

Presents

Guidelines for Construction PDF Documents

Version 2.0

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Introduction & Overview

History of the CPCoalition

Since 2013, a grassroots effort has been underway to define the new *Guidelines for Construction PDF Documents*. Though PDFs are the de facto format for digital construction documentation, national design standards haven't yet been defined. This coalition aims to help owners and design-build project teams define their own standards collaboratively. Jointly created by the Construction PDF Coalition (CPCoalition), the aim of these guidelines are to better leverage digital information being shared among designers, constructors and all project team members.

Vision

To maximize the quality and efficiency of digital handoffs through collaborative guidelines by an adaptive and open-source approach

Mission

The CPCoalition seeks to improve the digital collaboration between designers, builders, and end-users through adoption of new guidelines and policy. To promote the adoption of open-source deliverable standards that address the needs of designers, builders, and owners.

Use of the Guidelines

The intent is for the Project Team (comprised of the Owner, Architect, Contractor, and Owner's Facility Management representative) to use this Guideline as a point for discussion during the formation and execution of the project to agree upon the creation and collaboration around the contract PDF Deliverables that are shared. used and maintained on the project. By using this Guideline as a template, the Project Team can quickly gain alignment and agreement on the best solution for the project. As the Guideline was written in an informational and best practices format, each project will result in different implementation based on Project Team composition and experience with Construction PDF Documents – the important activity is that the Project Team convenes a meeting, using this Guideline as the template for discussion.

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Section 1: Consistency Across Drawings

1.1 Naming Convention

Consistent and logical structure for sheet names and detail call outs across all disciplines in the project enables the rapid hyperlink creation and navigation of PDF drawings and specifications.

The project specific **Location Breakdown Structure** (LBS) should be aligned across disciplines and throughout the project lifecycle. Figure 1 is a good example of a logical LBS across sheet names.

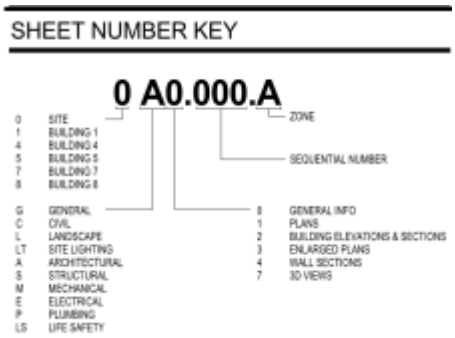


Figure 1 Sheet Number Key with LBS Logic

In addition to sheet name, a consistent LBS should be developed for both the **PDF File Name** and **Bookmark Name**.

Sample # 1 – Building_Discipline_Level_Area_Room_Object

Sample #2 – Building_Level_System_Zone_Object

Available References: NCS Module 1 Drawing Set Organization Module 1.7 Appendix B

1.2 Plot Location

To maintain consistency across versions and between trades, the plot location of title blocks, margins, and grid lines should remain consistent across like drawings or details. The design author shall provide and ensure compliance with consistent plot location in paper space through location of gridline intersections or other project baseline on similar sheet types amongst the set and across disciplines. For example, floor plan or enlarged plan views.

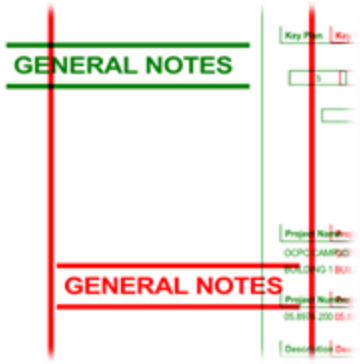


Figure 2 Overlay of Misaligned Plot Locations

1.3 Sheet Size

The designated sheet size(s), as collectively decided by the project team, should remain consistent across like sheets so that if overlaid, they align properly for comparison and coordination.

REFERENCE: NCS v5 UDS 2.2 Sheet sizes

1.4 Drawing Scale

Scale of each sheet type/view to be consistent amongst the set (underground coordination), across disciplines, as agreed upon by the Project Team. Scale should be determined for each sheet type (i.e. overall plans at 1/16”, partial plans at 1/8”, enlarged plans at 1/4”, sections at 3/4” etc.)

REFERENCE: UDS Module 4 and template project worksheet.

1.5 Gridline Visibility & Orientation

Consistent gridline visibility (i.e. should be consistent for navigating across all sheets, across disciplines for alignment purposes). Origin location and orientation of like grid lines should remain consistent with the architect's designation (true north or plan north). Consistency should continue downstream to include submittal shop drawings.

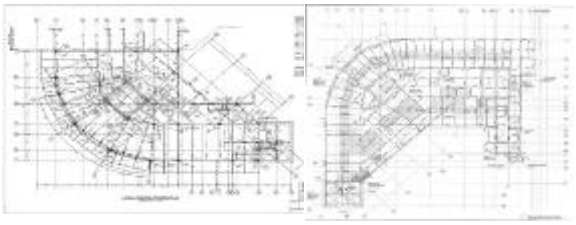


Figure 3 Misaligned Orientation and Scale Between Engineering and Shop Drawings cannot be Overlayed

1.6 Metadata & Title Block

The PDF is not the only open-source file type utilized in the AEC) industry. CPCoalition supports the alignment and consistency of metadata across the **Industry Foundation Class (.IFC)** and other open-source file formats required by the project.

