A Cradle-t

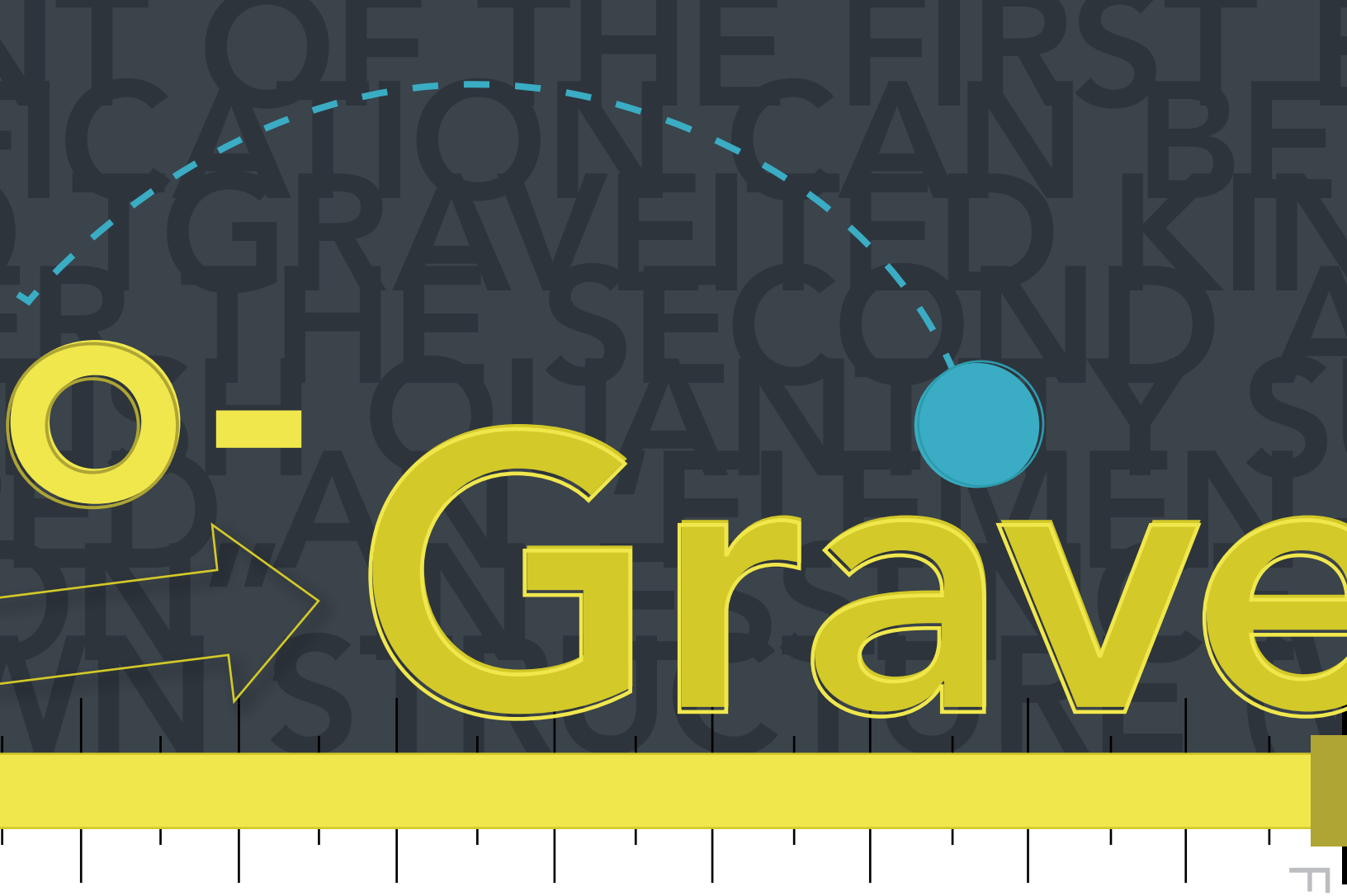
Start

Integrate

CLASSIFICATION HISTORY

The development of the first elemental classification can be traced back to the United Kingdom. Soon after the Second World War British Quantity Surveyors developed an "elemental classification," in essence a work breakdown structure (WBS) to provide cost containment as a result of the accelerated construction of post war and expansion boom.

