



# United States National CAD Standard® – V6

An introduction to the NCS V6



# Agenda

- Welcome & House Keeping Notes
- Introduction – Ed Lowe
  - What's in the NCS?
- Introduction – Michael Fate
  - Why should you use the NCS?
- Introduction – Johnny Fortune
  - BIM within the NCS?
- Q & A Panel
  - Ed Lowe, Michael Fate, Johnny Fortune, Stephen Spangler, Jennifer DiBona, Jason Sturniolo
  - Let us answer your questions
- Final Comments



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## Today's Panel Expert: Ed Lowe

Ed Lowe is a CAD Coordinator with Burgess & Niple, Inc., a multidiscipline engineering and architectural firm in Painesville, Ohio. Ed has over 30 years experience in the production of construction drawings including extensive use and support of AutoCAD for the past 25 years. As CAD Coordinator, Ed oversees CAD production for a wide variety of projects. His responsibilities also include class instruction, standards development, enterprise-wide installation and CAD/BIM related IT support. He is a contributing writer to some of our leading industry publications.

Ed serves as the Chair of the United States National CAD Standard® (NCS) Project Committee and Steering Committee and is a member of the National BIM Standard-United States® (NBIMS-US™) Project Committee.



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<http://www.burgessniple.com/>





# What is in the NCS?

- Everything you will need to assemble a concise set of documents /drawings for the built environment.
- It is a guide to what is required by todays Computer Aided Design software tools to create the necessary documentation for construction.
- It includes: Layering standards, symbols, line styles, document formatting, abbreviations, and everything needed to present your design in an easy to understand standard for construction.



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# What is in the NCS?

- Layering Standard.
  - Discipline designators

A- Architecture

C- Civil

H- Hazardous Materials

L- Landscaping

E- Electrical

T- Telecommunications

V- Survey





# What is in the NCS?

- Layering Standard.
  - Major Groups

-AIRS- Airport airspace features

-CHEM- Chemical

-POWR- Power

-SSWR- Sanitary Sewer

-DOOR- Doors

-PRKG- Parking Lots

-RIVR- Rivers



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# What is in the NCS?

- Layering Standard.
  - Minor Groups

-BLIN- Baseline

-CONC- Concrete

-MATC- Matchlines

-DUCT- Ductwork

-SWLK- Sidewalks

-LQPG- Liquid Petroleum Gas

-WALL- Walls



# What is in the NCS?

- Layering Standard.
  - Status Fields

-A Abandoned

-M Items to be moved

-E Existing to remain

-2 Phase number

-F Future work

-T Temporary work

-N New work





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# What is in the NCS?

- Layering Standard.
- Combinations

A-WALL-E

C-DRIV-ASPH-N

M-NGAS-PIPE

D-CHEM-H2O2

Discipline	Major	Minor	Minor	Phase	Total
180	201				36180
180	201	611			22105980
180	201	611	611		13506753169
180	201			17	615060
180	201	611		17	375801660
180	201	611	611	17	2.29615E+11
Lots of combinations before User Defined rule kicks in					2.4352E+11

V-BRKL-TOPB

P-SSWR-EQPM

L-SITE-SWLK-N



# What is in the NCS?

- Uniform Drawing System
  - Module 1 – Drawing Set Organization

## 1.1 Introduction

- 1.1.1 Set Content and Order
- 1.1.2 Sheet Identification
- 1.1.3 File Naming
- 1.1.4 Influences