Currently 3D PDFs can store significantly more metadata than 2D PDFs. On 2D PDF drawings, the pertinent project data should be contained within the **Title Block** of the drawing. Consistent title block arrangement and naming convention across drawing disciplines enable the efficient navigation for downstream stakeholders.

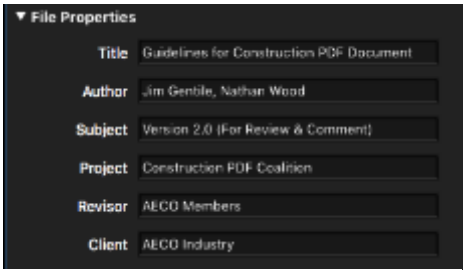


Figure 4 Standard 2D PDF Metadata Fields

Title Block Information Categories to Discuss & Align		
Page # or Spec #	**Revision**	**Author**
Project Title Name	**Date Issued**	**Discipline**
Sheet Title	**Document Type (elevation, detail, plan)**	**Location Breakdown Structure**

Customize the guidelines to your project or company level standards online using the PDF Guidelines Webform! Visit www.cpcoalition.com/create



Figure 5 Sample Title Block

1.7 PDF Markup Colors

Scope or company specific color coding of PDF markups should be consistent across all PDF document and should align with existing color designations, if previously setup in the BIMxP. This helps to ensure ease of clarity and consistency when collaborating with multiple reviewers simultaneously.



Figure 6 Color Codes by Trade

Section 2: Drawing Creation

2.1 Authoring Application Best Practices

The goal for Creation is to streamline the flow of data for use in construction and operations while minimizing overall file size. Best practices include the following: PDFs should be created directly from authoring application with output quality consistent with native file Format, Use vector based lines when creating PDFs Use efficient hatch fills so as not to inhibit PDF performance or increase file size. Complex line styles slow down rendering speed. Rather, simple lines styles provided within the native software program perform the best.

2.1.1 TrueType Font

Use True Type fonts to allow search ability within the PDF (SHX are not searchable) Limit information generated in PDF to what is agreed upon by the Project Team. Using TrueType fonts in CAD is preferred when creating PDFs because TrueType fonts are converted to searchable text in PDF.



Figure 7 TrueType vs Vector vs Raster Text

All text across PDF documents should be TrueType font. For more information on how to determine if your drawings contain TrueType font, see the Frequently Asked Questions in the Appendix.

2.1.2 Cross-Hatching & Fill Pattern

The overlay and crossing of vector lines creates a significant lag on PDF drawing load times when viewed on mobile devices with limited rendering capacity. Designers should limit or eliminate the use of cross-hatching in their design drawings.

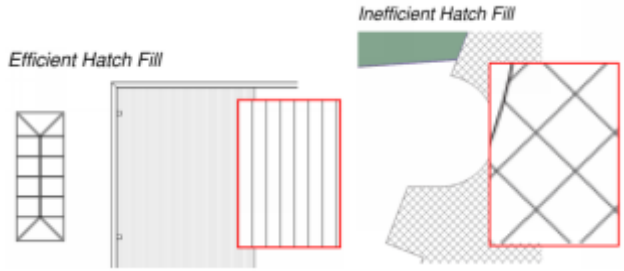


Figure 8 Example of Parallel vs Cross-Hatching

2.2 PDF Export Best Practices

PDFs can contain raster, vector and text or a combination of all of them. Our brains are excellent at recognizing patterns, so it's easy to look at a PDF and conclude that a PDF contains lines and text when it doesn't. The page may contain lines and characters, but what are used to represent them in the PDF may not be vector lines and text elements, which are needed to snap to content and to search and select text.

2.2.1 Raster vs. Vector Content

The way to determine if a PDF is a raster image, or scan, is to zoom in very closely. The lines and characters on the page will either change to a grid of square dots or become fuzzy. While raster was once preferred due to its reduced file size, the standard practice today is to always print your PDFs in the vector form**.**

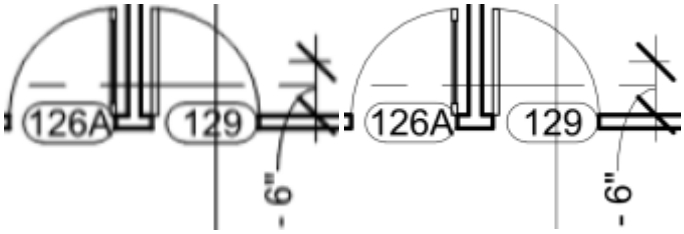


Figure 9 Example or Raster Print (left) and Vector Print (right)

2.2.2 Output Scale

Maintain output scale when printing to PDF Print to Scale, **avoid Fit to Page.** There are multiple places where the scale is controlled and it's very easy to get one of them wrong. It only takes one error along

the supply chain of information handoff to alter the scale of your output. See the Appendix for best practices on how to maintain output scale inside your preferred authoring application.