From the British Ministry of Education, the methodology overlay was exported to other Commonwealth countries such as Canada, South Africa, and Australia, which all adapted the classification modified to fit their needs. The United States imported the economic measure from Canada, in the 1970s, which resulted in the adoption of the UNIFORMAT classification by the American Institute of Architects (AIA) and the U.S. General Services Administration (GSA). The general Uniformat I classification for the United States was then adopted and developed by the General Services Administration (GSA) and the American Institute of Architects (AIA) in 1972 intended for use as an economic estimating and design cost analysis.



o-Grave

ed Approach to Using UNIFORMAT II

Finish

By Richard C. Schneider and David A. Cain

INTRODUCTION TO UNIFORMAT II

The ASTM E1557/ UNIFORMAT II standard is a three-level, function-oriented classification which links the schematic phase Preliminary Project Descriptions (PPD), based on Construction Standard Institute (CSI) Practice FF/180, to elemental cost estimates based on R.S. Means Cost Data. With the UNIFORMAT II Standard Classification for Building Elements and Related Site work, stakeholders (owners, operators, design professionals, contractors) can effectively start adding value engineering (V.E.) to the process earlier, at the schematic design phase of a project - before irreversible decisions are taken and numerous cost-saving opportunities lost. The information in the UNIFORMAT II Preliminary Project Descriptions and elemental estimates now make it possible for Managers to integrate at the schematic phase: energy simulation, life-cycle costing, risk analysis, elemental preliminary construction schedules and cash flow projections, operations and maintenance (O & M) budget forecasts, and evaluations for the United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Green Certification program.

The new and enhanced four level version of UNIFORMAT II was released in 1993 by American Society for Testing and Material (ASTM). This effort was developed by a joint task force including GSA, Construction Specifications Institute (CSI), R.S. Means, Tri-Services, and the Center for International Quality Standards (CIQS). In essence it was refined around a "holistic" life-cycle approach or cradle-to-grave concept.

This article presents one such approach for both Higher Education and one of the most progressive asset management governmental agencies, the U.S. National Park Service (NPS). Since higher education is not a single agency and a bit like herding cats, the following article makes a compelling argument to adopt this integrated approach from planning through to construction, operations and demolition. (Figure 1.1) below illustrates the typical five phases of the Building Life Cycle. UNIFORMAT II currently integrates and overlays all five phases.

Elements are traditionally defined as "major components, common to most facilities that serve a given function, regardless of the design specification, construction delivery method, or materials used. In practice, an element can be considered any logical component of a Work Breakdown Structure (WBS) such as the foundation and roof of a building. From the facilities professional and project management perspective, the UNIFORMAT II classification is the ideal WBS for the economics of the design phase of a construction project to control scope, cost, quality, and time.

The classification has other practical applications for the facilities professional when standardized tracking, monitoring and reporting is desirable during the design, construction, and operational life of buildings. These include:

- Design-Build performance specifications and cost assemblies
- Developing function/cost models for value engineering from elemental estimates
- A checklist for brainstorming alternatives during the creativity phase of value engineering
- Facility (asset) management, inventory, and condition assessment
- Life-cycle costing and capital replacement budgeting
- Preliminary construction schedules and cash flow projections

