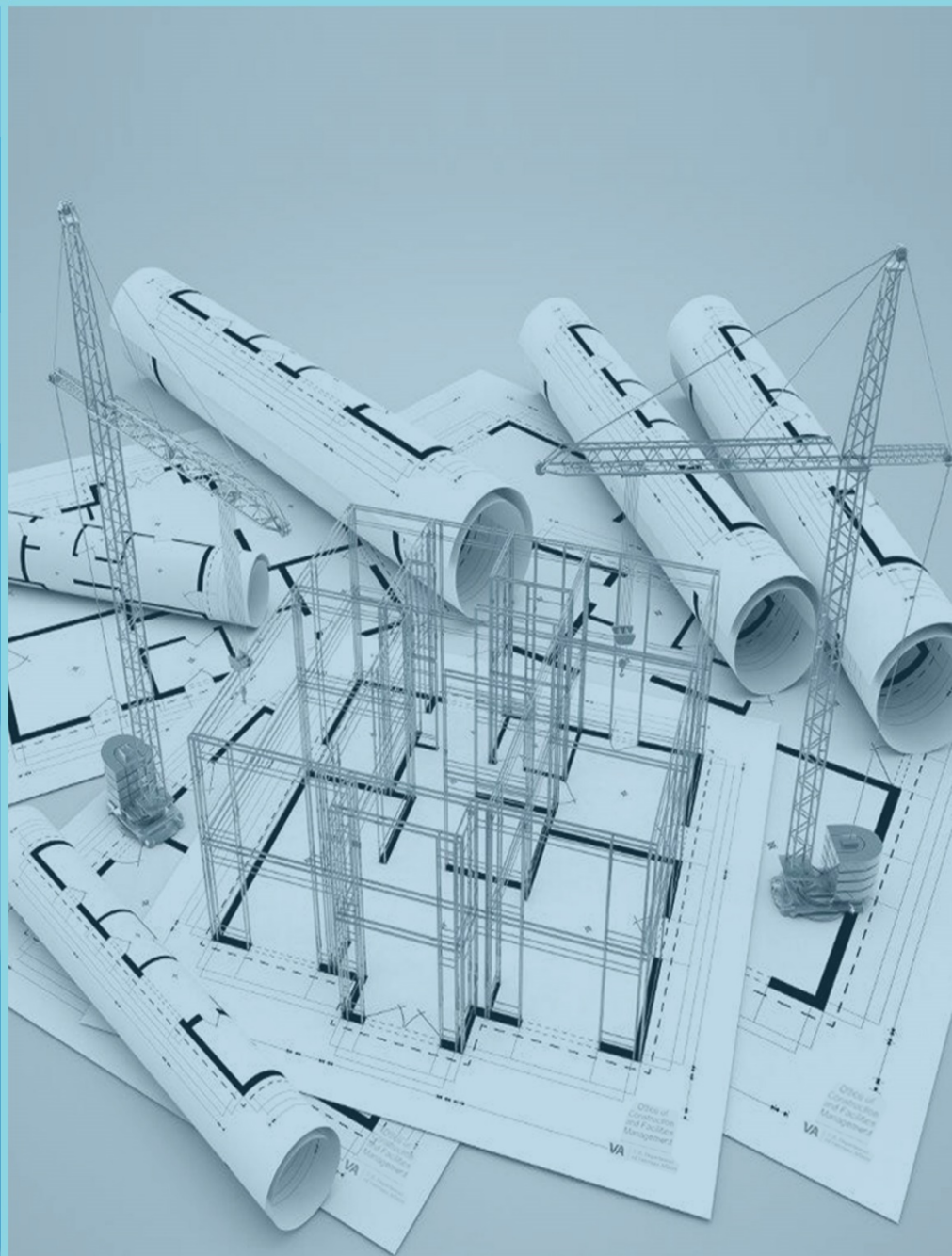




U.S. Department  
of Veterans Affairs

# VA DRAWING DELIVERABLE REQUIREMENTS



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## FOREWORD

In order to foster consistent drafting, graphical representation, and CAD standards for its design and construction documents, the Department of Veterans Affairs (VA) Office of Construction & Facilities Management (CFM) published the *VHA National CAD Standard Application Guide* (“*Application Guide*”) in May 2006 and therein adopted the *United States National CAD Standard*® (NCS), amending portions of the NCS for specific VA needs. At the time of the *Application Guide*’s publishing, the NCS was in version 3.1. Over the past 8 years much has changed within technology, the building industry, and the NCS; therefore, updates to the *Application Guide* became necessary. Additionally, as these new instructions apply to all 2D drawing output whether originating from CAD or BIM, the document title has been updated to *VA Drawing Deliverable Requirements* (DDR).