## 1.2 Set Content and Order

- 1.2.1 Subsets
- 1.2.2 Electronic Models

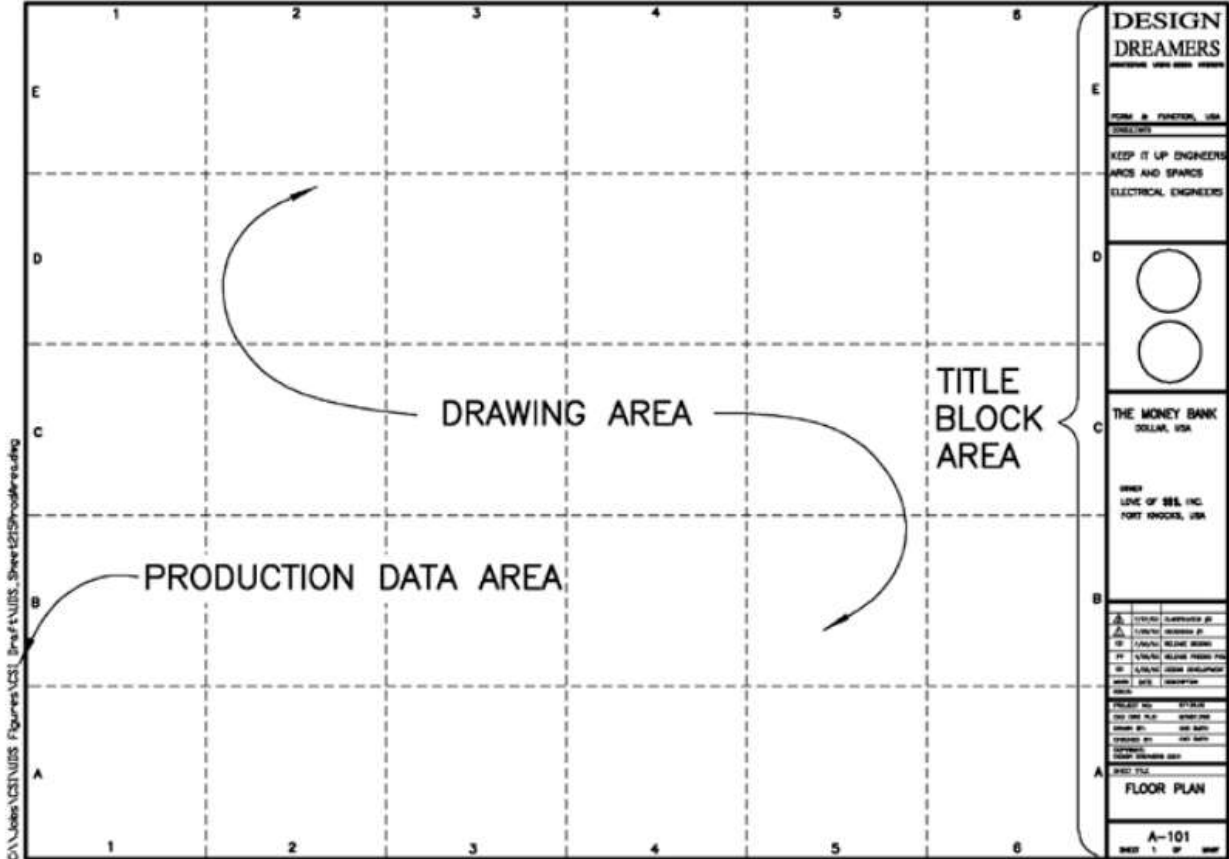
## 1.3 Sheet Identification

- 1.3.1 Standard Sheet Identification
- 1.3.2 Discipline Designators
- 1.3.3 Sheet Type Designator
- 1.3.4 Sheet Sequence Number
- 1.3.5 Supplemental Drawings

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- **Module 2 – Sheet Organization**



**UDS Figure 2.3-1** Overall sheet layout.

# What is in the NCS?

- Uniform Drawing System
  - Module 3 - Schedules

LEGEND, KEY, or INDEX	
MARK	ITEM DESCRIPTION

*UDS Figure 3.1.2-2 A list is not considered a schedule.*

ROOM FINISH SCHEDULE																	
NO	ROOM NAME	FLOOR	BASE	WALLS												CLG	NOTES
				N			S			E			W				
				MATL	FIN	CLR	MATL	FIN	CLR	MATL	FIN	CLR	MATL	FIN	CLR		
101	Entry			A	P1	1	A	V	2	A	P1	1	C	P2	3		

*UDS Figure 3.3.2-3 Triple-tier column identifier with column sub-identifiers.*

# What is in the NCS?

- Uniform Drawing System
  - Module 4 – Drafting Conventions



UDS Figure 4.2.1-3 North arrow location in the drawing block title.





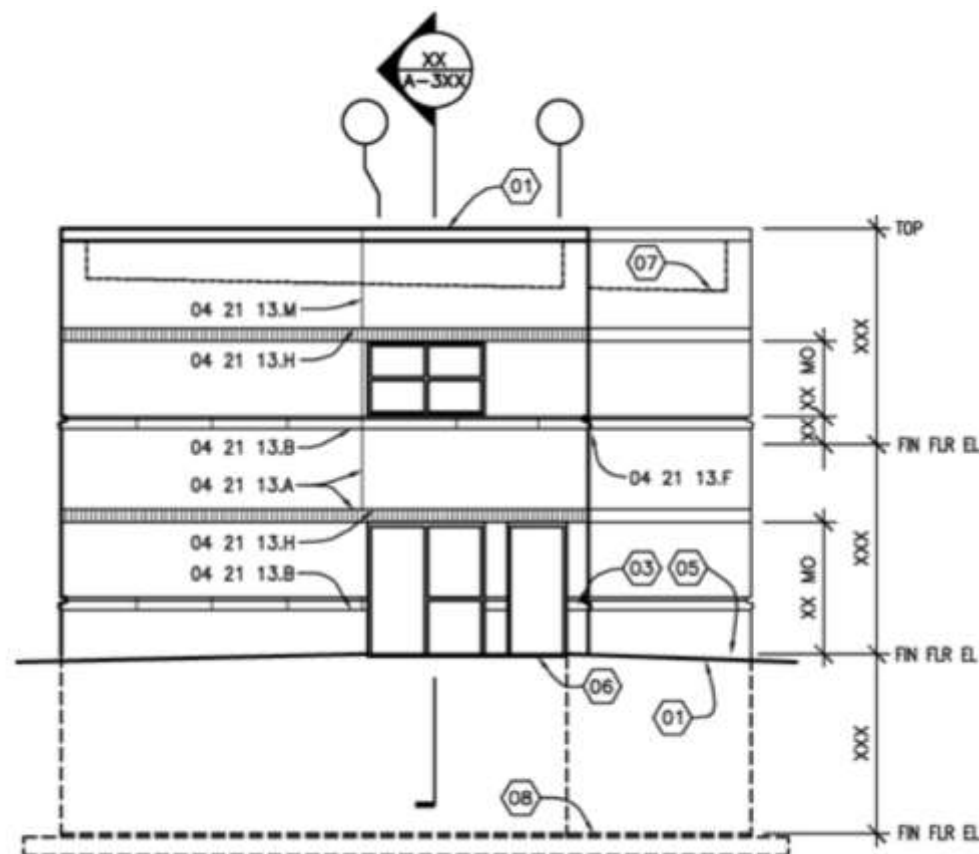
# What is in the NCS?

