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The USC School of Cinematic Arts:
The Arrival of Spring in the Facilities Industry

Where Does All This Information Belong?

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THIS ARTICLE IS MEANT TO TIE TOGETHER loose ends about BIM's role in filing and accessing information about the built environment. Some processes are new, some have been around since building documentation began. Incorporating updates, getting parallel efforts to work together, acknowledging related standards and classification structures, accommodating a variety of project delivery and operations methods: all include the need to systematically address where information belongs to achieve true interoperability.

The images in **FIGURE 1** (on page 27) show mechanical, electrical, and plumbing specifications. The top set shows the Construction Specification Institute (CSI) MasterFormat 2004 (MF2004) Divisions 21 Fire Suppression, 22 Plumbing, 23 HVAC, 26 Electrical, 27 Communications, 28 Electronic Safety and Security. The bottom shows a case where, even though MF2004 numbers were assigned, the author was still thinking in MF1995 where 3 Divisions were used: 13 Special Construction, 15 Mechanical, 16 Electrical.

Today, all participants in the built environment keep up with classification systems to file away and find information. Updates are necessary to keep up with distinctions between subject matters. For example, plumbing and HVAC needed their own Divisions 22 and 23 rather being crammed together in 15. Like a load calculation for occupancy where one 200 pound person is not the as same as two 100 pound people, HVAC and plumbing have their own personalities and requirements and are better off apart. Nevertheless, surveys indicate a large number of people still cling to 5-digit MF1995.

Today, information exchange about the built environment follows a typical pattern of development and execution. Once the owner's requirements have been decided as shown and specified in the construction documents by architects and engineers, there is no reason to keep all of the background information leading to the final design. It is proposed that the minimal hand over documentation from architects and engineers should be well formatted, clean and should have easily accessible indices to other documents such as the list of drawings, table of contents and schedules (doors, partitions, finishes, equipment, and commissioning). The contractor adds more information, also purging potential information that was not realized.

The Construction Operations Building Information Exchange (COBIE) will simplify this process. The architect specifies a set of performance requirements, delivers a schedule of every space classified a standard way, and a basic building model with a schedule of known clashes, for example pipes hitting beams. Through the typical submittal process, the contractor can easily document compliance with the specifications while inputting installed products, warranties, parts lists, and sequences of operations and maintenance to fill buckets where this information belongs, without ever duplicating any of these records. This is a marked departure from today. Ultimately the owner, occupants, and authorities having jurisdiction (AHJ) will keep information alive on an as-needed basis. Ideally using only real, up-to-date information systematically organized to ensure plans or options that were not implemented do not clutter up widely exchanged records.

But where do you file and find this information for broad exchange? **FIGURE 2** (below) shows a partial map between the MasterFormat, UniFormat, OmniClass and relevant standards, contract document forms, and existing knowledge sources about concrete, masonry and metals. It uses Excel colors: indigo are typically sections for new high rise construction. Light orange needs definition. Brown is UniFormat mappings provided by Mark Kalin, President of Specification Consultants in Independent Practice (SCIP). Blanks are not filled in yet.

Figuring out where materials and systems belong across classification schemes may seem

OCCS Number	OCCS Name	UniFormat Number	UniFormat Name	MF2004 Number	MF2004 Name	Standard 1	Standard 2	Standard 3
21 41 31	Superstructure & Enclosure	B1010	Floor Construction	03 31 00	Structural Concrete	Portland Cement: ASTM C150 Course Aggregate: ASTM C33 Fine Aggregate: ASTM C33 Air-Entraining: ASTM C260		
		B2010	Exterior Walls	03 33 10	Architectural Concrete			
		C2020	Finishes	03 35 00	Concrete Finishing			
21 41 31	Superstructure & Enclosure	B1010	Floor Construction	03 38 00	Post Tensioned Concrete	ACI-318	Post Tensioning Institute PCI	
		A1010, A2020, B1010, B2010, C1010,	Exterior Walls	03 40 00	Precast Concrete	Compression Test ASTM C31 and C39. Air Content ASTM C173. Unit Weight ASTM C567.	PCI Precast / Prestressed Concrete Institute	Slump: ASTM C143
21 14 31 19	Bearing Wall Construction			04 00 00	Masonry	BIA Brick Industry Association		
				04 10 00	Masonry Mortar	ASTM C109 Compressive Strength of Type 5 block and brick motar	ASTM C1019 Compressive Strength Test: For Grout Used in Masonry	ASTM C 136 Sieve analysis of aggregate used for mortar and grout
				04 20 00	(Facade) Unit Masonry			
21 41 71 11	Other Interior Construction	C1010	Interior Partitions	04 20 00	Unit Masonry	IECC 505.2.1 part of an egress pathway		
21 41 51	Enclosure	B2010	Exterior Walls	04 40 00	Stonework	ASTM E109 Magnetic Particle Inspection	AWS D1.1 Ultrasonic Inspection	ASTM C97 density, __ pounds per CF; ASTM C97 absorption by weight,__ %; ASTM C170 compressive strength __PSI; ASTM C880 Flexural strength, __PSI; ASTM C241 abrasion resistance, __
				04 72 00	Cast Stone			
				05 05 13	Shop-Applied Coating for Metal			
21 14 31 19	Bearing Wall Construction	B1010, B1020,	Roof Construction	05 12 00	Structural Steal Framing	AISC Structural Joints using ASTM A325 or A490 Bolts	AWI American Welding Society Inc.	ASTM Steel - Structural Reinforcing Pressure Vessel, Railway
21 41 31	Superstructure & Enclosure	B2010	Exterior Walls	05 12 13	Architecturally Exposed Structural Steel			
				05 20 00	Metal Joists			

Figure 2.

relatively straightforward. Looked at in detail however, multiple UniFormat classes for one MasterFormat class or vice versa are evidence that the same materials can serve multiple functions in the same facility. Special relationships between OmniClass tables are able to extend facility, material, and system descriptions even further. Ideally pointing to or calling up any item using one class, someday will be able to be toggled into other classes automatically, based on what you are looking for and how you are looking for it.

