



PDHonline Course G290W (4 PDH)

An Introduction to Building Design Specifications and Tools (Live Webinar)

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**BUILDING DESIGN
SPECIFICATIONS AND TOOLS**

Paul Guyer, P.E., R.A.

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Overview

This course will introduce you to the most important resource available to engineers and architects engaged in the design of buildings and related infrastructure. It represents the collective knowledge of thousands of engineers and architects over the past century. It will provide you with design guidance based on building and space types, design disciplines and objectives, and products and systems. It will provide you project management resources focused on project delivery teams, project planning and development, building commissioning, and project delivery and controls. You will have a single, easy-to-access source for operations and maintenance guidance, and exceptionally useful reference materials and tools. This is hands-on information that is easy to access and use that has been proven over-and-over on thousands of projects from small and routine to enormous and unique. You will learn how to quickly access and navigate this resource and put it to work for you on your next project. And....it is free!

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The presenter is....

J. Paul Guyer, P.E., R.A.

Registered Mechanical Engineer, Civil Engineer, Fire Protection Engineer and Architect with 47 years experience, 35 being in design of buildings and related infrastructure involving daily use of building design specifications and tools. 17 years were with the State of California designing very large facilities for the State Water Project and small to medium size facilities for the State Park System. 18 years were as founder and head of a private architectural engineering firm designing small to medium size projects for government and private clients in the Pacific region. An additional 9 years were in a senior staff position with the California Legislature, and the last 5 years have been as an independent consultant on infrastructure, professional affairs, and California state government relations.

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The foundation for this presentation is an understanding of the fact there are two types of knowledge we use in designing and managing the construction of buildings and related infrastructure:

- Theoretical**
- Experiential**

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Theoretical Knowledge

The theoretical knowledge we use is what we learned in engineering school, essentially the laws of applied physics (Bernoulli's equation, the laws of statics and dynamics, conservation of momentum, $F=ma$, the Second Law of Thermodynamics, etc.).

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Experiential Knowledge

Experiential knowledge is what we have learned, or been informed about by others, through on-the-job experience (100 sf space allowance per occupant for office space, 1/4"/ft slope for drainage piping, 10 air changes per hour for restroom ventilation, etc.).

This course is about accelerating your **experiential knowledge**. You will learn from the millions of hours of experience of many thousands of engineers and architects over the past hundred years. You will learn about an accessible and easy-to-use resource that brings this information together and provides you with proven design and construction guidelines, standards and tools to use immediately in your day-to-day project design. This type of resource was not available ten years ago; it truly provides a new dimension to our enterprise....designing and managing the construction of buildings and related infrastructure.

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What you will get from this course...

This course will introduce you to a resource that will immediately put at your disposal the collective **experiential knowledge** of thousands of engineers and architects gained on thousands of large and small building and infrastructure projects over the past hundred years.

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Some historical perspective....

Up until the 1980s the only method of preserving and passing on **experiential knowledge** about design of buildings and related infrastructure was print media: books, manuals, reports, monographs, etc. In the 1980s computers provided some additional facility in accessing and utilizing experiential knowledge, but it was not until the 1990s and development of the internet that there was a quantum leap in the ability to store, access and utilize experiential knowledge.

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Some historical perspective....

There are few that would disagree with the premise that the federal government is the repository of the largest institutional body of experiential knowledge about the design and construction of buildings and related infrastructure.

In the mid-20th century the federal government began in an organized way to preserve this knowledge using the rudimentary media that existed at the time....such as hard-copy books, manuals and reports....and essentially only for its internal use. The agencies that were most active in this undertaking were those with major design and construction programs such as the War Department (predecessor, of course, of the Department of Defense), the Tennessee Valley Authority and the Bureau of Reclamation.

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Some historical perspective....

During the second world war and the "cold war" era the Department of Defense (DOD) had an on-going requirement for design and construction of defense infrastructure including countless relatively conventional buildings. This exigency accelerated DOD's commitment to preserving its experiential knowledge about designing buildings and related infrastructure in the form of design manuals, criteria and guide specifications. Unfortunately this effort was undertaken rather parochially (i.e. the Army was not exchanging information with the Navy, etc.), was primarily for intra-agency use, and the knowledge base was only available in hard-copy media such as books, manuals, and reports....none of which were easily accessible....and especially not to those outside the DOD community (employees and contractors).

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Some historical perspective....

In the 1990s the DOD agencies, and other federal agencies such as the General Services Administration (GSA) and the Veterans Administration (VA), began to break down some of their parochial barriers, exchange information, and develop "unified" design manuals, criteria and guide specifications.

The access technology, however, had not yet reached the "internet" level. Storage, access and distribution had moved beyond the "hard copy" media but electronic media was limited to compact disc (CD) technology. Also, there remained a cultural view that this experiential knowledge was proprietary to the federal government, basically just for intra-federal-agency use, and not "in-the-public-domain."

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Some historical perspective....

At this time DOD (and other federal agencies) took the first step toward sharing this experiential knowledge with the professional public. The federal government provided electronic files of its knowledge base to the National Institute of Building Sciences (NIBS), a quasi-federal/public entity that is largely federal funded. NIBS organized the federal experiential knowledge base into the "Construction Criteria Base" which it offered for sale, in CD format, to the professional public. Initially NIBS's sale price was a bit on the high side. Also, since this experiential knowledge base is constantly changing, there was the additional hurdle and cost associated with the professional public having to order (and pay for) updated CDs.

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Some historical perspective....

The explosive emergence of internet-technology in the late 1990s-early 2000s provided an opportunity to greatly improve access to this experiential knowledge and, to its credit, the federal agencies and NIBS recognized that this experiential knowledge base (having been funded by the public) was in the public domain. The result has been the creation of an internet portal called the **Whole Building Design Guide (WBDG)**.

The reduction in federal agency parochialism together with the accessibility offered by internet technology has resulted in the availability of a very valuable internet-based experiential knowledge resource available to the professional public....**and it is free.**

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Some historical perspective....

In its current state of development, the WBDG has elements that are very valuable to the building design practitioner, elements that are not so useful, and elements that definitely need more work.

The purpose of this presentation is to:

- (a) familiarize you with the WBDG, and
- (b) Point you to those elements that will be most useful to you **today.**

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Now, let's look at what, I believe, is an enormously valuable base of experiential knowledge available to the building and infrastructure design and construction community: It is accessed through the internet portal....

WHOLE BUILDING DESIGN GUIDE
National Institute of Building Sciences
WWW.WBDG.ORG

....and it is free.

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**WHAT IS THE
 WHOLE BUILDING DESIGN GUIDE (WBDG) ?**

It is....

- an internet portal
- an easily accessible internet-based source of the **experiential knowledge** of thousands of engineers, architects and construction professionals garnered over more than 100 years and tens of thousands of projects.
- reflective, primarily, of the most experienced building and infrastructure design and construction institution in the world....the U.S. federal government.
- an compilation of design and construction guidance, detailed specifications, and computer based tools and CAD details that are up-to-date and ready for use on projects today.
- continuously updated and revised by design and construction professionals to reflect changes in building and infrastructure design and construction methods and materials.

