



# National BIM Standard - United States® Version 3

## 5 Practice Documents

### 5.9 The Uses of BIM: Classifying and Selecting BIM Uses, Version 0.91 – October 2013

#### CONTENTS

5.9.1	Scope – General Criteria .....	2
5.9.1.1	Business case.....	2
5.9.2	Normative references .....	2
5.9.3	Terms, definitions, symbols and abbreviated terms .....	3
5.9.4	The Uses of BIM: Classifying and Selecting BIM Uses.....	7
5.9.4.1	Description of use.....	7
5.9.4.2	Process Map.....	7
5.9.4.2.1	BPMN description.....	8
5.9.4.3	Guide for use of the BIM Use Classification System.....	8
5.9.4.3.1	Determine the purpose for implementing BIM.....	9
5.9.4.3.2	Elaborate on who, what, when, and to what level .....	11
5.9.5	Demonstrated Use and Acceptance.....	11
5.9.5.1	Evidence of repeatability .....	12
5.9.6	Bibliography .....	12

### 5.9.1 Scope – General Criteria

This document presents a system for the classification of the Uses of BIM. This classification system provides a common language for the Uses of Building Information Modeling (or BIM Uses) that can be leveraged to communicate the precise purpose and context of implementing BIM on a capital facility project. A BIM Use is defined as *a method of applying Building Information Modeling during a facility's lifecycle to achieve one or more specific objectives.*

#### 5.9.1.1 Business case

By providing a common language for understanding within the industry for the implementation of BIM Uses, we can begin to normalize the Use of BIM. This normalization will lead to wider adoption of Building Information Modeling. The standardization leads more common understanding of the methods in which BIM can be implemented throughout all aspects of a facility including disciplines, phases, and elements. Facility information is gathered, generated, analysed, communicated, and realized. Any activity implemented during the life of a facility should be implemented for a purpose. It is that purpose that this research strived to understand and document. Hopefully, this document will foster better communication throughout the silos of this industry. When the Uses of BIM are adopted throughout the industry, it will begin to standardize how this industry plans, designs, constructs, and operates facilities providing for a better understood implementation of BIM.

1. **Problem Solved:** The problem solved is this common language will allow for standardization of language throughout the industry. This BIM Use classification systems and procedure provide the fundamental terminology and structure for communicating the purposes for which BIM is implemented.
2. **Unique Features:** Unlike most lists of BIM Uses, BIM Uses within this document are defined primarily by purpose and objective of the Implementation of BIM, rather than phase, element, discipline, or level of development. Additionally the rigor used to develop and document these BIM Uses is more comprehensive than any efforts in the past.
3. **Use of Practice:** The BIM Uses within this document can be used for BIM Planning, processes, and information exchanges. Additionally, the BIM Uses can be used for procurement language and the development and structuring of additional standards such as NBIMS-US™.
4. **Return:** The return is realized when all parties can begin to reduce time spent attempting to understand requirements and processes. All parties will begin to have a shared understanding of BIM deliverables throughout the life of a facility.

### 5.9.2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- *BIM Uses*, <http://bim.psu.edu/uses>
- *BIM Project Execution Planning Guide and Templates*, <http://bim.psu.edu/Project/resources/default.aspx>
- *BIM Planning Guide for Facility Owners Guide and Templates*, Organizational BIM Assessment Profile, <http://bim.psu.edu/Owner/Resources/default.aspx>

### 5.9.3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

#### 5.9.3.1

##### **BIM**

**Building Information Modeling**

#### 5.9.3.2

##### **gather (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to collect or organize facility information

#### 5.9.3.3

##### **capture (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to represent or preserve the current status of the facility and facility elements

#### 5.9.3.4

##### **quantify (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to express or measure the amount of a facility element

#### 5.9.3.5

##### **monitor (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to collect information regarding the performance of facility elements and systems

#### 5.9.3.6

##### **qualify (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to characterize or identify facility elements' status