Knowing where information belongs for multi-descriptive filing and access becomes more important the more information is shared. Relationships between materials, assemblies, systems, performance requirements, use groups, services, facility types, local jurisdictions, and regions get intertwined and complex very quickly. Assuming reliable data structures can eventually be designed and built to transcend individual projects, machines, and programs—anyone should be able to find anything beginning at any starting point. On the down side, if an item is misclassified, it will be lost.

If building data could live in a unified framework with predefined semantic relationships all around all the places where data belongs, it gets tricky trying to figure out where the American Institute of Architects General Conditions (A201) and MF Divisions 00 Procurement and 01 General Requirements fit or what benefit "the front end" serves after a design is constructed.

As soon as a building is occupied, the design documents are no longer suitable to describe a building as well as the building itself does. Precisely where and how should typical contracting documents be reflected in open exchange standards to be specifically compressed or deleted when a project changes hands? A partial map of this area is show in **FIGURE 3** (below). Additional colors include Lime for COBIE and Blue-Gray for the Organization for Structured Information Standards (OASIS) Open Building Information Exchange (OBIX).

Figure 1.

The reason for organizing, cleaning and eliminating as much information as possible is the ability to learn only the steps and standard parts you need to tap into one reliable system from any point of vew. An ideal example from the International Framework for Dictionaries (IFD) can be found at **http://dev.ifd-library.org/index.php/Ifd:IFD_in_a_Nutshell**. The image was created by Lars Bjørkhaug, Senior Scientist at SINTEF Building and Infrastructure, and was provided courtesy of Håvard Bell PhD at the IFD, where the essential rule is "a concept can only exist once! There are no duplicates!" An ultimate IFD stores multiple classification systems and ontologies in its structure. Defining and sharing these structures is a new form of ontology, architecture, engineering, ownership, and manufacturing.

Knowing and distributing the context of where information belongs will help fine tune and substantially reduce the amount of information being archived or exchanged. If standard definitions, references, and typical placeholders can be applied "outside of" or "underlying" building information models and project specifications, the building itself can serve as an interface to up-to-date information stored and maintained elsewhere, referenced only as needed, ideally highlighting changes or updates since existing documents were frozen in time. ■

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OCCS Number	OCCS Name	UniFormat Number	UniFormat Name	MF2004 Number	MF2004 Namer	Standard 1	Standard 2	Standard 3
36 21 24 11	Project Management Information			01 50 00	Temporary Facilities and Controls			
				01 60 00	Project Requirements	IAI Design Object Library	LEED Materials and Recycling Points	
36 15 34 35	Property Rights			01 61 13	Software Licensing Requirements	AIA C106 Digital Data Licensing Agreement	ISO 35.100 Open Systems Interconnection	GeoDRM Geospatical Digital Rights Management Reference Model
36 21 24 11	Project Management Information			01 70 00	(Model) Execution Requirements	GeoDRM Geospatical Digital Rights Management Reference Model	IETF Internet Engineering Task Force	
				01 73 00	(Facility) Execution			
		Z1040	Project Closeout	01 77 00	Closeout Procedures	COBIE Construction Operations Building Information Exhange	AIA G704-2000 Certificate of Substantial Completion	
36 11 31 00	Calendars			01 78 00	Closeout Submittals		NIST National Institute of Standards and Technology	AIA G808-2001 Project Data
36 21 24 11	Project Management Information			01 78 23	Operations and Maintenance Data		OBIX Open Building Information	Fiatech and NIST Traceability
36 24 11 00	Record Documents			01 78 39	Project Record Documents	NBIMS National BIM Standard	IAI Internationa Alliance for Interoperability	ISO/IEC 11179, Information Technology
36 21 27 00	Facility Operation Information	Z1020	Procedural General Quality Requirements	01 79 00	Demonstration and Training	COBIE Construction Operations Building Information Exchange		
21 41 31	Superstructure & Enclosure			01 80 00	Performance Requirements	IECC 505 true/false interior or exterior space	IECC 505.21 space to be for	
36 21 24 17	Construction Techniques Information	F1030	Special Construction Systems	01 80 01	Building Service Performance Requirements	OBIX Open Building Information Exhange	DGIWG Digital Geospatial Information Working Group	36 21 27 00 Facility Operation
36 21 17 17	Sustainable Design Information	Z1020	Procedural General Quality Requirements	01 81 13	Sustainable Design Goals	USGBC LEED Scorecard		
		Z1020	Procedural General Quality Requirements	01 81 19	Indoor Air Quality		OBIX Open Building Information Exchange	
		Z1040	Project Closeout	01 90 00	Life Cycle Activities	COBIE Construction Operations Building Information Exchange	OSCRE Open Standards Consortium for Real Estate	OGC Onservations and Measurements Standard

Figure 3.