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Before we begin, let me offer a few comments....

First, do not make the mistake of assuming this **experiential knowledge** base is "federal" and therefore not useful "in the real world." This is most definitely not the case. This is an engineering knowledge base that is absolutely applicable across the entire spectrum of building and infrastructure projects your company or agency will encounter.

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A few comments....

Second, do not assume that because it is a federally generated knowledge base that it is "excessively complex and bureaucratic." Again, this is not the case. Candidly, building design and construction is a complex undertaking and a knowledge base for this enterprise must inherently reflect that complexity...but the WBDG is not *excessively* complex. And, although you will see the names of federal agencies extensively throughout the base, you need to simply look past them to the substantive guidance provided.

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A few comments....

Third, a very important factor in appreciation of resources accessible through the WBDG is that it is a "living" base of experiential knowledge that is continually updated and refined by engineers and architects working daily on real projects. This is the only knowledge base I am aware of that has this real-time/real-world aspect. There are information resources in the professional community that may parallel some components in the WBDG, but they are....to my knowledge....all produced by volunteer committees and updated only episodically. This is not to depreciate their importance in professional practice, but I simply think they lack the timeliness and proven utility of the federal Experiential Knowledge accessible through the WBDG portal. The manner in which the WBDG is generated also avoids the possibility of inappropriate influence exerted by vendors in the development of design and construction guidance.

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A few comments....

Fourth, do not mistake the WBDG as being a stilted "cook book" approach to building design. Not too long ago I was discussing the WBDG with a very well qualified and experienced mechanical engineer and he somewhat deprecatingly said he did not approve of "...a cook book approach to building design." The WBDG is not a cook book; it provides *guidance* that is always to be evaluated and tempered by professional judgment. Although it may seem less useful to a very well qualified and experienced engineer or architect, we need to recognize that we have many engineers and architects with lesser levels of qualification and experience employed in our companies and agencies who will find the type of guidance the WBDG provides very helpful.

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A few comments....

Fifth, do not dismiss the WBDG as a resource for you because your company or agency uses a "design-build" construction delivery process. If a company or public agency does not include design and construction criteria in its contract with a design-build contractor, it will have little control over the quality of the work. The WBDG provides a comprehensive universe of design and construction criteria that can be incorporated *by reference* into a contract between a company/public agency and a design-build contractor.

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A few comments....

And finally, there are components and modules of the WBDG that I believe are particularly useful, and others that...in their current state of development....are less so. To help you focus quickly on the best resources, topics of particular importance and utility will be designated with a ★.

Exceptionally useful features get ★★.

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Here is what you see when you go to the opening page at www.wbdg.org ➡

(As we move through this presentation...when you see the move from the PowerPoint slides to the www.wbdg.org web site.) ➡

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This tool bar reflects the basic structure of the WHOLE BUILDING DESIGN GUIDE

- ★ □ DESIGN GUIDANCE
- PROJECT MANAGEMENT
- OPERATIONS AND MAINTENANCE
- ★ ★ □ DOCUMENTS AND REFERENCES
- ★ ★ □ TOOLS

The CONTINUING EDUCATION and BIM modules are not usefully developed....and so will not be explored in this presentation.

- CONTINUING EDUCATION
- BIM
- APPLIED RESEARCH

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This is the structure of the WBDG DESIGN GUIDANCE module....

- ★ ❖ BUILDING TYPES
 - information organized by type of building or use
- ★ ❖ SPACE TYPES
 - information organized by functional space in buildings
- ❖ DESIGN DISCIPLINES
 - information organized by professional discipline
- ❖ DESIGN OBJECTIVES
 - information organized by design goal
- ❖ PRODUCTS AND SYSTEMS
 - information organized by products and systems

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NOTE, however....


The really good DESIGN GUIDANCE is in:

- ❖ DOCUMENTS & REFERENCES
 - CONSTRUCTION CRITERIA BASE
 - DOCUMENTS LIBRARY
 - DOD CRITERIA
 - ★ ★ ▪ UNIFIED FACILITIES CRITERIA

....which we will visit later.

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Here is what you see when you click the DESIGN GUIDANCE tab...




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This is the structure of the WBDG DESIGN DISCIPLINES module....

- ❖ ARCHITECTURE
- ❖ COST ESTIMATING
- ❖ FIRE PROTECTION ENGINEERING
- ❖ HVAC AND REFRIGERATING ENGINEERING
- ❖ INFORMATION TECHNOLOGIES ENGINEERING
- ❖ INTERIOR DESIGN
- ❖ LANDSCAPE ARCHITECTURE
- ❖ PLANNING
- ❖ PLUMBING ENGINEERING
- ❖ ARCHITECTURAL PROGRAMMING
- ❖ STRUCTURAL ENGINEERING

The information in this module is limited, but may have useful links to other more helpful information resources. Here is a brief look at the types of information you will find here




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This is the structure of the WBDG DESIGN OBJECTIVES module....

- ❖ ACCESSIBLE
- ❖ AESTHETICS
- ❖ COST EFFECTIVE
- ❖ FUNCTIONAL/OPERATIONAL
- ❖ HISTORIC PRESERVATION
- ❖ PRODUCTIVE
- ❖ SECURE/SAFE
- ❖ SUSTAINABLE

The information in this module is limited, but may have useful links to other more helpful information resources. Here is a brief look at the types of information you will find here




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This is the structure of the WBDG PROJECT MANAGEMENT module....

- ❖ PROJECT DELIVERY TEAMS
- ❖ PROJECT PLANNING AND DEVELOPMENT
- ❖ BUILDING COMMISSIONING
- ❖ PROJECT DELIVERY AND CONTROLS

The information in this module is limited, but may have useful links to other more helpful information resources. Here is a brief look at the types of information you will find here




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This is the structure of the WBDG OPERATIONS AND MAINTENANCE module....


- ❖ REAL PROPERTY INVENTORY - Provides an overview on the type of system needed to maintain an inventory of an organization's assets and manage those assets.
- ❖ COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEMS - Contains descriptions of procedures and practices used to track the maintenance of an organization's assets and associated costs.

The information in this module is limited, but may have useful links to other more helpful information resources. Here is a brief look at the types of information you will find here




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Under OPERATIONS AND MAINTENANCE and REAL PROPERTY INVENTORY we see....



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Under OPERATIONS AND MAINTENANCE and COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEMS we see....



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Now let's go to the DOCUMENTS AND REFERENCES tab...and recall that, in my view....this is where exceptionally valuable resources are located....


- ★ DESIGN GUIDANCE
- PROJECT MANAGEMENT
- OPERATIONS AND MAINTENANCE
- ★ ★ **DOCUMENTS AND REFERENCES**
- ★ ★ TOOLS

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This is the structure of the WBDG DOCUMENTS AND REFERENCES module....