#### 5.9.3.7

##### **generate (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to create or author information about the facility

#### 5.9.3.8

##### **prescribe (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to determine the need for and select specific facility elements

#### 5.9.3.9

##### **PxP**

**Project Execution Plan**

#### 5.9.3.10

##### **arrange (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to determine location and placement of facility elements

#### 5.9.3.11

##### **size (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to determine the magnitude and scale of facility elements

#### **5.9.3.12**

##### **analyze (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to examine elements of the facility to gain a better understanding of it

#### **5.9.3.13**

##### **coordinate (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to ensure the efficiency and harmony of the relationship of facility elements

#### **5.9.3.14**

##### **forecast (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to predict the future performance of the facility and facility elements simulate, predict

#### **5.9.3.15**

##### **validate (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to check or prove accuracy of facility information and that is logical and reasonable

#### **5.9.3.16**

##### **communicate (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to present information about a facility in a method in which it can be shared or exchanged

#### **5.9.3.17**

##### **visualize (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to form a realistic representation of a facility or facility elements

#### **5.9.3.18**

##### **transform (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to modify information and translate it to be received by another process

#### **5.9.3.19**

##### **draw (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to make a symbolic representation of the facility and facility elements

#### **5.9.3.20**

##### **document (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to create a record of facility information including the information necessary to precisely specify facility elements

#### **5.9.3.21**

##### **realize (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to make or control a physical element using facility information

#### **5.9.3.22**

**fabricate (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to use facility information to manufacture the elements of a facility

**5.9.3.23****assemble (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to use facility information to bring together the separate elements of a facility

**5.9.3.24****control (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to use facility information to physically manipulate the operation of executing equipment

**5.9.3.25****regulate (BIM Use purpose)**

in the context of BIM Use, the purpose for the use of BIM is to use facility information to inform the operation of a facility element

**5.9.3.26****Building Information Modeling****BIM**

a process focused on the development, use, and transfer of a digital information model of a building project to improve the design, construction, and operations of a project or portfolio of facilities.

**5.9.3.27****Building Information Modeling****BIM**

the act of creating an electronic model of a facility for the purpose of visualization, engineering analysis, conflict analysis, code criteria checking, cost engineering, as-built product, budgeting, and many other purposes.<sup>1</sup>

**5.9.3.28****Building Information Model****BIM**

a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition. A basic premise of BIM is collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update, or modify information in the BIM to support and reflect the roles of that stakeholder.

**5.9.3.29****BIM Project Execution Plan****BIM PxP or BIM Plan**

a plan that results from the BIM Project Execution Planning Process. This document lays out how BIM will be implemented on the project as a result of the decision of the group.

**5.9.3.30****characteristics (BIM Use)**

in the context of a BIM Use, a BIM Use Characteristic is an element used to define the Use of BIM, including its purpose and objective, facility element, facility phase, discipline and level of development.

---

<sup>1</sup> buildingSMART alliance®, *National Building Information Modeling Standard Version 1 - Part 1: Overview, Principles, and Methodologies*.

**5.9.3.31****BIM Project Execution planning procedure**

a process for planning the execution of BIM on a Facility. It consists of four primary steps:

- identify BIM Goals and BIM Uses
- design BIM Project Execution Process
- develop Information Exchanges
- define supporting infrastructure for BIM Implementation.

**5.9.3.32****BIM Use**

a method or strategy of applying Building Information Modeling during a facility's lifecycle to achieve one or more specific objectives.

**5.9.3.33****discipline**

disciplines are the 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.<sup>2</sup>

**5.9.3.34****facility phase**

a phase is a period of time in the duration of a construction project identified by the overall character of the construction processes that occur within it.<sup>3</sup>

**5.9.3.35****facility element**

a major component, assembly, or "construction entity part which, in itself or in combination with other parts, fulfills a predominating function of the construction entity" (ISO 12006-2).<sup>4</sup>

**5.9.3.36****goals (BIM)**

objectives used to define the potential value of BIM for a project and for project team members. BIM Goals help to define how and why BIM will be used on a project or in an organization.