The overarching intent of the DDR is to defer to the NCS wherever possible and only include information that is specific to VA project needs or that aids in mapping standards for legacy systems. Because the VA recognizes the value of Building Information Model (BIM) technologies and has committed to continuous implementation of use, the DDR is intended to be more conducive to BIM workflows. It is understood that while many in the industry have migrated to BIM use there is still a need to maintain 2D drawing and sheet standards, make provisions for exceptions due to technology challenges, and develop a means of bridging any workflow gaps that exist between CAD and BIM. As the VA continues to progress its BIM initiatives, the DDR also attempts to update the guidelines to encourage BIM-enabled workflows and diminish unnecessary efforts on service providers who need to provide CAD deliverables generated from their BIM design work.



# DRAWING DELIVERABLE REQUIREMENTS (DDR)

## 1. INTRODUCTION

The VA Drawing Deliverable Requirements (DDR) defers to the general standards and requirements of the United States National CAD Standard® (NCS) and only amends the content therein when necessary. Additionally, the DDR supersedes the previous *Application Guide* to better integrate legacy CAD requirements with current workflows of CAD and BIM without adversely affecting VA legacy systems.

The DDR is a supplemental guide to the NCS, and is not to be considered a stand-alone document. Compliance with the DDR will only be possible with a thorough understanding of and often reference to the content within the NCS. VA service providers are responsible for obtaining a license to the latest version of the NCS to meet VA requirements.

The NCS has a well-established revision cycle with continual updates for industry requirements. Additionally, the NCS is recognized as the industry standard and is developed to align with other industry leadership such as the American Institute of Architects (AIA) and the Construction Specifications Institute (CSI). As a broad industry standard, the NCS may not be all-inclusive of every need the VA has for CAD standards but can and does incorporate most general requirements; thus, the intention of the DDR is to supplement the NCS.

### **Legacy Information:**

Throughout the DDR, text boxes labeled *Legacy Information* are provided for interfacing with VA existing legacy CAD drawings. The information contained therein is provided as reference and not required for BIM drawing production.

## 2. APPLICABILITY

The DDR is the standard for all VA construction work where 2D documents are required. The information contained herein specifically applies to drawing deliverable requirements for VA projects (i.e., file naming conventions, sheet layouts, exported digital document files (PDF, DWF) and DWG output from native CAD software or exports from BIM software). The VA BIM guidance takes precedence over any conflicts arising between the guides for projects required to use BIM.

## 3. FILE FORMATS & VERSIONS

For each sheet represented in the 2D drawing set, there must be one corresponding DWG and one corresponding digital PDF (full-size sheet) with consistent graphical information for both file formats. Additional file deliverables must be determined on a project-by-project basis and specified in project specific contract requirements.

For new work, DWG file formats for deliverables must be fully compatible within one version of the latest release of AutoCAD. Each DWG representing a sheet must be fully self-contained and all references and/or links bound.

All 2D drawing files must be submitted in PDF 1.5 (or greater) file format, per ISO 32000-2 standard. All digital PDFs must be created directly from the native application (e.g. Revit, AutoCAD, Word, etc.). Drawing line work must be vector based and scale independent. All text must be provided as TrueType or OpenType font with the ability to search and select text. PDF sheet composition should follow the

format established in the *Guidelines for Construction PDF Documents* (<http://cpcoalition.com/guidelines/>).

Compile individual PDFs into a composite PDF set and at a minimum provide hyperlinking and bookmarking for each sheet and for all references (e.g., callouts, elevations, details, and section tags/marks) located on each sheet.

Submit all files in the appropriate folder as outlined in [Appendix C: VA Folder and File Structure](#).

## 4. COMPANION FILES & REFERENCES

The DDR is a subset of the VA National BIM Standards which may be sourced from the VA Technical Information Library (TIL): The VA provides several template files for reference and use for VA projects:

[VA DWG Title Block](#): A DWG file containing the VA Sheet Title Block

[VA RFA Title Block](#): A Revit Family file containing the VA Sheet Title Block

[VA Shared Parameters](#): A text file of shared parameters to support the Revit Titleblock

### Companion and Reference Documents to the DDR.

[Appendix A: VA Sheet Identification](#): Tables for NCS sheet Identification with VA specific modifications to the Discipline Designator List

[Appendix B: VA Sheet Example](#): A PDF sheet example illustrating the VA Title Block and various subcomponents.