- ★ ★ ❖ FEDERAL MANDATES
- ★ ★ ❖ CONSTRUCTION CRITERIA BASE (CCB)
- ❖ PERIODICALS
- ❖ CASE STUDIES
- ❖ PARTICIPATING AGENCIES
- ❖ INDUSTRY ORGANIZATIONS

With the exception of the CONSTRUCTION CRITERIA BASE the information in this module is limited, but may have useful links to other more helpful information resources. Here is a brief look at the types of information you will find here, exclusive of the CCB. We will look at the CCB in detail a little later



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This is the most important component in the WBDG DOCUMENTS AND REFERENCES module and, indeed, in the entire WBDG....

☆☆ ❖ CONSTRUCTION CRITERIA BASE (CCB) - an online collection of guide specifications, manuals, standards and other documents

Here is how it is structured....

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WHOLE BUILDING DESIGN GUIDE

☆☆ ❖ Construction Criteria Base (CCB)

- ☆☆ > Specifications Library
- ☆☆ > Regulations Library
- ☆☆ > Standards Library
- ☆☆ > Documents Library
- ☆☆ > CADD Library
- ☆☆ > Energy Library
- ☆☆ > Environmental Library
- ☆☆ > Sustainable Design Library
- ☆☆ > Tools Library *

* The "Tools Library" of the CCB is presented on the WBDG web site as a separate "tab", and will be discussed in that framework.)

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WHOLE BUILDING DESIGN GUIDE

☆☆ ❖ Construction Criteria Base (CCB)

- ☆☆ > Specifications Library
- ☆☆ > Regulations Library
- ☆☆ > Standards Library
- ☆☆ > Documents Library
- ☆☆ > CADD Library
- ☆☆ > Energy Library
- ☆☆ > Environmental Library
- ☆☆ > Sustainable Design Library
- ☆☆ > Tools Library *

Let's look first at the 5 modules that are of lesser value.... →

* The "Tools Library" of the CCB is presented on the WBDG web site as a separate "tab", and will be discussed in that framework.)

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WHOLE BUILDING DESIGN GUIDE

☆☆ ❖ Construction Criteria Base (CCB)

- ☆☆ > Specifications Library
- ☆☆ > Regulations Library
- ☆☆ > Standards Library
- ☆☆ > Documents Library
- ☆☆ > CADD Library
- ☆☆ > Energy Library
- ☆☆ > Environmental Library
- ☆☆ > Sustainable Design Library
- ☆☆ > Tools Library *

Now a quick look at the CADD Library.... →

* The "Tools Library" of the CCB is presented on the WBDG web site as a separate "tab", and will be discussed in that framework.)

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WHOLE BUILDING DESIGN GUIDE

☆☆ ❖ Construction Criteria Base (CCB)

- ☆☆ > Specifications Library
- ☆☆ > Regulations Library
- ☆☆ > Standards Library
- ☆☆ > Documents Library
- ☆☆ > CADD Library
- ☆☆ > Energy Library
- ☆☆ > Environmental Library
- ☆☆ > Sustainable Design Library
- ☆☆ > Tools Library *

Now we will look at the very valuable SPECIFICATIONS LIBRARY.... →

* The "Tools Library" of the CCB is presented on the WBDG web site as a separate "tab", and will be discussed in that framework.)

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WHOLE BUILDING DESIGN GUIDE

☆☆ ❖ Construction Criteria Base

- ☆☆ > Specifications Library
- ☆☆ > Unified Facilities Guide Specifications (UFGS)
 - NAVFAC Specifications
 - NAVFAC Standard Specifications
 - NAVFAC Guide Performance Work Statements
- ☆☆ > VA Master Specifications
- ☆☆ > DOE General Design Criteria
- ☆☆ > NIBS Specifications

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WHOLE BUILDING DESIGN GUIDE

- ☆☆ ❖ Construction Criteria Base
 - ☆☆ > Specifications Library
 - ☆☆ ■ **Unified Facilities Guide Specifications (UFGS)**
 - NAVFAC Specifications
 - NAVFAC Standard Specifications
 - NAVFAC Guide Performance Work Statements
 - ☆☆ ■ VA Master Specifications
 - DOE General Design Criteria
 - NIBS Specifications

The NAVFAC documents are similar to the UFGS specifications and usually only important on Navy projects. The VA specifications will be useful on health care facilities. We will focus on the Unified Facilities Guide Specifications

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☆☆ UNIFIED FACILITIES GUIDE SPECIFICATIONS

Here is how, in general, the United Facilities Guide Specifications (UFGS) [and related DOD specifications] are structured...

- General
- Products
- Execution

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☆☆ UNIFIED FACILITIES GUIDE SPECIFICATIONS

GENERAL STRUCTURE OF UFGS
SPECIFICATION SECTIONS

SECTION XX XX XX

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 STANDARD PRODUCTS
- 1.4 DELIVERY, STORAGE, HANDLING
- 1.5 PERFORMANCE REQUIREMENTS
- 1.6 REGULATORY REQUIREMENTS
- 1.7 PROJECT/SITE CONDITIONS
- 1.8 INSTRUCTION TO OWNER PERSONNEL
- 1.9 ACCESSIBILITY OF EQUIPMENT
- 1.10 SUSTAINABLE DESIGN REQUIREMENTS

PART 2 PRODUCTS

- 2.1 MATERIALS
- 2.1.1 MATERIAL 1
- 2.1.2 MATERIAL 2
- ETC.
- 2.2 PRODUCTS
- 2.3 PRODUCT 1
- 2.4 PRODUCT 2
- ETC.

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION REQUIREMENTS
- 3.2 INSTALL PRODUCT 1
- 3.3 INSTALL PRODUCT 2
- ETC.

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☆☆ UNIFIED FACILITIES GUIDE SPECIFICATIONS

There are four features of the Unified Facilities Guide Specifications (UFGS) that make them uniquely useful; these are....

- Design Notes
- Inspection Guidance
- Timely Updates
- Developed and maintained by professionals as a day-in-day-out activity, not via volunteer committees

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☆☆ UNIFIED FACILITIES GUIDE SPECIFICATIONS

Design Notes – Cast-in-Place Concrete

A couple of examples....

NOTE: Where flat surface finishing is important and the crew inexperienced in this type of concrete, ask for a sample installation to train the crew.

NOTE: Use these paragraphs where floor flatness is critical. Indicate areas where these requirements apply. Flatness will affect the appearance and function of finishes applied to the concrete and in situations such as large or long expanses of glossy floor materials. Low tolerance for product (thin set tile and wood gymnasium floors, etc.) and equipment will dictate to the designer to specify higher than normal flatness requirements. The numbers provided in brackets are typical numbers, but A/E should research and select F numbers high enough to get desired results but not so high as to cause undue cost increases and construction problems. F1PL 20/15 is equivalent to 5/16 inches in 10 feet. This test method is not suitable for unshored deck. Filled partitions need FL greater than or equal to 25.