**5.9.3.37****Level of Development****LOD**

the degree of granularity to which a model element is developed.

**5.9.3.38****objective (BIM)**

specific results that when accomplished move the organization toward their BIM goals.

**5.9.3.39****process (BIM)**

a generic name for the practice of performing BIM. This process can be planned or unplanned. The BIM Process may also be referred to as the BIM Execution Process or the BIM Project Execution Process. The BIM Project Execution Planning Process suggests diagramming the BIM process using process maps.

**5.9.3.40**

<sup>2</sup> OCCS Development Committee Secretariat, "OmniClass: Table 33 - Disciplines."

<sup>3</sup> OCCS Development Committee Secretariat, "OmniClass Table 31 - Phases."

<sup>4</sup> OCCS Development Committee Secretariat, "OmniClass Table 21 - Elements."

**Process Maps (BIM)**

a diagram of 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.

**5.9.3.41**

**project team**

every participant contracted to work on a project. This may include the owners, designers, contractors, subcontractors, suppliers, manufacturers, tenants, consultants, financiers, insurers, and surveyors.

**5.9.3.42**

**purpose (BIM Use)**

the specific objective to be achieved when applying Building Information Modeling during a facility’s life.

**5.9.3.43**

**vision (BIM)**

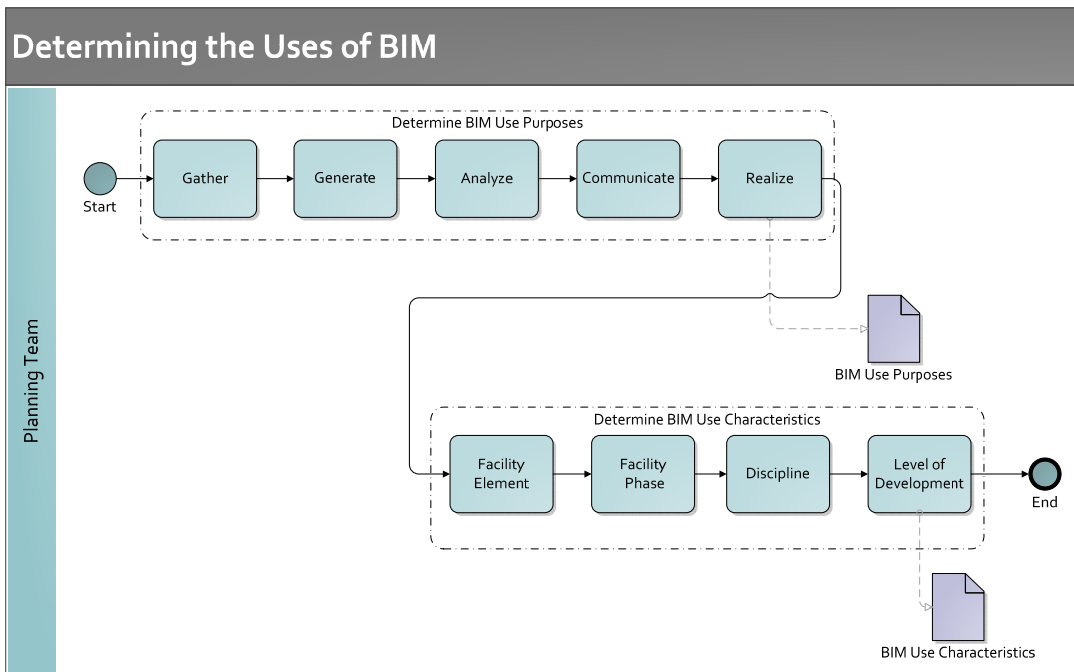
a picture of what the BIM Implementation is striving to become.