WIDTH OF LINE IN mm	USE OF LINE
Extra Fine 0.13 _____	Fine detail which cannot be accomplished using a fine (0.18 mm) line.
Fine 0.18 _____	Material indications, surface marks, hatch lines, patterns.
Thin 0.25 _____	Text: 2.5 mm (3/32") to 10 mm (3/8") Dimension lines, leaders, extension lines, break lines, hidden objects, dotted lines, dashed lines, setback lines, center lines, grid lines, schedule grid lines.
Medium 0.35 _____	Text: 4 mm (5/32") to 10 mm (3/8") Object lines, property lines, text, lettering, terminator marks, door and window elevations, schedule grid accent lines.
Wide 0.50 _____	Text: 6 mm (7/32") to 10 mm (3/8") Titles, edges of interior and exterior elevations, profiling. Cut lines, property lines, section cutting plane lines, drawing block borders.
Extra Wide 0.70 _____	Text: 13 mm (1/2") to 25 mm (1") Match lines, large titles, footprints, title block borders, sheet borders, schedule outlines.
XX Wide 1.00 _____	Major title underlining and separating portions of designs.
XXX Wide 1.40* _____	Border sheet outlines and cover sheet line work. (*ISO 128-20-1996)
XXXX Wide 2.00 _____	Border sheet outlines and cover sheet line work.

## 4.2.7.1 Common Line Types



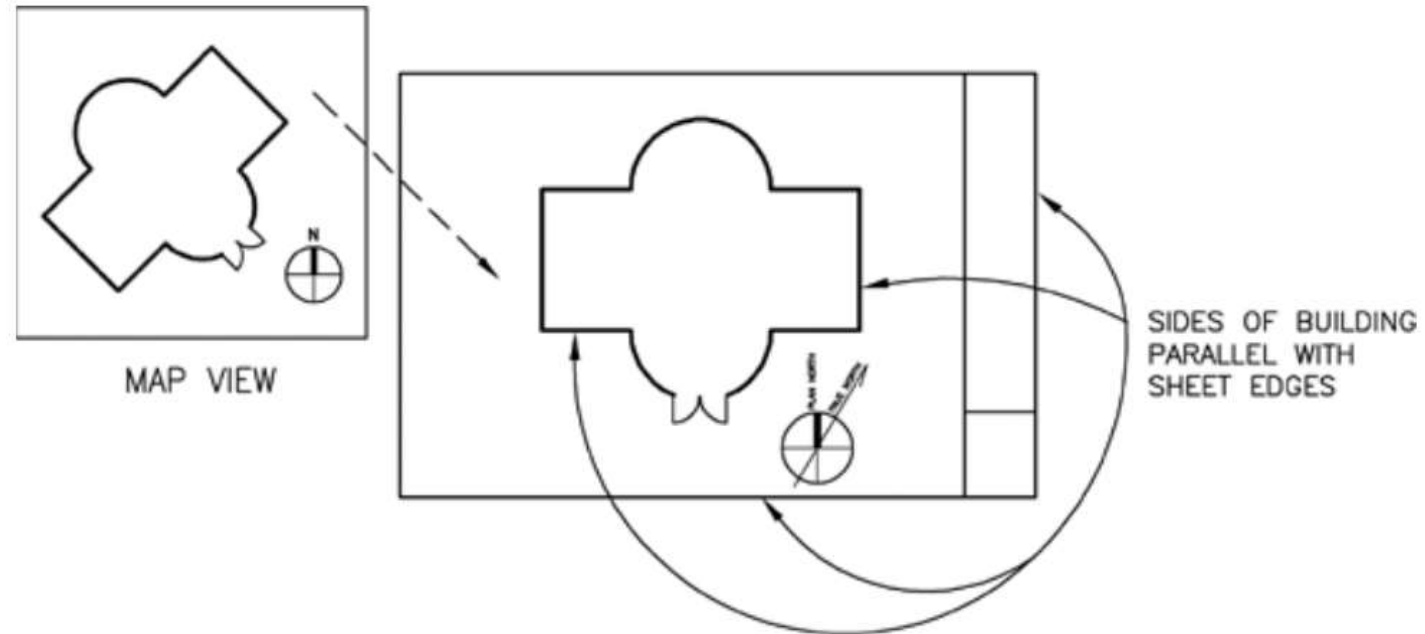
# What is in the NCS?