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☆☆ UNIFIED FACILITIES GUIDE SPECIFICATIONS

Inspection Guidance - Cast-in-Place Concrete

An example....

Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

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☆☆ UNIFIED FACILITIES GUIDE SPECIFICATIONS

Now let's look at some examples of the UFGS...

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WHOLE BUILDING DESIGN GUIDE

☆☆ ❖ Construction Criteria Base

- ☆☆ > Specifications Library
- ☆☆ > Regulations Library
- ☆☆ > Standards Library
- ☆☆ > Documents Library
- ☆☆ > CADD Library
- ☆☆ > Energy Library
- ☆☆ > Environmental Library
- ☆☆ > Sustainable Design Library

Now let's look at another "high value" component of the CCB, the Documents Library...

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☆☆ UNIFIED FACILITIES CRITERIA

The DOCUMENTS LIBRARY of the CONSTRUCTION CRITERIA BASE (CCB) contains a huge number of downloadable manuals, guides and similar documents produced by the major federal agencies engaged in design and construction of buildings and related infrastructure. An exceptionally useful module is the UNIFIED FACILITIES CRITERIA (UFC) with is essentially Department of Defense knowledge base. Let's look at some examples

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☆☆ UNIFIED FACILITIES CRITERIA

Table 4.2
Space and Ceiling Requirements for Appellate Courtrooms and Associated Spaces

SPACES	SIZE	
	NSF	(ft ²)
COURTROOMS		
En Banc Courtroom	3,000	(278.7)
Panel Courtroom	1,800	(167.2)
ASSOCIATED SPACES		
Public Waiting Area	300	(27.9)
Soundlock	80	(7.4)
Public/Attorney Coat Closet	20	(1.9)
Judges' Conference Room	250	(23.3)
Judges' Robing Room*		
Soundlock	80	(7.4)
Tablet 1	50	(4.7)
Tablet 2	50	(4.7)
Attorney Work Room - Waiting Area*	250	(23.3)
Work Area	100	(9.3)
ATV Room	120	(11.1)
Equipment Storage Room	100	(9.3)

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☆☆ UNIFIED FACILITIES CRITERIA

2.2 INDOOR DESIGN CONDITIONS
(DEGREE C (F) DRY BULB AND PERCENT RELATIVE HUMIDITY):

TABLE 2.2

Room or Area	Summer		Winter	
	DB	MRH	DB	MRH
Animal Research Areas	18 (65)	60	29 (85)	30
Animal Operating Rooms	18 (65)	60	29 (85)	30
Animal Receiving and Examination Rooms	18 (65)	60	29 (85)	30
Procedure Laboratories (Necropsy)	18 (65)	60	29 (85)	30
Quarantine Wards	18 (65)	60	29 (85)	30
Support Areas	25 (78)	55	22 (72)	30*
				(Note 4)
Class Rooms	25 (78)	55	22 (72)	30*
Conference Rooms	25 (78)	55	22 (72)	30*
Locker Rooms	25 (78)	55	22 (72)	30*
Lounges	25 (78)	55	22 (72)	30*
Storage Rooms	25 (78)	55	22 (72)	30*
Toilets	25 (78)	55	22 (72)	30*
Miscellaneous (Unoccupied Areas)				
Electric Equipment Rooms (See Note 3)	39 (104)	---	10 (50)	---
	(Maximum)		(Maximum)	

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☆☆ UNIFIED FACILITIES CRITERIA

TM 6-113-1AFM-88-10, Vol. 1

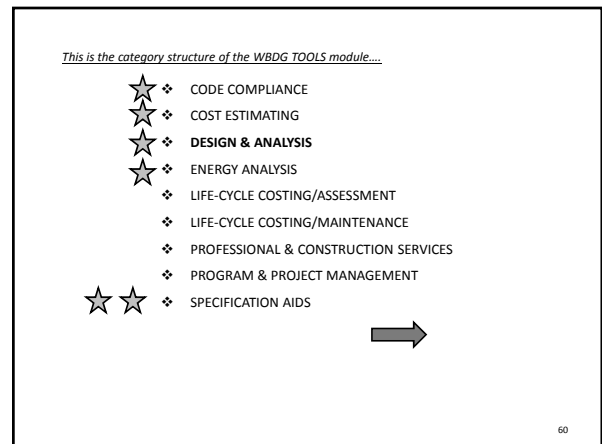
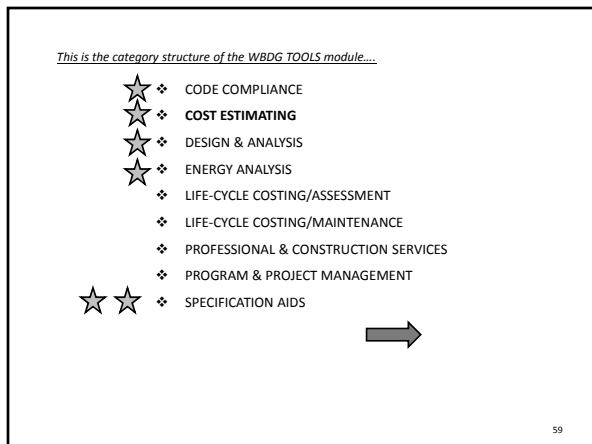
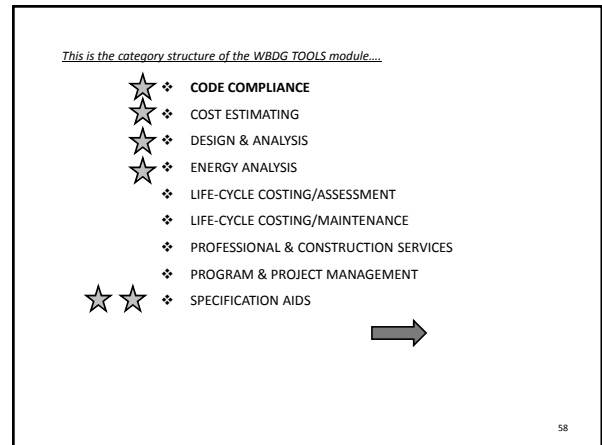
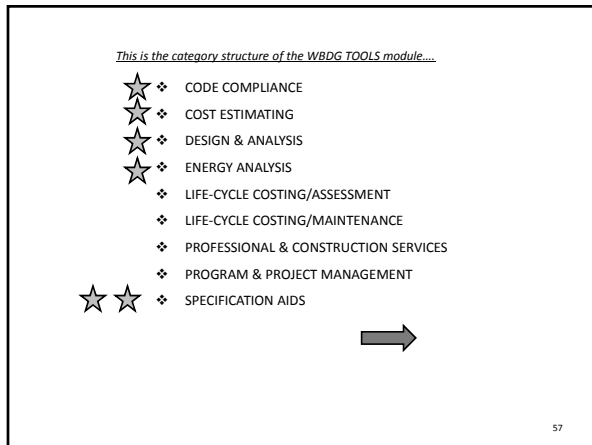
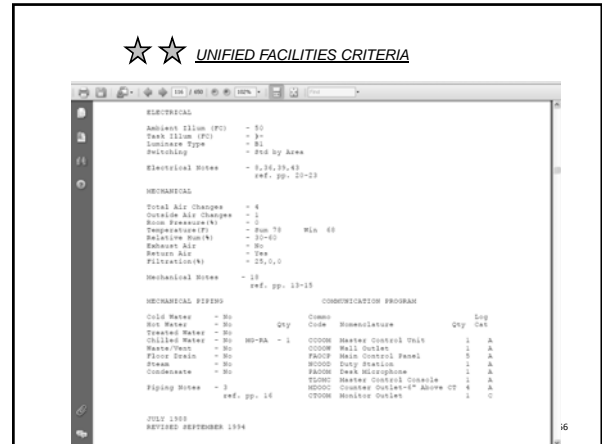
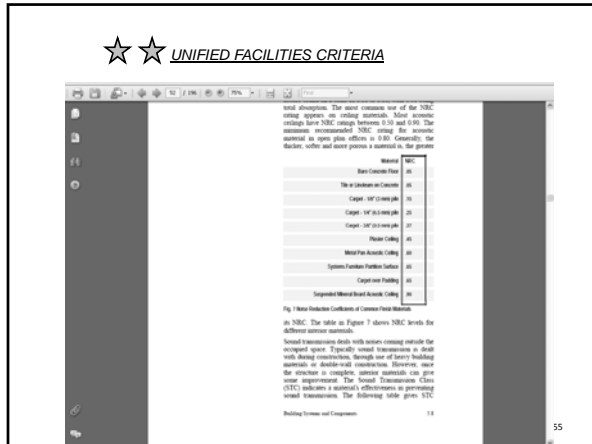
Table 5-4. Change in Yield for Variation in Well Diameter