**5.9.4 [The Uses of BIM: Classifying and Selecting BIM Uses](#)**

**5.9.4.1 Description of use**

The BIM Use Classification System can be implemented is an alternative approach to the first step of the procedure defined in Chapter 2 of the *BIM Project Execution Planning Guide*. Rather than classifying the BIM Uses by facility phase (as was done in the BIM Project Execution Planning Guide), this system classifies BIM Uses based on the purpose of implementing BIM. It is critical to understand that BIM does not change the purpose – only the means by which the purpose is achieved.

**5.9.4.2 Process Map**



**Figure 5.9-1 Determining the Uses of BIM**

**5.9.4.2.1 BPMN description**

The classification system can be implemented using two primary processes and six secondary processes. The project planning team first select the primary BIM Use purposes based on the project characteristics. The secondary purposes are selected. After the BIM Uses Purposes are selected, the BIM Use elaboration characteristics are selected for each BIM Use Purpose. This includes 1) selecting facility element, 2) determining facility phase, 3) establishing discipline, and 4) identifying level of development. The combination of purpose and characteristics provides the necessary detail to communication the intent of the BIM Use.

**5.9.4.3 Guide for use of the BIM Use Classification System**

**BIM STRATEGY:**

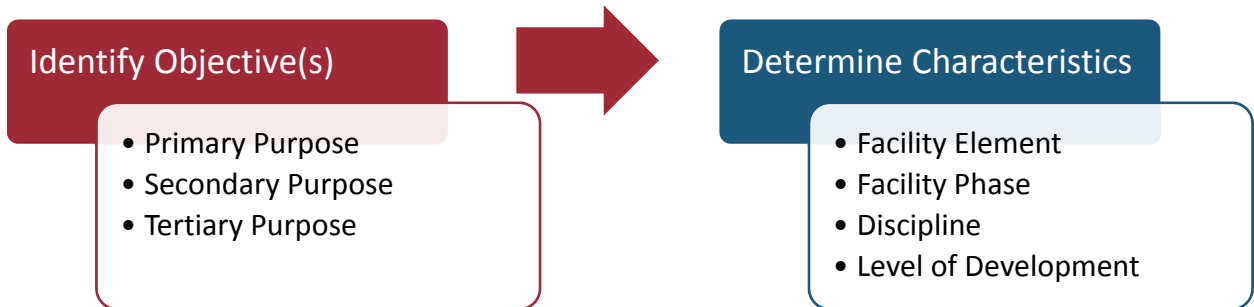
**Mission:** Defines the purpose of the project.

**Vision:** The picture of the project after it has integrated BIM.

**Goals:** Specific aims which the project wishes to accomplish.

**Objectives:** Specific results that when accomplished move the goals.

Based on the overall BIM strategy including the Mission, Vision, Goals and Objectives for a project or organization, the planning team should identify the appropriate BIM Uses. A challenge and opportunity faced by the early project planning team is identifying the most appropriate uses for BIM on a project given the project characteristics. There are many different traditional tasks that can benefit by being replaced by the implementation of BIM. The goal of this section is to provide a method for identifying appropriate BIM Uses for project implementation. These steps, as shown in Figure 5.9-2, include defining the purpose and additional characteristics for each BIM Use.



**Figure 5.9-2: BIM Use Selection Procedure**



#### 5.9.4.3.1 Determine the purpose for implementing BIM<sup>5</sup>

##### **BEGIN WITH THE END IN MIND<sup>9</sup>**

When planning for the implementation of BIM it is critical to consider the entire life of the facility. The planning team should strive to understand how all facility stakeholders will be implementing BIM.

The planning team should consider how the facility owners are going to be using BIM first and then work their way back through construction, through design and into planning.