NATIONAL PARK SERVICE

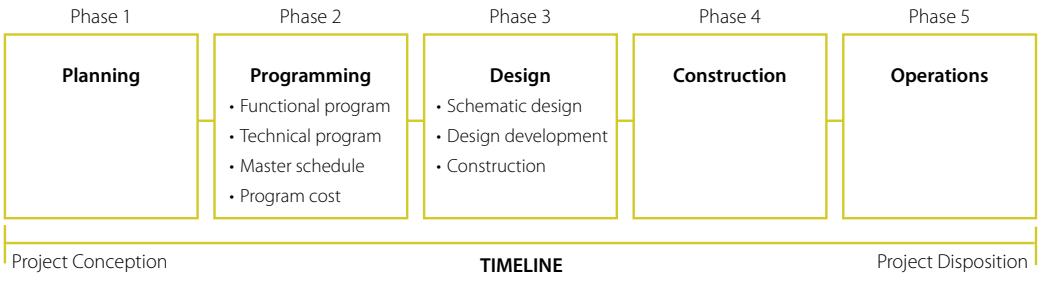
The U.S. Department of Interior's (DOI) National Park Service (NPS) is responsible for the management of 391 park units, which include many of the most recognizable and notable built facilities and natural and cultural resources in the U.S. Among many others, these include the likes of Independence Hall, the Statue of Liberty, and the Washington Monument.

The NPS asset portfolio includes more than 27,000 buildings, 8,500 monuments, over 16,000 miles of trails, some 1,200 water systems, about 1,400 wastewater treatment plants, and more than 4,000 employee housing units. Many of these assets are heritage assets, which have historic or cultural significance that not only support DOI's mission, but also are part of the NPS core mission.

UNIFORMAT II

The capability to link the life-cycle elements of a facility or asset through an industry standard classification system results in multiple benefits to the facilities professional. UNIFORMAT II provides a work breakdown structure that can be used to seamlessly link an asset to associated equipment, equipment to the inventory and condition assessment process and facility condition assessments to cost estimating. The NPS has used a cost estimating industry guideline to improve a facilities professional's ability to inventory assets and equipment, as well calculating the life-cycle costs for all significant facilities investment decisions.

Figure 1.1 Five Phases of the Building Life Cycle



UNIFORMAT II is a format for classifying building elements and site-work. It enhances project management and reporting at all stages of the building life cycle, programming, design, construction, operations, and disposal. The expanded version of the UNIFORMAT II classification system includes new elements and expanded descriptions, including a fourth level in the work breakdown structure (Figure 1).

Figure 1

L1	L2	L3	L4	Uniformat II Work Breakdown Structure
G	BUILDING SITEWORK			
	G20	SITE IMPROVEMENTS		
		G2010	ROADWAYS	
			G201001	BASES & SUBBASES
			G201002	DRAINS, INLETS, CURBS & GUTTERS
			G201003	PAVED SURFACES
			G201004	MARKING & SIGNAGE
			G201005	GUARDRAILS & BARRIERS
			G201006	RESURFACING
			G201099	OTHER ROADWAYS

Figure 2

Work Categories	
1000	Roads
2000	Trails / Walks
3000	Grounds
4000	Buildings
5000	Utilities
6000	Waterways / Aviation /Railroad
7000	Unique Assets (Fortifications, Memorials etc.)
8000	Support
9000	Administrative

Figure 3

Asset Code	WBS Component
1100 - Roads	G2010
1300 - Parking Area	G2020
1700 - Road Bridge	G9090
1800 - Road Tunnel	G9092
2100 - Trails	G2030
3100 - Maintained Landscapes	G2050
3600 - Campground	G2060
4100 - Building	A10
5100 - Water System	G3010
5200 - Waste Water System	G3020
5400 - Electrical System	G4010

One way of estimating facility life-cycle costs is to perform detailed quantity takeoffs for all materials and tasks associated with the construction, operation, and maintenance of the facility. Master Format 95™, a classification that is based on products and materials, is a logical format choice when preparing detailed cost estimates. But a cost estimate prepared using a format based on a listing of products and materials is time consuming, costly, and inappropriate at the early design stages. Estimates based on an elemental classification such as UNIFORMAT II provide the necessary cost information for the analyst to evaluate building alternatives in a cost-effective manner.