[Appendix C: VA Folder and File Structure](#): An outline of required folder structure for submittals.

### Reference Documents for working with Legacy CAD Files.

[VA Legacy Layer List](#) (not for new projects): Reference tables for use for VA legacy CADD files and systems and examples of layer components such as typical layer format, color, linetype, and lineweight assignments. Layers defined in the original *Application Guide* are updated to conform to the NCS.

[VA NCS CTB Table](#): A reference table documenting *Color Number, RGB Values, Lineweight, and Screening* as defined in the AutoCAD Color Dependent Plot Style ([NCS.ctb](#)).

## 5. AMENDMENTS TO THE NCS

The content contained in the NCS provides the baseline for uniform drawing set organization. The DDR adopts the NCS, incorporated into this document by reference, and amends the content as indicated herein. The following sections correlate to sections and topics within the NCS. For each section refer to the NCS for more detailed information and requirements.

### 5.1. AIA CAD LAYER GUIDELINES

The AIA CAD Layer Guidelines apply to DWG files regardless of the software used (i.e., developed natively in CAD software or exported from BIM Software). It is critical that standard layer naming guidelines be followed. The DDR fully adopts the layer list and syntax provided in the NCS. At a minimum, layer naming must be comprised of Discipline Designators (level 1) and Major Groups. Minor



Groups and Status Fields are preferred as this extends the usefulness of the DWG files; their use, however, is at the discretion of the responsible party providing the information.

Required Format	Preferred Format
A-WALL	A-WALL-FULL-E

To maintain graphical fidelity, legibility, and usability of digital drawings, assign various and contrasting colors, linetypes, and lineweights for CAD layers to enable visual on-screen identification and/or color printing. Specific color numbers, linetypes, or lineweights for certain layers are not mandated.

Reference the NCS for appropriate Layer Name Format, Drawing View Layer List, Annotation Layer List, and associated NCS appendices.

**Legacy Information:**

Refer to [VA Legacy Layer List](#) for specific layer information. Although not required for BIM drawing production, this appendix is recommended as a reference for configuring the BIM software for consistent output.

## 5.2. NCS UNIFORM DRAWING SYSTEM (UDS)

### 5.2.1. Module 1 - Drawing Set Organization

#### Set Content and Order

A complete drawing sheet index containing the drawing numbers and drawing titles must be provided when making a document submittal to VA. Information contained within the index must match the information within the title block of each sheet for the project. Follow the discipline and sheet order as prescribed in the NCS.

#### Sheet Identification

The Drawing Number on the VA Title Block must correlate to the Sheet Identification within the NCS.

Level 1 Discipline Designators must follow the NCS. Various Level 2 Discipline Designators (also called discipline modifiers) are listed in the NCS module as examples but may not be all-inclusive of complex project needs. Use of alpha characters not listed within the NCS for Level 2 is permitted so long as there is no conflict with predefined Level 2 Designators for the respective discipline for which it is being used. Clearly identify the use of any custom Level 2 Discipline Designators in the index of drawings. Refer to the NCS for all other Sheet Identification information and format including Discipline Designators, Sheet Type Designators, Sheet Sequence Numbers, and allowable suffixes.

Refer to [Appendix A: VA Sheet Identification](#) for VA specific information.

#### File Naming

To sustain the established structure and workflow of standardizing, updating, and organizing 2D documents, the VA requires strict compliance with the file naming conventions specified herein. VA filenames must consist of the project number, which is comprised of a six digit code made up of the station number, a dash, and the project number; building number; Sheet Number as described (Sheet Identification); and file extension. When a drawing reflects work that is



associated with several buildings or the station in general, such as site plans or utility plans that contain several buildings in the project, then use “0” before the Sheet Number.