UDS Figure 4.3.3.1-1 Example of an elevation showing all symbols.

# What is in the NCS?

- Uniform Drawing System
  - Module 4 – Drafting Conventions



UDS Figure 4.2.1-1 Sheet layout orientation.



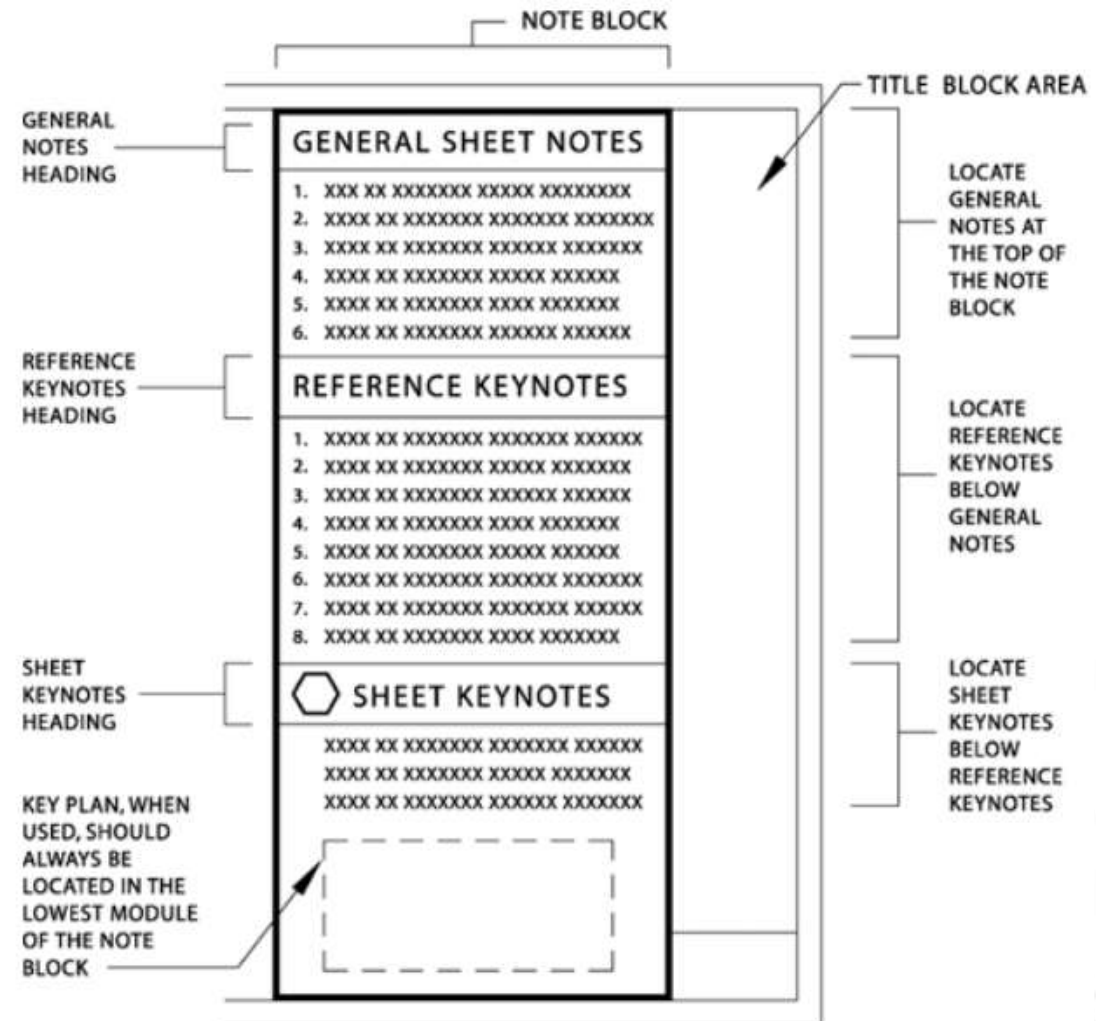
# What is in the NCS?