NPS WBS IMPLEMENTATION

The work categories shown below provide the framework for identifying the asset types that are managed by the NPS (see Figure 2.)

For example, the 5000 Utilities work category is the primary classification for Water Systems, Waste Water Systems, Electrical Systems, Radio Systems, Phone Systems, and IT Systems. This hierarchical system is similar to the UNIFORMAT II WBS and provides the front-end linkage of assets to its associated equipment. The next step was to make a connection between the NPS asset code and the UNIFORMAT II WBS. This linkage is shown in Figure 3, which represents only a portion of the total number of asset codes and their WBS components.

In many cases, the NPS created a new WBS component based on the official UNIFORMAT II WBS list. Figure 4 shows a partial list of WBS sub-components for Buildings at the fourth level.

The NPS made a connection between an asset and its equipment through the UNIFORMAT II work breakdown structure. The next step in this process was to use the classification system to establish an annual, comprehensive or life-cycle condition assessment link to the asset (WBS component) and its equipment (WBS sub-component). The Department of the Interior, which includes the National Park Service, is moving toward standard computerized maintenance management software (CMMS) for all of its bureaus.

Figure 4 (Buildings WBS; Partial List)

A10	ST	Buildings	
A1010	S1	SF	Foundation - Standard
A1020	S1	SF	Foundation - Special
A1030	S1	SF	Foundation - Slab on Grade
A2020	S1	SF	Basement Walls
B2010	S1	SF	Exterior Walls
B2020	S1	EA	Exterior Windows
B2030	S1	EA	Exterior Doors
B3010	S1	SF	Roof Covering
B3020	S1	EA	Roof Opening

Figure 5

Work Order	459778	CA-Water, 08-502 Requa Water System		WO Priority	5
Location/Asset	13255	Water System, Requa 08-502		Loc/Eq Priority	
Equipment/Feature				Equipment Up?	
Reported By	CHENSEL	Reported by Date	5/26/04		
WO Status	CLOSE	WO Status Date	8/24/04	**Work Type**	FM
GL Account				**Sub Type**	INCAA
WBS Component				**Park Alpha Code**	REDW
Sub Component					

Job Details		Park Planning	Problems/ Follow-up Work	
Plan Type	CA		**Work Category**	5000
Job Plan	1222		Work Activity	
Safety Plan			Problem Code	
PM	2319		Originating WO	

Figure 6

Work Order	459781	CA-Water, 12-502 Lane Ranch Water System	Status	CLOSE

Operations

OP	Description	WBS Code	Done?	Deficiency (Y,N)
10	WELL SYSTEMS / WATER SOURCES	G301001	N	
20	POTABLE WATER DISTRIBUTION	G301002	N	
30	POTABLE WATER STORAGE	G301003	N	
40	FIRE PROTECTION WATER DISTRIBUTION	G301004	N	
50	FIRE PROTECTION WATER STORAGE	G301005	N	
60	NON-POTABLE WATER DISTRIBUTION	G301006	N	Y

Figure 7

Work Order	498296	Repair water line FY04		WO Priority	5
Location/Asset	13255	Water System, Requa 08-502		Loc/Eq Priority	
Equipment/Feature	115297	Pipe, Galvanized, 400 LF,1.5 IN		Equipment Up?	Y
Reported By	CHENSEL	Reported by Date	7/19/04		
WO Status	WACOST	WO Status Date	8/16/04	Work Type	FM
GL Account		Warranty Date		Sub Type	DM
WBS Component	G3010	Quantity	1,500		
Sub Component	G301002	Measurement Unit	LF	Park Alpha Code	REDW

Job Details		Park Planning
Plan Type	CA	
Job Plan	1222	
Safety Plan		
PM	2319	

Work Order	498296	Repair water line FY04
Location / Asset	13255	Water System Requa 08-502
Equipment/Feature	115297	Pipe, Galvanized, 400 LF, 1.5IN
Totals		
CESS Estimate		

CREATING CONDITION ASSESSMENT WORK ORDERS

Generation of a Condition Assessment Work Order is required prior to conducting the condition assessment inspections. This requirement standardizes inspections throughout the NPS by creating a work order and associated Condition Assessment (CA) Job Plan against which identified deficiencies can be reported and costed for each asset.