**Example File names for Sheet Files (Single Building)**

Drawing Title	Station Number	Project Number	Building Number	Sheet Number	Drawing Date yyyymmdd	File Extension
Cover Sheet	489-	423.	800.	GI001.	20171201.	
Index	489-	423.	800.	GI002.	20171201.	dwg
Asbestos Removal Plan	489-	423.	800.	HA101.	20171201.	dwg
Asbestos Removal Section	489-	423.	800.	HA301.	20171201.	dwg
Civil Demolition	489-	423.	800.	CD101.	20171201.	dwg
Civil Site	489-	423.	800.	CS101.	20171201.	dwg
Architectural Demolition	489-	423.	800.	AD101.	20171201.	dwg
Architectural Plan	489-	423.	800.	AS101.	20171201.	dwg
Architectural Elevation	489-	423.	800.	AS201.	20171201.	dwg
Architectural Section	489-	423.	800.	AS301.	20171201.	dwg

**Example File names for Sheet Files (Multi-Building)**

Drawing Title	Station Number	Project Number	Building Number	Sheet Number	Drawing Date yyyymmdd	File Extension
Cover Sheet	489-	423.		GI001.	20171201.	dwg
Index	489-	423.		GI002.	20171201.	dwg
Civil Site	489-	423.	0.	CS101.	20171201.	dwg
Architectural Demolition Bldg. 800	489-	423.	800.	AD101.	20171201.	dwg
Architectural Demolition Bldg. 902	489-	423.	902.	AD101.	20171201.	dwg
Architectural Plan Bldg. 800	489-	423.	800.	AS101.	20171201.	dwg
Architectural Plan Bldg. 902	489-	423.	902.	AS101.	20171201.	dwg
Architectural Elevation Bldg. 800	489-	423.	800.	AS201.	20171201.	dwg
Architectural Elevation Bldg. 902	489-	423.	902.	AS201.	20171201.	dwg
Architectural Section Bldg. 800	489-	423.	800.	AS301.	20171201.	dwg
Architectural Section Bldg. 902	489-	423.	902.	AS301.	20171201.	dwg

Therefore, the sheet file naming syntax is:

[StationNumber-ProjectNumber].[BuildingNumber].[SheetNumber].[FileExtension]

From the previous tables, examples of associated files for the cover sheet would be:

**Single and Multi-Building Sheet Filename Example:**

**489-423.800.GI001.20171201.dwg**

**489-423.800.GI001.20171201.pdf**

**Multi-Building Site Plan Sheet Filename Example:**

**489-423.0.GI001.20171201.dwg**

**489-423.0.GI001.20171201.pdf**

Likewise, when using BIM, the model filenames would use the same naming schema to include station and project number. However, in lieu of the sheet number, the file name would indicate model discipline and division. To indicate the discipline or trade, the filename can contain the NCS discipline designator or an abbreviation of the discipline (i.e., A or Arch). The model file naming syntax is:

[StationNumber-ProjectNumber].[BuildingNumber].[Discipline(+opt.UserDefined)].[FileExtension]

**Model Filename Example:**

**489-423.800.A. 20171201.rvt or 489.641-423.800.Arch. 20171201.rvt (denoting an Architectural Model)**

**489-423.800.Alv1. 20171201.rvt (denoting Architectural Model of building level one)**

## 5.2.2. Module 2 - Sheet Organization

The VA requires the use of a Standard Title Block, sheet size 30"x 42" (Arch E1 / Arch F). Title Block drawing files are provided on the TIL and contain an information block as well as embedded dimension and text styles. All sheets within the set must clearly denote project phase deliverables as required in PG-18-15 (i.e., Concepts, Schematic Design, Design Development, or Construction Documents). Plan North must be oriented towards the top or left of sheet. All buildings which are fully sprinklered must be indicated as such on each architectural, structural, HVAC, plumbing, and electrical floor plan. Project phase, sprinklered or non-sprinklered, and revisions must be identified within the appropriate section of the Title Block. The Title Block for each sheet must be complete and accurate to enable efficient use by the VA. See [Appendix B: VA Sheet Example](#).

Develop and submit a Cover Sheet for each submission to the VA. The Cover Sheet for the drawing set must include all relevant contact information (i.e., company name, address, phone numbers, point of contact, & email) for each project team member relating to the submission (e.g., Architect, Engineering, and Consultants). Include a list of all relevant VA standards, applicable national codes, and the effective date for standard and code utilized for the project. Also, make signature block provisions within the cover sheet for VA signoff and approval during the review process (e.g., VA Project Manager, etc.)