- Uniform Drawing System
  - Module 5 – Terms and Abbreviations
    - The Terms and Abbreviations Module provides the following:
      - A consistent standard of communication in construction documents.
      - A searchable list of common terms and abbreviations used in the construction industry.
      - Consistent spelling of terms and abbreviations.
      - Notes on common use and non-preferred terminology.

- **Uniform Drawing System**
  - **Module 6 – Symbols**

# What is in the NCS?

- Uniform Drawing System
  - Module 7 – Notations



UDS Figure 7.3.6-1 Note block hierarchy-order of notes that appear in the note block.



# What is in the NCS?

- Uniform Drawing System
  - Module 8 – Code Conventions

## 8.2.1 Type of Information

The organization of information related to the determination of regulatory compliance within construction documents is grouped in 12 categories, as follows:

Category Group	Brief Description
<b>1-General</b>	Items related to the overall project, including: owner and project identification; site location and jurisdiction; design professional identification; contractor identification; synopsis of applicable construction regulations; and effective dates.
<b>2-Site</b>	Items related to the project site, including: distances to lot lines; site grading; flood control; environmental impact statements; deed restrictions; and zoning information. Zoning includes: zoning use classification; site coverage data; floor area ratio (FAR) data; parking data; signage data; fire districts; and historical preservation.
<b>3-Building</b>	Items related to the overall building design, including: identification of use groups (occupancy); type of construction; and building height and area. An overview of site-specific structural considerations relative to seismic and wind design are often included.
<b>4-Life Safety-Egress</b>	Items related to means of egress, including: occupant loads; identification of exit access from rooms and spaces; exit travel distance; number and capacity of exits for each floor; stair and door details; and egress and exit lighting.
<b>5-Fire Protection-Passive</b>	Items related to built-in-place (passive) fire protection, including: fire-resistance ratings of various components and assemblies; identification of mixed uses; opening protectives (e.g., fire doors); penetrations; and interior finish.
<b>6-Accessibility</b>	Items related to making sites, facilities, buildings, and elements accessible to and usable by persons with physical disabilities, including: interior and exterior accessible route requirements; detectable warnings and signage; elevator details; clear floor space; and plumbing fixtures.
<b>7-Energy</b>	Items related to overall energy conservation, including: envelope thermal performance; glazing areas and fenestration R-values; mechanical and electrical equipment loads and efficiencies; service water heating details; and air infiltration.
<b>8-Structural</b>	Items related to structural design criteria, including: applicable design loads; structural system description; soil data; material design standards; and special inspections.
<b>9-Fire Protection-Active</b>	Items related to type(s) of fire protection systems (active), including: fire suppression systems; standpipes; fire alarm and detection; smoke control; fire extinguishers; and high-hazard abatement.
<b>10-Plumbing</b>	Items related to plumbing requirements, including: number of plumbing fixtures; water distribution; plumbing riser diagram; water usage data; protection of potable water; cleanout locations; storm water drainage; and piping materials and connections.
<b>11-Mechanical</b>	Items related to mechanical requirements, including: ventilation requirements; combustion air; duct construction and layout; fire damper locations; exhaust and intake locations; and listing and labeling of equipment.
<b>12-Electrical</b>	





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# What is in the NCS?

- BIM Implementation Guide
- Plotting Guidelines
- Appendixes:



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# What is in the NCS?

- Appendixes:

## 9.0 Appendix I - Implementation Guidelines

### **GUIDELINES FOR IMPLEMENTING THE UNITED STATES NATIONAL CAD STANDARD® (NCS)**

Implementing a standard has its challenges. Often, getting started is the most difficult part of transitioning to a new CAD standard. Contained within this appendix is an approach with input from several successful company implementations.

Each site's implementation approach will depend upon the unique characteristics of that workplace, and the time available to adopt the standard. The following strategies have worked for some, and are offered only as an example.



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## Today's Panel Expert: Michael Fate

Michael is the BIM Department Director at tk1sc, an MEP consulting firm in Southern California. He has worked in various capacities in small local firms as well as large international firms. He is an advocate of standards and strongly believes that standardization is the key to consistency and efficiency in any organization.

He has worked with the United States National CAD Standard® (NCS) since its inception. Michael serves as the Vice-chair of the NCS Project Committee and Steering Committee and was the NCS Steering Committee Liaison to the V6 NCS Symbols Task Team.



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# Why should you use the NCS?

## *Individual Viewpoint*



"I'M A STRONG BELIEVER IN CAD STANDARDS-THAT'S  
WHY I USE THIS EXCELLENT SET OF MY OWN"



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# Why should you use the NCS?

