineers, contractors and building materials suppliers. See: www.csinet.org	http://www.csinet.org
Department of Defense (DoD)	The Department of Defense is the largest property holder in the government and has a portfolio of approximately 571,000 facilities. [There has not been much activity at high levels related to BIM at this point in time but their CIO is implementing Agile Cloud Computing strategy which illustrates how other federal agencies are likely to evolve.]	http://dodcio.defense.gov/
Engineer Research and Development Center (ERDC)	The U.S. Army Corps of Engineers' (USACE) Engineer Research and Development Center (ERDC) helps solve our Nation's most challenging problems in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the Army, Department of Defense, civilian agencies, and our Nation's public good.	http://www.erdc.usace.army.mil/
Federal Facilities Council (US) (FFC)	The Federal Facilities Council (FFC) was established in 1953 as the Federal Construction Council. It operates under the auspices of the Board on Infrastructure and the Constructed Environment (BICE) of the National Research Council. The FFC's mission is to identify and advance technologies, processes, and management practices that improve the performance of federal facilities over their entire life-cycle, from planning to disposal.	http://sites.nationalacademies.org/DEPS/FFC/DEPS_047398
Federal Real Property Council (US Federal group of senior execs) (FRPC)	The Federal Real Property Council was established to implement Executive Order 13327 Federal Real Property Asset Management (2004	http://www.acq.osd.mil/ie/fim/library/ExecutiveOrder_13327.pdf
Fiatech	An applied research and capital construction organization initiated by the Construction Industry Institute (CII) and NIST to improve productivity in the construction industry. Their roadmap aligns with buildingSMART alliance®, especially their focus on interoperability	http://www.fiatech.org/interoperability

ORGANIZATION (ABBREVIATION or ACRONYM)	ROLE IN BIM DOMAIN	SOURCE
United States General Services Administration (GSA)	The federal agency responsible for public buildings and one of seven federal agencies responsible for facility construction. The GSA is one of the leaders in the BIM effort as they have required that all new building starts are required to provide a BIM	http://www.gsa.gov
International Alliance for Interoperability (IAI)	A voluntary organization, created in 1995, to represent the public and private sectors in an effort to facilitate the exchange of dynamic information among members of the building community. Objectives: 1. to develop and recommend practices for the uniform transmission and sharing of information and data 2. to provide a forum to promote the use of the recommended standards of information sharing 3. to develop a process for certifying compliance with the recommended standards. The IAI was reorganized and superseded as buildingSMARTinternational (bSi). All technical projects of the IAI were incorporated into bSI.	
International Standards Organization (ISO)	World's largest developer and publisher of international standards. ISO is a network of the national standards institutes of 162 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system. ISO is a non-governmental organization that forms a bridge between the public and private sectors. Many of its member institutes are part of the governmental structure of their countries, or are mandated by their government. Other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations. Therefore, ISO enables a consensus to be reached on solutions that meet both the requirements of business and the broader needs of society.	www.iso.org.
Lean Construction Institute (LCI)	An organization dedicated to eliminating waste or non- value added effort for the construction industry by applying lean concepts	http://www.leanconstruction.org/
National Aeronautics and Space Administration (NASA)	A United States government agency responsible for science and technology related to air and space. NASA was created in 1958 to oversee U.S. space exploration and aeronautics research. One of several agencies actively promoting the use of BIM in it's own capital improvement program.	http://www.nasa.gov/audience/forstudents/5-8/features/what-is-nasa-58.html

ORGANIZATION (ABBREVIATION or ACRONYM)	ROLE IN BIM DOMAIN	SOURCE
National Institute of Building Sciences (NIBS)	The National Institute of Building Sciences was established by Public Law 93-383, Sect. 809 in 1974. This 501c3 organization was established to build collaborative relationships between the public and private sector to encourage the efficient flow of information related to the construction industry's productivity deficit.	http://www.nibs.org/
National Institute of Standards & Technology (NIST)	Founded in 1901, NIST is a non-regulatory federal agency within the U.S. Department of Commerce. NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. The Building and Fire Research Labs continues to inform BIM research and standards groups.	http://www.nist.gov/building-and-fire-research-portal.cfm
Open Geospatial Consortium (OGC)	A global forum for the collaboration of developers and users of spatial data products and services, and to advance the development of international standards for geospatial interoperability	http://www.opengeospatial.org/
Organization for the Advancement of Structured Information Systems (OASIS)	The Standards Development Organization with primary responsibility for developing Open XML Standards for information exchange.	https://www.oasis-open.org/org
Object Management Group (OMG)	The Object Management Group (OMG®) is an international, open membership, not-for-profit computer industry standards consortium. Founded in 1989, OMG standards are driven by vendors, end-users, academic institutions and government agencies. OMG Task Forces develop enterprise integration standards for a wide range of technologies and an even wider range of industries. OMG's modeling standards, including the Unified Modeling Language (UML) and Model Driven Architecture (MDA), Business Process Management Notation (BPMN) is the foundation for NBIM's Information Delivery Manual (IDM).	http://www.omg.org/
OSCRE Real Property Standards	The Opens Standards Consortium for Real Estate through their committee process have developed property standards for the real property industry that have a direct bearing on the organizational structure of BIM.	http://www.oscre.org/
Pankow Foundation (NIBS/Fiatech – Architectural Precast Concrete Studies)	Pankow Foundation funds several buildingSMART alliance® grants to define the data exchange requirements and workflow scenarios for exchanges between architect and precast contractor, for architectural and structural precast concrete.	http://www.pankowfoundation.org/