## 5.2.3. Module 3 - Schedules

Schedules in the NCS are defined as having at a minimum a subject title (Heading) with three columns of related information under subheadings (Mark, Item Description, and Distinguishing Feature). Provisions are made for Legends, Keys, or Indices as having at a minimum a Heading and two columns under subheadings of Mark and Item Description. VA projects often require many schedules and legends to adequately document the project. All Schedules must at a minimum follow the general format in the NCS Schedules Module.



Refer to the NCS for additional standard schedules. Additionally, refer to the [VA Standard Details \(PG-18-4\)](#) for other examples of schedules and related information specific to VA projects not covered within the NCS.

VA projects must utilize the NCS Appendix B – Schedule Formats for the standard Door and Frame Schedule, Window Schedule, and Room Finish Schedules.

**Content for Opening Schedules**

Opening Schedules must provide all information as required in the VA National Standards:

Opening/Door/Window	Frame	Assembly
Mark	Material	Fire rating
Dimensions (Width, Height, Thickness)	Details (Head, Jamb, Mullion, Sill)	Key side, Locks and Security Room Number
Material and Finish	Type/Elevation	Hardware Set
Type/Elevation	Glazing (Type, Width, Height)	Blast rating
Glazing (Type, Width, Height)	Threshold	Acoustical Rating
Louver (Width, Height)		Notes/Comments

**Content for Room & Room Finish Schedules**

Room & Room Finish Schedules must define all information as required in the VA National Standards:

Room
Number *
Name
Floor
Wall Material(s)
Ceiling Material(s)
Applicable Notes/Comments

\* Each room can have varying numbers for use by Planning, Contracting, and Wayfinding. Incorporate the use of all three numbers in Room Schedules as the information becomes available.

**5.2.4. Module 4 - Drafting Conventions**

**Scale**

Scaled views for drawings must consist only of scales identified in the NCS Common Scales List. All scaled views represented on a sheet must have a corresponding graphic scale on the same sheet. Graphic scales may be included as part of the title mark as indicated in the NCS or may be placed at the bottom right hand corner of the sheet. Non-Scaled view (e.g., perspectives) may be used as needed.

See [Appendix B: VA Sheet Example](#).

**Lines**

The standard linetypes and nine basic lineweights identified in the NCS must be used. Use of custom linetypes is permissible if there is not a corresponding linetype available in the NCS. Any custom linetypes used must be clearly identified in a drawing legend as to what element(s) are being indicated.

See DDR Section 5.2.6 - Module 6 - Symbols for information regarding line display for piping.

**Text**

The NCS *Module 4 – Drafting Conventions* does not mandate any particular text font be used but establishes a minimum printed height of 3/32". NCS *Module 6 – Symbols* and *Module 7 – Notations* require fonts to be capitalized, non-stylized (i.e., not italicized, underlined, bold, or otherwise highlighted), and a Sans Serif font (e.g., Arial, or Arial Narrow) with a width factor of no less than 0.8.

In addition to the minimum NCS requirements for text, the VA requires the following to be used for all new sheet files regardless of the native authoring software (i.e. CAD or BIM):

**Updated VA Standard**

Text Use	Style/Type Name	Font	Minimum Width Factor	Minimum Height
General Text Details, Schedules, Tags	Arial Narrow [User Defined]	Arial Narrow	0.8	3/32"
Headings, Titles, Plan Area Labels	Arial [User Defined]	Arial	1.0	3/16"

Alternate Sans Serif Fonts may be used. Do not use "Standard" as a text style/type name. The text style/type name must include the font name for easy identification but may also contain a user defined modifier to distinguish it from other styles/types (e.g., "Arial Narrow General")

**Legacy Information:**

**Minor edits to existing VA legacy DWG files need not be brought into compliance with the NCS.** The following table is for Legacy systems and is provided as reference for accessing archived files, mapping of text to the preferred text style/types for VA projects, and as an acceptable option when performing minor edits to existing files where modifying text styles might render the drawings illegible.

**Legacy VA Standard (For Reference)**

Text Use	Style Name	Font	Minimum Width Factor	Minimum Height
Headings, Titles, Plan Area Labels	Bold	Bold	1.0	3/16"
General Text, Schedules, Tags	RomanS	RomanS	1.0	1/8"

**Units**

The primary measurement unit for VA drawings will be in Imperial (e.g., 1/4" = 1' – 0").