## *Management Viewpoint*



"WE BELIEVE WE NOW HAVE A CONSENSUS  
ON THE CAD STANDARDS"

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United States National CAD Standard®



## Today's Panel Expert: Johnny Fortune

Johnny Fortune is actively involved in standards development within several national committees for the United States National CAD Standard®, the National BIM Standard-United States®, the National BIM Guidelines for Owners, and the USACE/Industry BIM/CIM Consortium. Fortune serves as the Chair of the buildingSMART alliance® and is BIM Director at Bullock Tice Associates in Pensacola, Florida where he has led the complete transition from CAD to BIM production, directs the company's overall BIM strategies, standards, technology operations, and oversees BIM integration with external stakeholders. He's presented CAD/BIM workflow integration at several venues including; Autodesk University, NIBS Annual Conference, GeoBuiz, CSI chapter meetings, Society of American Military Engineer and other events.



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# BIM within the NCS?

*The three most common questions...*

**WHY** does the NCS contain information about BIM?

**HOW** does NCS content apply to BIM implementation?

**WHAT** content is in the NCS BIM implementation section?

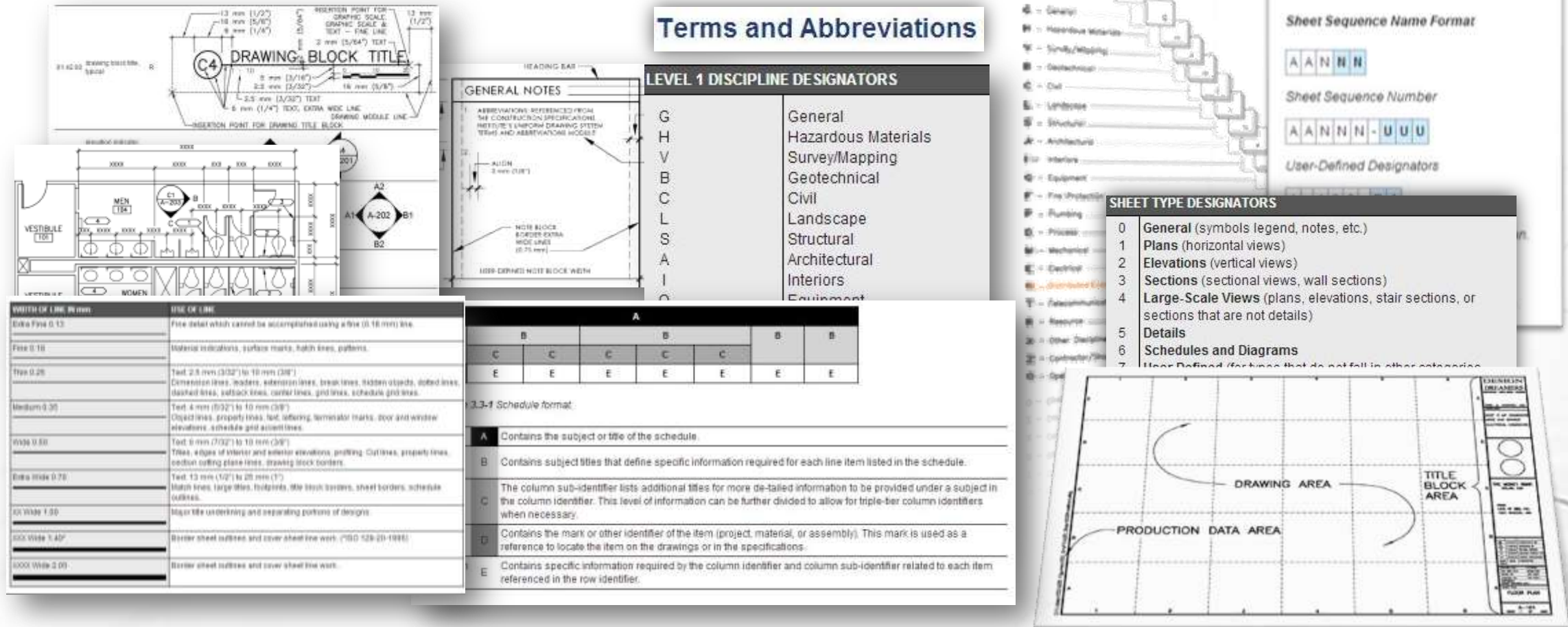


# NCS BIM: Why?

- Project contracts and deliverables remain Sheet-Centric and require graphical output to be NCS compliant
  - Permitting/Review Process
  - Owner/Client requirements
  - Established CAD/PDF/Paper delivery process
- Recognized a void amongst the NCS and NBIMS-US™ for practical BIM workflow
  - NBIMS-US™ doesn't address graphical standards
  - NCS wasn't written for BIM so clarifications were needed
- NCS contains a lot of content that is used in a BIM environment