Based on the overall strategy, the planning team should begin to determine how they will be implementing BIM on the project. The planning team should consider how they will be using information during the course of the project including how they will:

- Gathering
- Generating
- Analyzing
- Communicating
- Realizing

Often, these tasks or purposes have been implemented using “traditional” processes. It is up to the project team to determine if they will be implementing these using BIM. (More detailed descriptions can be found in the next section of this guide.) It is important that the team consider each of potential uses (as shown in **Error! Reference source not found.**) and consider their relationship with the project goals.

---

<sup>5</sup> Stephen R. Covey, *The 7 Habits of Highly Effective People: Restoring the Character Ethic*, Rev. ed. (New York: Free Press, 2004).

BIM Use Purpose		BIM Use Objective	Synonyms	
01	<b>Gather</b>	<b>to collect or organize facility information</b>	administer, collect, manage, acquire	
	01	Capture	to represent or preserve the current status of the facility and facility elements	collect
	02	Quantify	to express or measure the amount of a facility element	quantity takeoff
	03	Monitor	to collect information regarding the performance of facility elements and systems	observe, measure
	04	Qualify	to characterize or identify facility elements' status	follow, track, identify
02	<b>Generate</b>	<b>to create or author information about the facility</b>	create, author, model	
	01	Prescribe	to determine the need for and select specific facility elements	program, specify
	02	Arrange	to determine location and placement of facility elements	configure, lay out, locate, place
	03	Size	to determine the magnitude and scale of facility elements	scale, engineer
03	<b>Analyze</b>	<b>to examine elements of the facility to gain a better understanding of it</b>	examine, evaluate	
	01	Coordinate	to ensure the efficiency and harmony of the relationship of facility elements	detect, avoid
	02	Forecast	to predict the future performance of the facility and facility elements	simulate, predict
	03	Validate	to check or prove accuracy of facility information and that is logical and reasonable	check, confirm
04	<b>Communicate</b>	<b>to present information about a facility in a method in which it can be shared or exchanged</b>	exchange	
	01	Visualize	to form a realistic representation of a facility or facility elements	review
	02	Transform	to modify information and translate it to be received by another process	translate
	03	Draw	to make a symbolic representation of the facility and facility elements	draft, annotate, detail
	04	Document	to create a record of facility information including the information necessary to precisely specify facility elements	specify, submit, schedule, report.
05	<b>Realize</b>	<b>to make or control a physical element using facility information</b>	implement, perform, execute,	
	01	Fabricate	to use facility information to manufacture the elements of a facility	manufacture
	02	Assemble	to use facility information to bring together the separate elements of a facility	prefabricate
	03	Control	to use facility information to physically manipulate the operation of executing equipment	manipulate
	04	Regulate	to use facility information to inform the operation of a facility element	direct

**Table 5.9-1 BM Uses Purposes and Objectives**

When determining whether they will be implementing BIM for these BIM Use purposes, the project team needs to consider the BIM resources, competency, and experience of the team. The resources include software, hardware, and IT support. When determining competency and experience, the planning team should consider past performance and overall ability. It is important to understand that if the team does not have the necessary skills to successfully implement BIM it may actually hinder the adoption of BIM. At the end of this effort the team should be able to make a “go / no go” decision on each of the BIM Use purposes prior to more elaboration on each BIM Use.

**5.9.4.3.2 Elaborate on who, what, when, and to what level**

After the planning teams determines for which purposes the project will be implementing BIM, they need to determine, as shown in **Error! Reference source not found.**, which discipline, which phase, which facility elements, and to what level of development these BIM Use purposes will be implemented.

Characteristic	Description
<b>Facility Element</b>	The system of the facility on which the BIM Use will be implemented.
<b>Facility Phase</b>	The point in the facility’s life at which the BIM Use will be implemented.
<b>Discipline</b>	The party by whom the BIM Use will be implemented.
<b>Level of Development</b>	The degree of granularity to which a model element is developed.