Original Diameter	New Well Diameter				Nominal Diameter (inch)	Well Thickness (inch)
	67	127	147	307		
12"	100%	110%	117%	127%	137%	137%
18"	90	100	108	114	119	125
24"	84	93	100	108	112	117
30"	79	88	95	102	104	110
36"	76	85	91	98	100	106
42"	73	82	87	94	96	102
48"	69	77	82	87	91	94

Note: The above gives the theoretical increase or decrease in yield that results from changing the original well diameter to the new well diameter. For example, if a 12-inch well is enlarged to a 36-inch well, the yield will be increased by 59 percent. The values in the above table are valid only for wells in unconfined aquifers (water table wells) and are based on the following equation:

$$Q_2/Q_1 = (R_2/R_1)^2 (1 - (R_2/R_1)^2)$$
 where:
 Q_1 = yield of new well
 Q_2 = yield of original well
 R_1 = radius of cone of depression, in feet (the value of R used for the table is 300 feet)
 R_2 = diameter of new well, in feet
 d = diameter of original well, in feet
 Δ = Depth. Depth of a well is usually determined from the logs of test holes or from logs of other nearby wells that utilize the same aquifer. The deeper the well is driven into a water bearing stratum, the greater the discharge for a given drawdown. Where the water in the percussion method of drilling, and where sloughing is a problem, it is customary to drill and drive the casing to the lower extremity of the aquifer to be screened and then install the appropriate size screen inside the casing before pulling the casing back and exposing the screen to the water bearing formation.
 Screens. Wells completed in sand and gravel with open-end casings, not equipped with a screen on the bottom, usually have limited capacity due to the small stable area (open end of casing) and tend to pump large amounts of sand. A well designed screen permits utilizing the permeability of the water bearing materials around the screen. For a well completed in a sand-gravel formation, use of a well screen will usually provide much more water than if the installation is left open-ended. The screen functions to restrain sand and gravel from entering the well, which would diminish yield, damage pumping equipment, and deteriorate the quality of the water produced. Wells developed in hard rock areas do not need screens if the well is sufficiently stable and sand pumping is not a problem. (1) Absolute size. The well screen

54



This is the category structure of the WBDG TOOLS module....

- ★ ❖ CODE COMPLIANCE
- ★ ❖ COST ESTIMATING
- ★ ❖ DESIGN & ANALYSIS
- ★ ❖ ENERGY ANALYSIS
- ❖ LIFE-CYCLE COSTING/ASSESSMENT
- ❖ LIFE-CYCLE COSTING/MAINTENANCE
- ❖ PROFESSIONAL & CONSTRUCTION SERVICES
- ❖ PROGRAM & PROJECT MANAGEMENT
- ★ ★ ❖ SPECIFICATION AIDS

➔

61

This is the category structure of the WBDG TOOLS module....

- ★ ❖ CODE COMPLIANCE
- ★ ❖ COST ESTIMATING
- ★ ❖ DESIGN & ANALYSIS
- ★ ❖ ENERGY ANALYSIS
- ❖ LIFE-CYCLE COSTING/ASSESSMENT
- ❖ LIFE-CYCLE COSTING/MAINTENANCE
- ❖ PROFESSIONAL & CONSTRUCTION SERVICES
- ❖ PROGRAM & PROJECT MANAGEMENT
- ★ ★ ❖ SPECIFICATION AIDS

➔

62

This is the category structure of the WBDG TOOLS module....

- ★ ❖ CODE COMPLIANCE
- ★ ❖ COST ESTIMATING
- ★ ❖ DESIGN & ANALYSIS
- ★ ❖ ENERGY ANALYSIS
- ❖ LIFE-CYCLE COSTING/ASSESSMENT
- ❖ LIFE-CYCLE COSTING/MAINTENANCE
- ❖ PROFESSIONAL & CONSTRUCTION SERVICES
- ❖ PROGRAM & PROJECT MANAGEMENT
- ★ ★ ❖ SPECIFICATION AIDS

➔

63

This is the category structure of the WBDG TOOLS module....

- ★ ❖ CODE COMPLIANCE
- ★ ❖ COST ESTIMATING
- ★ ❖ DESIGN & ANALYSIS
- ★ ❖ ENERGY ANALYSIS
- ❖ LIFE-CYCLE COSTING/ASSESSMENT
- ❖ LIFE-CYCLE COSTING/MAINTENANCE
- ❖ PROFESSIONAL & CONSTRUCTION SERVICES
- ❖ PROGRAM & PROJECT MANAGEMENT
- ★ ★ ❖ SPECIFICATION AIDS

➔

64

This is the category structure of the WBDG TOOLS module....