## NCS BIM: How?

*Graphical Output = Applicable Content*



**Line Weights Table:**

Width of Line, in mm	Use of Line
Extra Fine 0.13	Fine detail which cannot be accomplished using a fine (0.18 mm) line.
Fine 0.18	Material indications, surface marks, hatch lines, patterns.
Fine 0.25	Text: 2.5 mm (3/32") to 10 mm (3/8") Dimension lines, leaders, extension lines, break lines, hidden objects, dotted lines, dashed lines, subblock lines, center lines, grid lines, schedule grid lines.
Medium 0.30	Text: 4 mm (5/32") to 10 mm (3/8") Object lines, property lines, text, lettering, terminator marks, door and window elevations, schedule grid section lines.
Wide 0.50	Text: 6 mm (1/8") to 10 mm (3/8") Titles, edges of interior and exterior elevations, plotting, cutlines, property lines, section cutting plane lines, drawing block borders.
Extra Wide 0.75	Text: 10 mm (1/2") to 20 mm (3/4") Hatch lines, large titles, footprints, title block borders, sheet borders, schedule cutlines.
XX Wide 1.50	Major title underlining and separating portions of designs.
XXX Wide 3.00	Border sheet outlines and cover sheet line work. (ISO 528 (31-1995))
XXXX Wide 3.00	Border sheet outlines and cover sheet line work.

**Terms and Abbreviations Table:**

LEVEL 1 DISCIPLINE DESIGNATORS	General
G	General
H	Hazardous Materials
V	Survey/Mapping
B	Geotechnical
C	Civil
L	Landscape
S	Structural
A	Architectural
I	Interiors
O	Equipment

**Sheet Sequence Name Format:**

Sheet Sequence Number: A A N N N - U U U

User-Defined Designators: U U U

**SHEET TYPE DESIGNATORS:**

Designator	Description
0	General (symbols legend, notes, etc.)
1	Plans (horizontal views)
2	Elevations (vertical views)
3	Sections (sectional views, wall sections)
4	Large-Scale Views (plans, elevations, stair sections, or sections that are not details)
5	Details
6	Schedules and Diagrams
7	User-Defined (for types that do not fall in other categories)

**3.3-1 Schedule format:**

A	B	C	D	E
Contains the subject or title of the schedule.	Contains subject titles that define specific information required for each line item listed in the schedule.	The column sub-identifier lists additional titles for more detailed information to be provided under a subject in the column identifier. This level of information can be further divided to allow for triple-bar column identifiers when necessary.	Contains the mark or other identifier of the item (project, material, or assembly). This mark is used as a reference to locate the item on the drawings or in the specifications.	Contains specific information required by the column identifier and column sub-identifier related to each item referenced in the row identifier.

**Drawing Area Layout:**

DRAWING AREA

PRODUCTION DATA AREA

TITLE BLOCK AREA

Source: <http://www.nationalcadstandard.org>

# NCS BIM: What?

## Main Sections

- Introduction
- AIA CAD Layer Guidelines
- Uniform Drawing System
- **BIM Implementation**
- Plotting Guidelines
- Appendixes

## Contents

***0.0 Introduction***

***1.0 References***

***2.0 Clarifications***

***3.0 Basic BIM Guidelines***

Source: <http://www.nationalcadstandard.org>

# NCS BIM: Sample Content

## Section

## Sample

- **Introduction**
- References
- Clarifications
- Basic BIM Guidelines
- Summary

*The BIM Implementation section identifies relevant topics within the NCS that can be incorporated within BIM workflow by adding clarification as needed without displacing an established CAD workflow.*



# NCS BIM: Sample Content

## Section

- Introduction
- **References**
- Clarifications
- Basic BIM Guidelines
- Summary

## Sample

### ***NBIMS-US™ V2***

***Since all drawing output should at this point be [United States] National CAD Standard® compliant, we are making this a requirement for a minimum BIM.***



# NCS BIM: Sample Content

## Section

- Introduction
- References
- **Clarifications**
- Basic BIM Guidelines
- Summary

## Sample

### **2.3 Sheet Organization**

*The sheet organization module can be implemented as-is for BIM use. No exceptions or clarifications are necessary.*

### **2.7 Symbols**

*...drafting or annotation symbols ...are all applicable. Model elements [FFE]... need not be symbolized if they could vary from actual component type used*

# NCS BIM: Sample Content

## Section

- Introduction
- References
- Clarifications
- **Basic BIM Guidelines**
- Summary

## Sample

### ***3.1 Authoring Content***

***Dimensions should not be overridden. Once a project progresses past schematic/conceptual phase, use real-world dimensions for components, not nominal dimensions.***

### ***3.2 Model Coordination and Delivery***

***Model(s) should be purged, cleaned, and audited prior to distribution to other team members or project stakeholders***

# NCS BIM: Sample Content

## Section

- Introduction
- References
- Clarifications
- Basic BIM Guidelines
- **Summary**

## Sample

*Utilizing the NCS for BIM production will maintain a paramount purpose of the standard — consistent and streamlined communication among owners and design/construction teams.*



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## Today's Panel Expert : Stephen Spangler

Stephen Spangler graduated from Virginia Tech with a Mechanical Engineering degree. He worked for NAVFACENGCOM for 2 years, then in 1992 went to work at the U.S. Army Corps of Engineers' CAD/BIM Technology Center in Vicksburg, MS. He has been involved with the United States National CAD Standard® since Version 1.0, serving on both the NCS Steering Committee and various other committees. Stephen is also the author of the USACE A/E/C CAD Standard and A/E/C Graphics Standard documents, both of which are based on the NCS, but add additional Department of Defense requirements. He is a big Star Trek/Star Wars fan and enjoys collecting autographs and attending science fiction conventions. His goal in life is to prove to his daughters that he does not spend his whole day at work "playing videogames and surfing the internet".