The Condition Assessment Work Order includes the CA Job Plan for Water Systems and Preventive Maintenance application record with a frequency of one year and a start date for the inspection (Figure 5).

The Condition Assessment Job Plan for a "Water System" (CA 1222) includes inspection steps, each with a WBS subcomponent and description as shown in Figure 6.

In addition to the CA Job Plan, an inspection guidance document with the same WBS sub-components was created for a Servicewide level of consistency and systematic process for conducting condition assessments. The primary components and sub-components for assets other than Buildings are found in Uniformat *G30 Site Mechanical Utilities*, while other support systems are found in *G20 Site Improvement* and *G40 Site Electrical Utilities*.

If a deficiency is identified during the condition assessment inspection (as shown in Figure 6) a follow-up work order is created that describes the deficiency in detail with quantities and other information required to estimate the cost of the corrective action.

ENSURING CONSISTENCY IN THE EVALUATION OF TRACKING AND MONITORING THE FINANCING OF BUILDING PROJECTS OVER TIME IS ESSENTIAL FOR ANY SUCCESSFUL PLANNING DESIGN AND CONSTRUCTION UNIT WITHIN THE ACADEMY OF EDUCATION.

LINKAGE TO COST ESTIMATING SOFTWARE SYSTEM (CESS) ESTIMATE

The Cost Estimating Software System (CESS) Estimate "button" in the NPS CMMS provides a direct link to the Timberline™ Estimating Tool (Figure 7). Since NPS Facilities professionals are not cost estimators, assemblies were constructed to assist the person preparing a cost estimate. An assembly is a collection of items used in performing a specific repair. For example, if 400 feet of galvanized pipe must be replaced, the estimate should include the excavation of the pipe, bedding repairs, pipe replacement, fill and compaction of the trench. The assembly cost data is indexed based on a modified version of UNIFORMAT II. Figure 8 shows the UNIFORMAT II WBS being used as the front-end of CSI Masterformat Specification.

The cost assemblies make it easier to prepare an accurate estimate but also complete the process of linking an asset to its associated equipment. By including UNIFORMAT II WBS subcomponents in the condition assessment process, it makes it possible to use this coding to reference an equipment deficiency to the corresponding cost assemblies in the Timberline™ database.

APPLICATION FOR HIGHER EDUCATION

Ensuring consistency in the evaluation of tracking and monitoring the financing of building projects over time is essential for any successful planning

Figure 8

CESS NPS Assemblies - Uniformat 1998 Specification (Modified)				
Uniformat Level	CESS	Example		
Level 1	Group Assembly	B	**********SHELL**********	
Level 2	Group Assembly	**B30**	**ROOFING**	
Level 3	Group Assembly	B3010	**ROOF COVERINGS**	
Level 4	Assembly	B3010-010	Roof, Built Up Roofing System, Inspect membrane & remove debris	
A	**********SUBSTRUCTURE**********			
A10	***FOUNDATIONS***			
A1010	**STANDARD FOUNDATIONS**			
A1010-005	Foundations, Concrete Wall Footing			CY
B	**********SHELL**********			
B10	***SUPERSTRUCTURE***			
B20	***EXTERIOR ENCLOSURE***			
B2010	**EXTERIOR WALLS**			
B2010-005	Log Structure, Chinking Between Joints			
B30	***ROOFING***			
B3010	***ROOF COVERINGS***			
B3010-010	Roof, Built-Up Roofing System, Inspect membrane & remove debris			Msf
B3010-012	Roof, Built-Up Roofing System, infrared moisture inspection			Msf
B3010-014	Roof, Built-Up Roofing System, minor membrane repair			Sq
B3010-020	Roof, Single Ply Thermoplastic (PVC), inspect & remove debris			Msf