- ★ ❖ CODE COMPLIANCE
- ★ ❖ COST ESTIMATING
- ★ ❖ DESIGN & ANALYSIS
- ★ ❖ ENERGY ANALYSIS
- ❖ LIFE-CYCLE COSTING/ASSESSMENT
- ❖ LIFE-CYCLE COSTING/MAINTENANCE
- ❖ PROFESSIONAL & CONSTRUCTION SERVICES
- ❖ **PROGRAM & PROJECT MANAGEMENT**
- ★ ★ ❖ SPECIFICATION AIDS

➔

65

This is the category structure of the WBDG TOOLS module....

- ★ ❖ CODE COMPLIANCE
- ★ ❖ COST ESTIMATING
- ★ ❖ DESIGN & ANALYSIS
- ★ ❖ ENERGY ANALYSIS
- ❖ LIFE-CYCLE COSTING/ASSESSMENT
- ❖ LIFE-CYCLE COSTING/MAINTENANCE
- ❖ PROFESSIONAL & CONSTRUCTION SERVICES
- ❖ PROGRAM & PROJECT MANAGEMENT
- ★ ★ ❖ SPECIFICATION AIDS

We will look now at the SPECIFICATIONS AIDS which contains a very important tool to use in conjunction with the high-value Unified Facilities Guide Specifications we have looked at....

66

This very important tool is....

☆☆ **SPECSINTACT**

SPECSINTACT is a word processing software designed specifically to process Unified Facilities Guide Specifications (UFGS) (and related DOD guide specifications). It is operationally similar to commercial products such as Microsoft Word, but has additional tagging-based features that perform a number of key functions automatically such as compilation of referenced standards, submittal requirements, inspection requirements and metric conversion. Although the UFGS can be downloaded and processed using Microsoft Word and similar word processing software, large infrastructure agencies and companies may want to consider adopting SPECSINTACT as an office standard for preparation of project specifications.

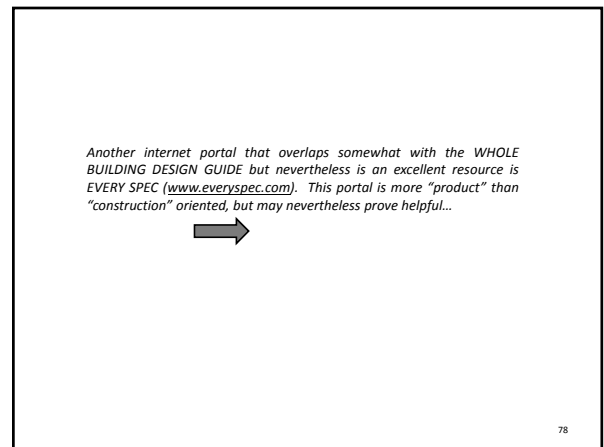
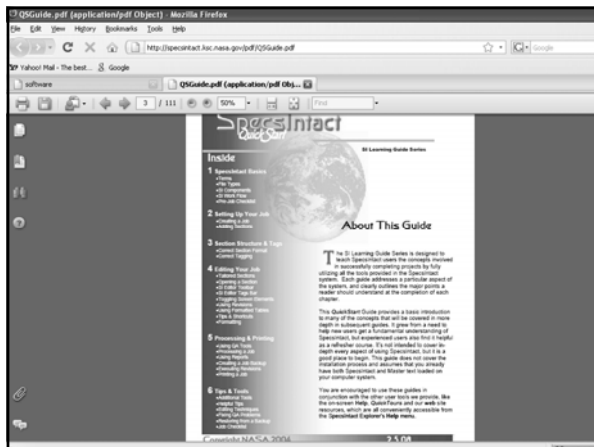
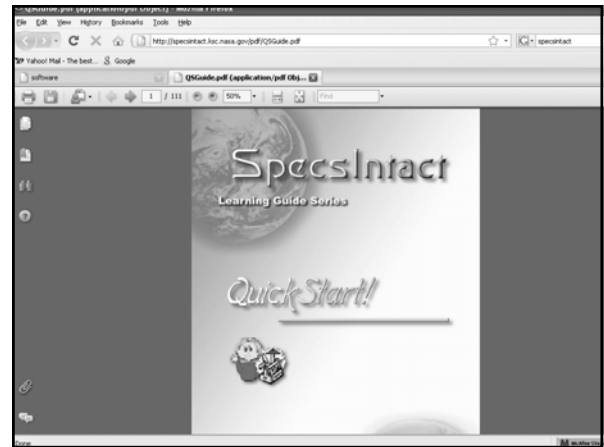
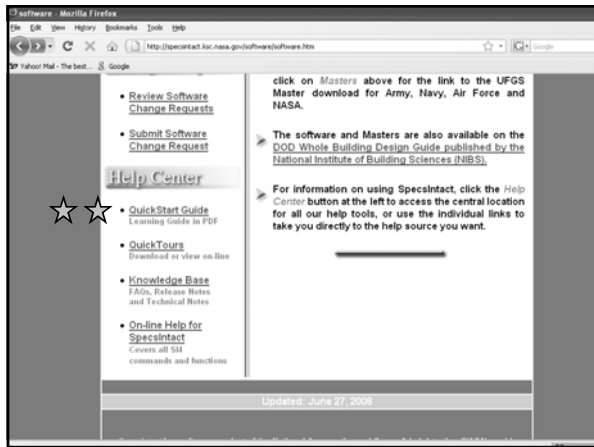
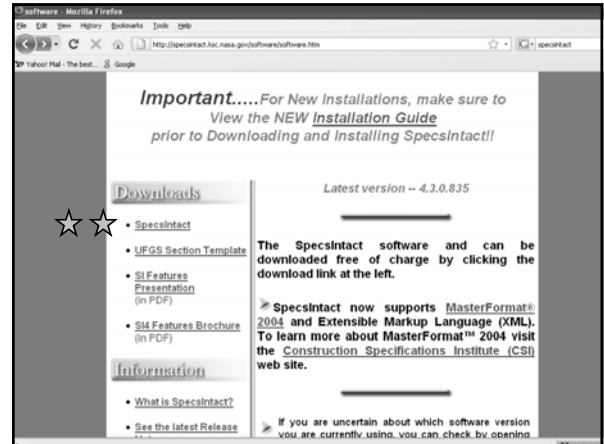
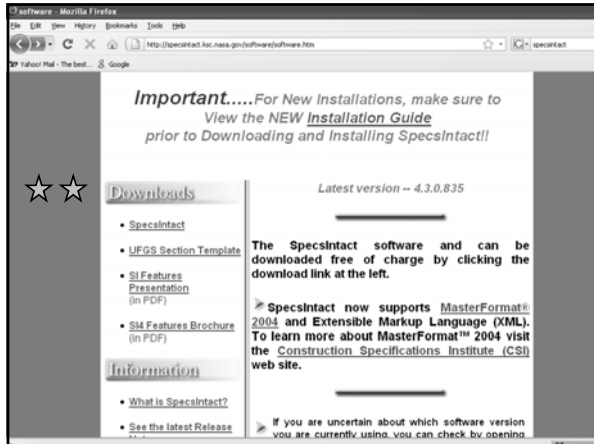
67