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<https://cadbim.usace.army.mil/>

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## Today's Panel Expert : Jennifer DiBona

Jennifer DiBona is a long-time CAD consultant and trainer doing business as That CAD Girl. She is based in Raleigh, North Carolina. That CAD Girl provides sales, support and training for Carlson Software, AutoCAD and IntelliCAD software programs as well as Carlson hardware and data collection. We specialize in Field to Finish, Surface Modeling and all aspects of CAD standardization..

Jennifer joined the United States National CAD Standard® (NCS) Project Committees in 2010. She served as the Chair of the V6 NCS Survey/Civil Ad Hoc Task Team and is a member of the Project Committee and Steering Committee.



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## Today's Panel Expert : Jason Sturniolo

Jason Sturniolo is an Associate with RRMM Architects and the firm's BIM/CAD Manager. Jason has been with the firm since 2006, during which time he has been responsible for the development and maintenance of RRMM's BIM/CAD standards. He is also an Autodesk Certified Instructor for Revit and is a Revit Certified Professional who has been responsible for both implementing Revit and training RRMM staff. Jason also serves as a member of the United States National CAD Standard® (NCS) project Committee and Steering Committee and is a member of the National BIM Standard-United States® (NBIMS-US™) Project Committee. In his spare time he restores classic muscle cars.



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# Get Involved!

- Join the NCS Project Committee
- Membership – Open to Everyone
- Requirement – Ownership of NCS V6
- Online Application at:  
[https://www.nationalcadstandard.org/ncs6/join\\_committee.php](https://www.nationalcadstandard.org/ncs6/join_committee.php)

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## Join the National CAD Standard Project Committee

Complete and submit the following information to become a member of the NCS Project Committee.

### APPLICATION FORM

Fields marked with an \* are required.

**Name / Organization**

Salutation:

First Name:\*

Last Name:\*

Title:

Organization:\*

**Member Classification:\***  
b5a and the Institute categorize members in order to ensure an appropriate representation of the various interests of the building community in the makeup of project committees. Please select the category most appropriate for your business.

**Contact Information**

Address:\*

City:\*

**NCS Ownership Verification**  
**NCS Purchase Verification:\***  
In accordance with the NCS Project Committee Rules of governance, all Project Committee and Task Team members are required to have the current version (6.0) of the Standard. You may [purchase the Standard online](#) if you have not

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**RELATED DOCUMENTS**  
[NCS Rules of Governance \(PDF\)](#)



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## Interested in purchasing the NCS?

- **10% discount for attendees**
- **Use the discount code: NCSWEB1**
- **Discount valid through July 1, 2016**



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# For More Information...

Visit – [www.nationalcadstandard.org](http://www.nationalcadstandard.org)

buildingSMART alliance  
a council of the National Institute of Building Sciences

[MEMBER PORTAL LOGIN](#)

## Thank You!

The United States National CAD Standard (NCS) streamlines and simplifies the exchange of building design and construction data from project development throughout the life of a facility. It coordinates the efforts of the entire industry by classifying electronic building design data consistently allowing streamlined communication among owners and design and construction project teams. Use of the NCS can reduce costs and produce greater efficiency in the design and construction process.

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**Webinar- Introduction to NCS V6**  
NCS V6 Steering Committee

May 5, 2016, 2:00-3:00PM ET

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**Why the US National CAD Standard Matters to FM**

Dr. Walter Black, AV Symbols - November, 2015

**Efficient Design Drawings**

Ed Lowe, Burgess & Niple, Inc - July, 2015

Own a license to a previous version?



Access the United States  
National CAD Standard® - V5

### RELATED RESOURCES

[New in NCS Version 6](#)

[NCS Version 6 Content](#)

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### CREATE ACCOUNT

[ORDER THE NCS](#)

Follow the steps below to get started:

- Step 1:** [Order the NCS](#) to obtain a license. If you already have a license code, proceed to Step 3.
- Step 2:** Upon purchase, click the link to view the invoice on the thank you page or email receipt and locate the 'Reference ID' on the invoice. This is your license code.
- Step 3:** Enter the license code in the field below (including dashes) along with your email and click 'Submit'.

License Code

Email

[SUBMIT](#)

### RETURNING USER

Enter your email/password below and click 'Submit'.

Email

Password

[SUBMIT](#)

[Forgot password?](#)

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