USING **UNIFORMAT II** HAS A SIGNIFICANT **BENEFIT OF PERFORMING** AN ECONOMIC ANALYSIS BASED ON AN ELEMENTAL FRAMEWORK INSTEAD OF ON A PRODUCT-BASED CLASSIFICATION IS THE **REDUCTION IN TIME AND COSTS** FOR EVALUATING ALTERNATIVES AT THE EARLY DESIGN STAGE. THIS **ENCOURAGES** MORE ECONOMIC ANALYSES AND **MORE EFFICIENT** CHOICES AMONG BUILDINGS AND ELEMENTS.

design and construction unit within the academy of education. Higher education continues to look for enhancements for better reporting project management tools at all stages of the building life cycle, planning, programming, design, construction, operations, and disposal.

Using UNIFORMAT II has a significant benefit of performing an economic analysis based on an elemental framework instead of on a product-based classification is the reduction in time and costs for evaluating alternatives at the early design stage. This encourages more economic analyses and more efficient choices among buildings and elements.

Other UNIFORMAT II benefits include providing a standardized format for collecting and analyzing historical data to use in estimating and budgeting future projects; providing a checklist for the cost estimation process as well as the creativity phase of the value engineering job plan; providing a basis for training in cost estimation; facilitating communications among team members regarding the scope of work and costs in each discipline; and establishing a database for automated cost estimating.

The following highlights the benefits of applying UNIFORMAT II in design specifications, cost estimating, and cost analysis. A proposed summary sheet for presenting building and site work elemental costs with cost analysis parameters provides an efficient tool for communicating economic information to decision makers in a quickly understood, concise format that helps them make project choices. Owners, developers, programmers, cost planners, project managers, schedulers, architects and engineers, operating and maintenance staff, manufacturers, specification writers, and educators will find the classification useful.

SUMMARY FOR UNIFORMAT II (ASTM STANDARD E1557 AND CSI PRACTICE FF/180)

Today, elemental classifications are utilized primarily for design estimates. In the U.S., the GSA, DOI, and the military services have been the main proponents of UNIFORMAT. There has also been an increasing number of state public works and education departments call for it as mandatory. The academy of higher education has yet to adopt UNIFORMAT II, as a standard format. Additional applications for UNIFORMAT II have been developed and embedded into design-build, construction management at risk performance specifications, facilities technical programs requirements, building condition assessment, many recent software tools, and capital replacement budgeting.

With ASTM and CSI supporting the use of UNIFORMAT in North America, it is anticipated that the classification will gain widespread acceptance and save the construction industry significant sums of money resulting from the use as the industry gold standard.

UNIFORMAT II, by all measures, is the new standard and asset life-cycle project management tool for all facilities professionals, particularly the federal government and higher education. UNIFORMAT II adds the depth of elemental classification for building specifications, cost estimating and analysis. UNIFORMAT II provides the structure in cost information necessary to initiate life cycle costing, energy analysis, and value engineering studies from the beginning stages of the design process, i.e., schematic design.

Lack of these elements has always been major obstacles to an effective and comprehensive methodology. Today, NPS has positioned itself to become a public sector leader in managing its diverse asset portfolio and infrastructure. This article has attempted to illustrate first, how the NPS has embedded UNIFORMAT II in its Asset Management Plan and the merits of its work breakdown structure.

Rich Schneider recently retired as an asset management specialist for the National Park Service, Prescott, AZ. This is his first article for *Facilities Manager*, and he can be reached at *richbarb@cableone.net*. David Cain is associate vice president for facilities planning and operations at California State University-East Bay; he can be reached at *david.cain@csueastbay.edu*.