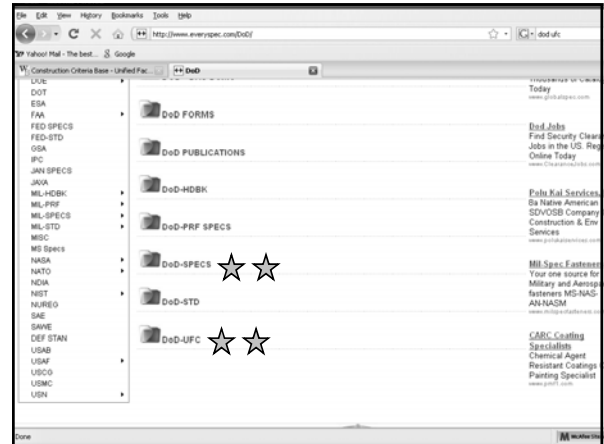
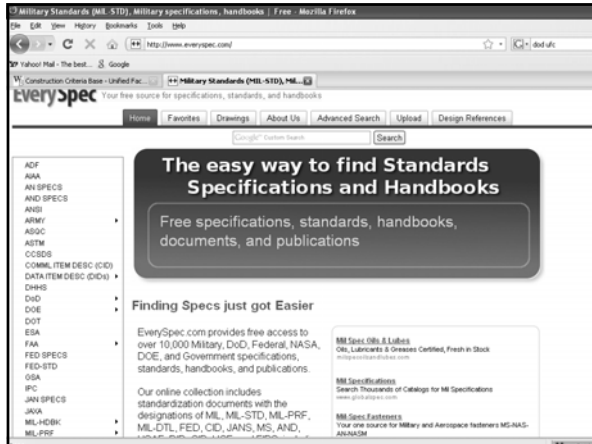
☆☆ www.wbdg.org/ <http://specsintact.ksc.nasa.gov/>


SPECSINTACT can be accessed either through the Whole Building Design Guide portal (<http://www.wbdg.org/>) or directly at (<http://specsintact.ksc.nasa.gov/>). . Let's take a look at it →

68







 In conclusion, let me summarize....

81

There are two types of knowledge we use in designing and managing the construction of buildings and related infrastructure:

- Theoretical
- Experiential

82

We now have the information technology to deliver **experiential knowledge** in real-time and in a user-friendly format that will allow it to be used immediately in day-to-day projects.

83

It is accessed through the internet portal....

WHOLE BUILDING DESIGN GUIDE
National Institute of Building Sciences
WWW.WBDG.ORG


....and it is free.

84

The WBDG is....

- ❑ an easily accessible internet-based source of the *experiential knowledge* of thousands of engineers, architects and construction professional garnered over more than 100 years and tens of thousands of projects.
- ❑ reflective, primarily, of the most experienced building and infrastructure design and construction institution in the world....the U.S. federal government.
- ❑ an enormous compilation of design and construction guidance, detailed specifications, and computer based tools and CAD details that are up-to-date and ready for use on projects today.
- ❑ continuously updated and revised by design and construction professionals to reflect changes in building and infrastructure design and construction methods and materials.


85



Some important points....

86


An important point....



Do not make the mistake of assuming this knowledge base is "federal" and therefore not useful "in the real world." This is most definitely not the case. This is an engineering knowledge base that is absolutely applicable across the entire spectrum of building and infrastructure projects your company or agency will encounter.

87


An important point....



Do not assume that because it is a federally generated knowledge base that it is "excessively complex and bureaucratic." Again, this is not the case. Candidly, building design and construction is a complex undertaking and a knowledge base for this enterprise must inherently reflect that complexity....but the WBDG is not *excessively* complex. And, although you will see the names of federal agencies extensively throughout the base, you need to simply look past them to the substantive guidance provided.

88


An important point....



A very important factor in appreciation of the WBDG is that it is a "living" base of experiential knowledge that is continually updated and refined by engineers and architects working daily on real projects. This is the only knowledge base I am aware of that has this real-time/real-world aspect. There are information resources in the professional community that may parallel some components in the WBDG, but they are....to my knowledge....all produced by volunteer committees and updated only episodically. This is not to depreciate their importance in professional practice, but I simply think they lack the timeliness and proven utility of the WBDG. The manner in which the WBDG is generated also avoids the possibility of inappropriate influence exerted by vendors in the development of design and construction guidance.

89

An important point....



Do not mistake the WBDG as being a stilted "cook book" approach to building design. Not too long ago I was discussing the WBDG with a very well qualified and experienced mechanical engineer and he somewhat deprecatingly said he did not approve of "...a cook book approach to building design." The WBDG is not a cook book; it provides guidance that is always to be evaluated and tempered by professional judgment. Although it may seem less useful to a very well qualified and experienced engineer or architect, we need to recognize that we have many engineers and architects with lesser levels of qualification and experience employed in our companies and agencies who will find the type of guidance the WBDG provides very helpful.

90

An important point....

5 With regard to "Design-Build"....

- If a private company or public agency does not include design and construction criteria in its contract with a Design-Build Contractor, it will have little control over the quality of the work.
- The WBDG provides a reasonably straightforward way to incorporate design and construction criteria by reference in its contract with a Design-Build Contractor.

91

6 Keep in mind these locations for very valuable resources. At the "opening-page-tab-level"...

- ★ DESIGN GUIDANCE
- PROJECT MANAGEMENT
- OPERATIONS AND MAINTENANCE
- ★ ★ DOCUMENTS AND REFERENCES
- ★ ★ TOOLS

92

7 In the DESIGN GUIDANCE tab....

- ★ BUILDING TYPES
- ★ SPACE TYPES
- DESIGN DISCIPLINES
- DESIGN OBJECTIVES
- PRODUCTS & SYSTEMS

93

8 In the PROJECT MANAGEMENT tab....there is still work to be done.

- PROJECT DELIVERY TEAMS
- PROJECT PLANNING AND DEVELOPMENT
- BUILDING COMMISSIONING
- PROJECT DELIVERY AND CONTROLS

94

9 In the OPERATIONS AND MAINTENANCE tab....there is still work to be done.

- REAL PROPERTY INVENTORY
- COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEMS

95

10 In the DOCUMENTS AND REFERENCES tab....the CONSTRUCTION CRITERIA BASE is the Big Kahuna....

- ★ ★ FEDERAL MANDATES
- ★ ★ CONSTRUCTION CRITERIA BASE (CCB)
- PERIODICALS
- CASE STUDIES
- PARTICIPATING AGENCIES
- INDUSTRY ORGANIZATIONS

96

11 In the CONSTRUCTION CRITERIA BASE....

- ★ ★ SPECIFICATIONS LIBRARY
- ★ ★ > UNIFIED FACILITIES GUIDE SPECIFICATIONS
- ★ ★ REGULATIONS LIBRARY
- ★ ★ STANDARDS LIBRARY
- ★ ★ DOCUMENTS LIBRARY
- ★ ★ > UNIFIED FACILITIES CRITERIA
- ★ ★ CADD LIBRARY
- ★ ★ ENERGY LIBRARY
- ★ ★ ENVIRONMENTAL LIBRARY
- ★ ★ SUSTAINABLE DESIGN LIBRARY

97

12 And in the TOOLS tab....

- ★ CODE COMPLIANCE
- ★ COST ESTIMATING
- ★ DESIGN & ANALYSIS
- ★ ENERGY ANALYSIS
- LIFE-CYCLE COSTING/ASSESSMENT
- LIFE-CYCLE COSTING/MAINTENANCE
- PROFESSIONAL & CONSTRUCTION SERVICES
- PROGRAM & PROJECT MANAGEMENT
- ★ ★ SPECIFICATION AIDS
- ★ ★ > SPECSINTACT

98

Now let's review the Quiz....