**Table 5.9-1: BIM Use Characteristics**

Adding this detail, elaborates on the BIM Uses above only a purpose. It is possible to have multiples of each characteristic for each BIM Use purpose. For example, multiple disciplines can implement multiple BIM Use purposes during multiple phases on multiple facility elements. Therefore it is possible at the conclusion of the effort, that the project team may have as few as 5 elaborated BIM Uses or as many as 50 or more elaborated BIM Uses depending on the level of implementation of the project. At the conclusion of the effort, the team will now be able to describe all the Uses in terms of discipline, phase, elements, level of development and purpose. Often after elaborating on the characteristics of the BIM use, a planning team often determines that they have more BIM Uses.

**5.9.5 Demonstrated Use and Acceptance**

This BIM Use classification was developed through a comprehensive ontology development methodology. The methods used to classify the BIM Uses included: 1) defining domain and scope, 2) acquiring domain knowledge, 3) identifying domain terms, 4) integrating the terms, 5) evaluating (refinement and validation) classification system, and 6) documenting classification system. To develop the classification system, over 550 Terms were documented using content analysis, software analysis, brainstorming, and industry practice analysis. These 550 Use terms were then grouped by common attributes into approximately 30 groups. During this process only the purpose of the BIM Use term was considered. Therefore items such a project phase, facility element, discipline, and level of development were not considered when developing the classes. These groups were then organized into larger categories of BIM Uses and organized into a hierarchal structure. This structure was then internally evaluated through competency questions, mapping the original terms to the structure, and comparing it to other structure such as the BIM tetralogy<sup>6</sup>. Based on the internal evaluation, the Ontology was updated and validated externally. The Ontology its was reviewed by 30 individuals most of which are members of the buildingSMARTalliance® NBIMS-US™ committees, USACE/Industry Advisory Committee and BIMForum, and Other Industry leading committees. These individuals represented all sectors of the industry including standards developers, academia, industry, designers, contractors, owners, and consultants. The BIM Uses document itself was reviewed by Steven Ayer (Penn State), Dianne Davis (AEC Infosystems), Robert Fraga (MBP), Sonali Kumar (Balfour Beatty), Charles Miller (MBP), Mairav

<sup>6</sup> buildingSMART alliance®, “Tetralogy of BIM,” National BIM Standard - United States®, 2013, [http://www.nationalbimstandard.org/project\\_structure.php](http://www.nationalbimstandard.org/project_structure.php).

Mintz (MBP), and Rachel Riopel Wiley (HDR). Based on the external feedback, the structure was updated and documented.

#### 5.9.5.1 Evidence of repeatability

While the BIM Use Classification System is in its initial stages of adoption, it has been validated by over 30 industry experts and is currently being implemented

#### 5.9.6 Bibliography

BIMForum. "2013 Level of Development Specification." AIA / AGC, August 22, 2013. <http://bimforum.org/wp-content/uploads/2013/08/2013-LOD-Specification.pdf>.

buildingSMART alliance®. *National Building Information Modeling Standard Version 1 - Part 1: Overview, Principles, and Methodologies*. National Institute of Building Sciences, 2007.

———. "Tetralogy of BIM." *National BIM Standard - United States®*, 2013. [http://www.nationalbimstandard.org/project\\_structure.php](http://www.nationalbimstandard.org/project_structure.php).

Computer Integrated Construction Research Program. *BIM Project Execution Planning Guide - Version 2.1*. University Park, PA, USA: The Pennsylvania State University, 2011. <http://bim.psu.edu>.

Covey, Stephen R. *The 7 Habits of Highly Effective People: Restoring the Character Ethic*. Rev. ed. New York: Free Press, 2004.

OCCS Development Committee Secretariat. "OmniClass Table 21 - Elements," May 16, 2012. <http://www.omniclass.org/>.

———. "OmniClass Table 31 - Phases," October 31, 2012. <http://www.omniclass.org/>.

———. "OmniClass: Table 33 - Disciplines." OmniClass Secretariat, October 30, 2012. <http://www.omniclass.org/pdf.asp?id=11&table=Table%2033>.