**Dimensioning**

Dimensions must contain auto-populated values with no dimensional overrides. Dimensions are to be associated/anchored to the object to which they are dimensioning (i.e. no floating or orphaned dimensions).

**Smoke Barriers and Fire-rated Partitions**

All smoke barriers and fire-rated partitions are to be indicated on Architectural; Heating, Ventilating and Air-Conditioning (HVAC); Plumbing; and Electrical floor plans that are 1/8 in. scale or larger.

**2D documents created in CAD:** Use the NCS prescribed linetypes to indicate smoke barriers and fire-rated partitions for native DWG files.

**2D documents exported from BIM:** See the VA BIM Manual for information regarding wall partition requirements and/or provisions.

### 5.2.5. Module 5 - Terms and Abbreviations

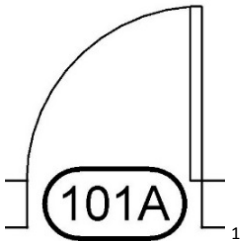
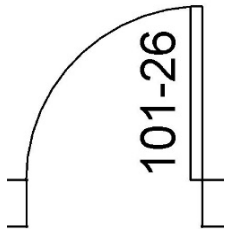
The DDR fully adopts NCS *Module 5 – Terms and Abbreviations*. Abbreviations should be avoided whenever possible to reduce confusion and misinterpretation.

### 5.2.6. Module 6 - Symbols

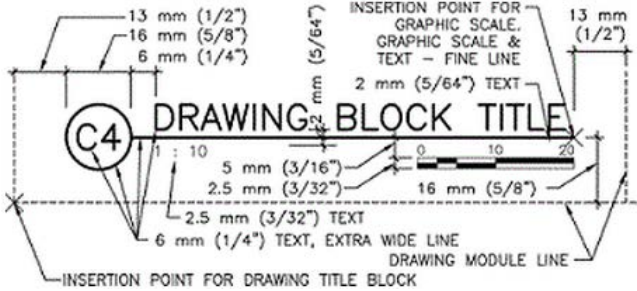

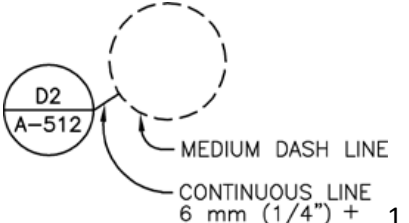
The NCS Symbols module is adopted for use with VA projects. For any symbol discrepancies between NCS and VA Standard Details (PG-18-4), utilize the NCS symbol. Not all symbols needed for VA projects will be listed in the NCS or VA Standard Details (PG-18-4); therefore, a custom symbol may be used so long as it does not create a conflict with the standards and is clearly identified in a legend and/or description. The order of precedence for use of symbols is:

1. NCS UDS Module 6 - Symbols
2. VA Standard Details (PG-18-4) for reference
3. Custom symbols with a corresponding legend depiction and description.

Refer to the NCS for full listing of symbols. The following table is provided to illustrate a few notable changes from VA legacy standards.

DDR VA Standard	Graphic Example
<p><b>Door Tags:</b> Option 1 – Use the NCS Door Tag Symbol.</p>	
<p><b>Door Tags:</b> Option 2 – Align Door Tag with panel and omit tag border (useful for projects requiring longer door numbering scheme).</p>	

<sup>1</sup> NCS v6 Module 6 - Symbols, 6.4 Symbols, <http://www.nationalcadstandard.org>, 2015

DDR VA Standard	Graphic Example
<p><b>Title Marks:</b> Option 1 – Use the NCS Title Mark. The Graphic Scale may be omitted from the Title Mark if it is located elsewhere on the sheet.</p>	
<p><b>Title Marks:</b> Option 2 - The indicator (detail number) may contain a reference for the sheet on which the detail resides (example as shown A-101). elsewhere on the sheet.</p>	
<p><b>Detail Callouts:</b> Use the NCS symbol to indicate detail callouts.</p>	

The NCS classifies symbol definitions as various types: *Identity, Line, Material, Object, Reference, or Text*. Comply with the NCS symbols for *Identity, Material, Reference, and Text* unless otherwise amended by the DDR. Symbols for components classified as **Lines** or **Objects** within the NCS Symbols module are permitted to vary from the definition within the NCS so long as the **Line** or **Object** is clearly identifiable via tags, schedule, and/or legends. Any linetype not available within the NCS can be created following the same convention established therein. Reference the linetypes definitions within the VA Standard Details PG-18-4 for common linetypes specific to VA projects. Any custom linetypes must be clearly denoted on the drawings as to what it is indicating.