99

Quiz

1. The *Whole Building Design Guide (WBDG)* is:

- a. An internet portal
- b. A resource for experiential knowledge of building design
- c. A resource for theoretical knowledge of building design
- d. "a" and "b"
- e. "a" and "c"
- f. "b" and "c"

100

Quiz

2. The WBDG is managed by the:

- a. Environmental Protection Agency
- b. National Institute of Building Sciences
- c. National Institute for Testing and Standard
- d. Department of Defense

101

Quiz

3. The most useful information accessible through the WBDG portal is found under which "tab" or "pull-down menu":

- a. Design Guidance
- b. Project Management
- c. Operations and Maintenance
- d. Documents and References
- e. Tools

102

Quiz

4. Which of the following *Design Guidance* elements is not considered particularly useful in its current state of development:

- a. Building Types
- b. Space Types
- c. Design Disciplines
- d. Design Objectives

103

Quiz

5. Which of the following *Design Objectives* is considered to contain some useful information?

- a. Functional/Operational
- b. Productive
- c. Secure/Safe
- d. Sustainable

104

Quiz

6. The one of the two most useful resources accessible through the WBDG is:

- a. National Facilities Guide Specifications
- b. Unified Facilities Guide Specifications
- c. Federal Facilities Guide Specifications
- d. American Facilities Guide Specifications

105

Quiz

7. The second of the two most useful resources accessible through the WBDG is:

- a. U.S. Facilities Criteria
- b. National Criteria Database
- c. Federal Facilities Criteria
- d. Unified Facilities Criteria

106

Quiz

8. In the *Documents & References* module of the WBDG, which of the following elements is most useful:

- a. Federal Mandates
- b. Construction Criteria Base
- c. Participating Agencies
- d. Case Studies

107

Quiz

9. The *Construction Criteria Base* is located in which of the following WBDG modules:

- a. Design Guidance
- b. Project Management
- c. Operations and Maintenance
- d. Documents and References
- e. Tools

108

Quiz

10. Which of the following *Libraries* in the *Construction Criteria Base* is considered to contain substantial useful information for a broad range of projects:

- a. Specifications Library
- b. Documents Library
- c. CADD Library
- d. Tools Library
- e. All of the above
- f. None of the above

109

Quiz

11. Which of the following is considered the most useful element in the *Specifications Library*:

- a. Unified Facilities Guide Specifications
- b. NAVFAC Specifications
- c. DOE General Design Criteria
- d. NIBS Specifications

110

Quiz

12. *SpecsIntact Editor* is a:

- a. Catalog of specifications
- b. Manual of style for specification writers
- c. An online database
- d. A word processing program

111

Quiz

13. "Design Notes" are:

- a. AIA aesthetic standards
- b. A feature of CADD details
- c. A feature of the Unified Facilities Guide Specifications
- d. A feature of the Unified Facilities Criteria

112

Quiz

14. *Unified Facilities Criteria* manuals are:

- a. Accessible via the National Publishers Clearinghouse
- b. Available with a Confidential or higher security clearance
- c. Downloadable from the internet in TXT format
- d. Downloadable from the internet in PDF format
- e. Not accessible on the internet

113

Quiz

15. An important tool for utilizing *Unified Facilities Guide Specifications* is:

- a. Microsoft XP or later
- b. Microsoft Vista
- c. SpecsIntact User Module
- d. SpecsIntact Quick Start Guide
- e. Apple iPod Bluetooth

114

Quiz

16. The _____ manages the *SpecsIntact* program for all federal agencies and its internet portal is an excellent resource for the latest about the *Unified Facilities Guide Specifications*.

- a. Corps of Engineers
- b. Naval Facilities Engineering Command
- c. National Aeronautics and Space Administration
- d. USAF Chief Engineer's Office

115

Quiz

17. The *Unified Facilities Criteria* and *Unified Facilities Guide Specifications* can _____ the contract between an Owner and a Design-Build Contractor.

- a. not be incorporated into
- b. be incorporated by reference into
- c. be added by the Owner unilaterally after the contract is signed into
- d. none of the above

116

Quiz

18. Do not make the mistake of assuming the Whole Building Design Guide knowledge base is "federal" and therefore _____ "in the real world."

- a. valuable
- b. applicable
- c. useful
- d. not useful

117

Quiz

19. Do not assume that because the Whole Building Design Guide is a federally generated knowledge base that it is _____.

- a. available to federal contractors
- b. available without charge
- c. excessively complex and bureaucratic
- d. available to the non-engineering public

118

Quiz

20. A very important factor in appreciation of the WBDG is that it is a _____ base of experiential knowledge that is continually updated and refined by engineers and architects working daily on real projects.

- a. proprietary
- b. living
- c. static
- d. Factory Mutual

119

Quiz

21. Do not mistake the WBDG as being a _____ approach to building design.

- a. code approved
- b. cook-book
- c. minimal utility
- d. mandatory

22. The WBDG is reflective, primarily, of the most experienced building and infrastructure design and construction institution in the world....the _____.

- a. International Code Council
- b. American Society of Civil Engineers
- c. American Institute of Architects
- d. federal government

120

Quiz

23. Another internet portal that overlaps somewhat with the Whole Building Design Guide but nevertheless is an excellent resource is available online at _____.

- a. www.everyspec.com
- b. www.ntis.gov
- c. www.nbis.org
- d. www.nbis.gov

24. The starting point for navigating the Whole Building Design Guide web site is the _____ at www.wbdg.org/

- a. NAVFAC menu
- b. NASA menu
- c. search engine
- d. pull-down menus

121

Quiz

25. "Design Notes" are found in the _____.

- a. Unified Facilities Guide Specifications
- b. Uniform Building Criteria
- c. Unified Building Guide Specifications
- d. Uniform Guide Criteria

122

Thank you for your time!
QUESTIONS??

PDHonline.org, Inc., / PDH Center
info@PDHonline.org 703-988-0088



That's all folks!

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