ORGANIZATION (ABBREVIATION or ACRONYM)	ROLE IN BIM DOMAIN	SOURCE
United States Green Building Council (USGBC)	A non-profit U.S. based organization dedicated to sustainable building design and construction that are the developers of the LEED building rating system.	http://www,usgbc.org
World Wide Web Consortium W3C	The central international standards organization for the World Wide Web, also abbreviated WWW or W3.	http://www.w3.org/Consortium/
BIM Task Force Group – UK	A consortium of AECOO practitioners, academics, and consultants funded by the UK Government to develop guidance documents for the 2016 requirements that all bidders for UK central government contracts achieve at least a "Level 2" BIM Competency. See the PAS 1192-2- 2013 document as a set of diagrams and specifications that could impact US Multinational organizations and future US – UK Harmonization requirements.	http://www.bimtaskgroup.org/pas-1192-22012/

END of ORGANIZATIONS

3.4.4 XML and digital formats

XML and DIGITAL FORMAT (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Associated General Contractors xml (AGCxml)	Association of General Contractor's schema. A suite of XML schemas for exchanging construction project information between software applications used by facility owners and AEC firms.	http://agcxml.org/background/
Automating Equipment Information Exchange (AEX)	A common mechanism for designers and manufacturers using varied software applications to exchange data required to engineer, manufacture and install equipment ranging from fans, pumps, valves, heat exchangers and pressure vessels. AEX XML specifications are used to automate information exchange among various software systems that support capital facility equipment engineering, procurement, construction, and operations and maintenance work processes. XML is a computer language designed to transport and store data.	http://www.cfixml.org/index.html
Architects, Engineers and Contractors Extensible Markup Language) (aecXML	A data representation standard designed by buildingSMART alliance® for all the non-graphic data involved in the construction industries. This information may be resources such as projects, documents, materials, parts, organizations, professionals, or activities such as proposals, design, estimating, scheduling and construction. GC recently engaged the Burger Consulting Group to lead the charge of taking the agcXML to the next step.	Adapted from NBIMS-US™ V1 see: http://www.agc.org/cs/industry_topics/technology/agc_xml for NIBS involvement and http://agcxml.org/ for the standard.
Building Automation and Control Networks (See http://www.bacnet.org/) (BACnet)	BACnet is a data communication protocol developed by ASHRAE to standardize communications between building automation devices from different manufacturers, allowing data tobe shared and equipment to work together easily. This is accomplished using an object-oriented approach for representing all information within each controller. BACnet uses any combination of five types of local area network or LAN technology for transporting BACnet application messages. See LonWorks (http://www.lonmark.org/) and oBIX (http://www.obix.org/).	2013, BACnet International
bimXML	Building Information Modeling XML a complimentary approach to IFC.	http://bimxml.org/

XML and DIGITAL FORMAT (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Business Process Execution Language (BPEL)	BPEL (Business Process Execution Language) for Web services is an XML-based language designed to enable task-sharing for a distributed computing or grid computing environment - even across multiple organizations - using a combination of Web services. Using BPEL, a programmer formally describes a business process that will take place across the Web in such a way that any cooperating entity can perform one or more steps in the process the same way.	https://www.oasis-open.org/committees/bpel4people/
Capital Facilities Industry Extensible Markup Language (cfXML)	Technical information shared among purchasers, suppliers and engineering contractors throughout the supply chain for the procurement and operations and maintenance of engineering equipment and plant. Electronic data exchange allows data to be reliably transferred between stakeholders without time consuming, costly and potentially error prone manual transcription of data. The cfiXML schema solution provides a common language to enable stakeholders to share this information electronically	http://www.cfixml.org/index.html
City Graphic Markup Language CityXML	CityGML is a common information model and XML- based encoding for the representation, storage, and exchange of virtual 3D city and landscape models. CityGML provides a standard model and mechanism for describing 3D objects with respect to their geometry, topology, semantics and appearance, and defines five different levels of detail. Included are also generalization hierarchies between thematic classes, aggregations, relations between objects, and spatial properties. CityGML is highly scalable and datasets can include different urban entities supporting the general trend toward modeling not only individual buildings but also whole sites, districts, cities, regions, and countries.	http://www.citygml.org/index.php?id=1523
Electronic Business Extensible Markup Language (ebXML)	Electronic business using extensible markup language is a modular suite of specifications that enables enterprises to conduct business over the Internet.	NISTIR 7417 page 76
Electronic Business Extensible Markup Language (ebXML)	Electronic Business Extensible Markup Language (ebXML)	HTTP://www.w3.org/XML

XML and DIGITAL FORMAT (ABBREVIATION or ACRONYM)	DEFINITION	SOURCE
Green Building XML (gbXML)	An XML schema developed by Green Building Studio, Inc. to facilitate the transfer of building information stored in CAD building information models, enabling integrated interoperability between building design models and a wide variety of energy analysis tools.	http://gbxml.org/
IFCxml (IFCxml)	xml which has been developed to map to the IFC data model.	http://www.iai-international.org/Model/IFC(ifcXML)Specs.html
OpenBuilding Information Xchange (oBIX)	Standard for a web services protocol for communication between building mechanical and electrical systems and enterprise applications. Developing as a project of the Organization for the Advancement of Structured Information Standards (OASIS)	https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=obix
XML Schema Definition (XSD)	A language for defining the structure or Schema, of an XML encoding; its structure, content, semantics, elements, attributes, hierarchy, namespaces, data types, and default or fixed values.	http://www.w3.org/XML/Schema

END of
XML and DIGITAL FORMATS