**2D documents created in CAD:** Piping must be depicted as single line drawings for maximum legibility and identified with linetypes.

**2D Documents exported from BIM:** Piping must be depicted with the actual diameter in lieu of symbolized linetypes so long as its purpose is clearly identified (i.e. tagged, color coded, etc.) and the drawings remain legible. Single lines should only be used in BIM when legibility is compromised due to congested areas.

**Symbols Classification Examples (permitted to vary from the NCS)**

Classification	Examples
----------------	----------

Classification	Examples
Line	Site Utilities, Building Utilities, Various Piping
Object	Doors, Windows, Toilet Fixtures, Furniture

**Object representation and reference tag designations must be consistent throughout the drawing set to enable automatic software recognition of objects and text characters.**

The following table provides examples of the symbol classifications within the NCS.

**Symbols Classification Examples (to comply with the NCS)**

Classification	Examples
Identity	Valves, Fire Alarms, Light Fixtures, Electrical Outlets
Material	Hatch Patterns, Display in Plan/Details, Display in Elevation, Display in Section, etc.
Reference	Interior/Exterior Elevation Indicators, Section/Detail Indicators, Tags** (room, door, window, wall), etc.
Text	Electrical Outlets

\*\* Tag borders may be omitted or expanded if necessary to maintain legibility accommodate additional characters needed for larger projects.

### 5.2.7. Module 7 - Notations

The DDR amends the NCS *Module 7 - Notations* module. Unless prescribed by the VA on a project-by-project basis, it is at the discretion of the responsible party providing information to select the notation method that best communicates drawing information. Inline notations are permitted and use of note blocks aligned to the right of the sheet is not mandated. If reference and/or sheet keynoting are used, follow the prescribed format in the NCS. Employ a consistent notation method for each facility and its corresponding projects.

### 5.2.8. Module 8 - Code Conventions

The NCS *Module 8 – Code Conventions* is not required.

## 5.3. BIM IMPLEMENTATION

The NCS contains a *BIM Implementation* section to help bridge workflows of a BIM and CAD environment and provides some basic BIM guidelines. The DDR fully adopts the BIM Implementation section.

## 5.4. PLOTTING GUIDELINES

Plot quality has many determining factors including but not limited to: plotting equipment, plot configuration, pen settings, plot styles/tables used (CTB/STB), layer/element overrides, and/or layer names. Printing from the native authoring software with different variables across different systems can yield inconsistent results; therefore, to enable more consistent graphical output, the submitted digital PDF files for any given project must be considered the official source for reprographic production in lieu of printing from the native authoring software, be it CAD or BIM.

Although the DWG file is not intended to be used for printing reproduction, it must be formatted in a manner to extend usability for future use (e.g., underlay or baseline drawing for new additions or alterations). All DWG files must comply with the instructions under the DDR [5.1 AIA CAD Layer Guidelines](#) to ensure the DWG files can be efficiently modified and layers mapped to various colors, linetypes, and lineweights.

To ensure appropriate lineweight control and enable extended use of the DWG file, the following is required:

**2D documents created in CAD:** Use the VA provided [NCS.ctb](#) plot style to control lineweight.

**2D documents exported from BIM:** Use settings within BIM software to control lineweights by object and/or category to ensure drawings will have appropriate lineweight irrespective of layer color.

**Legacy Information:**

The NCS does not mandate that specific colors print at a predetermined lineweight; however, VA legacy systems used a color dependent plot style utilizing the AutoCAD CTB file ([NCS.ctb](#)). This file is available on the TIL.

[VA Legacy Layer List](#) and [VA NCS CTB Table](#) are provided as a reference to assist mapping various plot configurations to achieve consistent output.

## 6. TECHNICAL INFORMATION LIBRARY (TIL) DETAILS

[VA Standard Details \(PG-18-4\)](#) in the TIL which are categorized by division are available as a reference for producing VA project drawings. The details must be reviewed and may require updating prior to use. When used, TIL Standard Details are to be stripped of the generic title block information prior to insertion into a project drawing, verified to be NCS compliant, and updated as needed for a specific project by the responsible party providing the information. Only details pertaining to the project should be included in the drawings.

## 7. ACKNOWLEDGMENTS

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