2.2.3 Unused Metadata

Unused layers, extraneous viewports, an unnecessary metadata leads to increase file sizes and downstream stakeholder confusion. Designers should **update PDF export settings** to remove this unused metadata from the PDF export.

Section 3: Collaboration & Security

3.1 Digital Signatures

Most regulatory authorities with jurisdiction (aka, Authority Having Jurisdiction or AHJ) over construction projects have laws and rules that require any construction document filed for public record (directly or indirectly) bear the architect's and/or engineer's **signature, date and seal**. Many states, require that not only all final construction documents are filed for public record, but all final construction documents that are also provided to the owner or the owner's representative be signed, dated and sealed. This includes not only construction plans, but reports and even letters that contain architecture and/or engineering opinions or directives.

For the purposes of electronically transmitting construction documents filed for public record with an AHJ or otherwise released for construction, we recommend they be digitally signed as per the ISO/DIS 32000-2.4 Document Management - PDF - Part 2: PDF 2.0 standard. In the United States, this is also consistent with an increasing number of State level architecture and engineering board's rules for digitally signing construction PDF documents. Digitally signing construction PDF documents is also good practice from a security and legal perspective, because it ensures the documents are tamper proof and protects the design professional's intellectual property against infringement. At the same time, digitally signing documents ensures non-repudiation to all parties, and makes the documents legally binding.

APPENDIX: Supplemental Information/Best Practices

Glossary

Metadata

Metadata is the backbone of digital curation. Without it a digital resource may be irretrievable, unidentifiable or unusable. Metadata is descriptive or contextual information which refers to or is associated with another object or resource. This usually takes the form of a structured set of elements which describe the information resource and assists in the identification, location and retrieval of it by users, while facilitating content and access management.

Metadata is made up of several elements which can be categorized into the different functions they support. A metadata standard will normally support several defined functions, and will specify elements which make these possible. A metadata standard may support some or all the following functions:

Descriptive Metadata enables identification, location and retrieval of information resources by users, often including the use of controlled vocabularies for classification and indexing and links to related resources.

Technical Metadata describes the technical processes used to produce, or required to use a digital object.

Administrative Metadata is used to manage administrative aspects of the digital object such as intellectual property rights and acquisition. Administrative Metadata also documents information concerning the creation, alteration and version control of the metadata itself. This is sometimes known as meta-metadata!

Optical Character Recognition (OCR)

OCR text can also be included in PDFs. Running OCR, or Optical Character Recognition (found in Revu eXtreme or Adobe Acrobat Pro), on a PDF without real text will add hidden, searchable text to the PDF. The hidden OCR text can then be searched, selected and highlighted, but it does not display. OCR text will highlight blue when using Ctrl+Shift+A to show all the text, but remember that this is hidden text.

Raster

A raster image is created from a series of square dots, called pixels. An example of a raster PDF is one that has been created by scanning an existing piece of paper. A scanned PDF is created by making a bitmap image, like a JPEG or TIFF, of the existing paper page, and then that image is place on the PDF page. This means that a scanned or raster PDF only contains a grid of dots that represent lines and text; it does not actually contain lines or text. So, there are no lines for the Snap to Content function to snap to and there is no text to select or search.

Vector

A vector-based PDF uses line segments to define all of the geometry on the page. Most PDFs created from CAD are vector-based. Vector PDFs are usually preferred to raster PDFs because they contain more smart data that make it easier to work. You should always try to work with vector PDFs created from the

source instead of creating PDFs from scans. The benefits of working with a vector PDF are that the display of the geometry remains sharp when you zoom in to see details of the drawing, and measurements and takeoffs (as well as their calibration) are more precise in a vector PDF because you can use Snap to Content to snap to the vector lines in the PDF.

Vector characters are created by line segments that are used to draw the shape of each character. This usually occurs when the PDF has been created from CAD (often AutoCAD) and a non-TrueType font is used.

Vector characters from CAD can usually be spotted because they have a "lumpy" appearance when you zoom in close. The lines segments used to create the character prevent a smooth appearance in the curved strokes of a character, which is why they can be "lumpy".

Graphic design programs, like Adobe Illustrator, also create vector characters. But, in this case the vector characters have clear, sharp edges when you zoom in. They create vector characters in PDF because it is common for designers to use custom fonts and formatting, and vector characters are used to make sure that the PDF looks exactly like the original file.

Text

Text is an independent type of content in PDFs. You may see text characters in the PDF, but those characters may not necessarily be a PDF text element. Instead, it might be defined by raster dots or vector line segments. We can recognize and read both of these without any problems, but they cannot be selected, edited or searched because they are not PDF text elements.

To avoid confusion, "characters" is used when referring to text in general and "text" when referring to PDF text elements, or "real text."

Frequently Asked Questions (FAQ)

What's the difference between raster, vector, and text?

Let's start with PDF text elements, or real text, which is always preferred because it results in a smarter PDF. PDFs created from character-based programs, like Word and Excel, almost always create PDFs that contain real text. When you zoom in on the text, the edges of the characters always look sharp and crisp – no matter how close you zoom in. The text is searchable and can always be selected.

Raster characters are just like what we talked about before. Individual pixels are used to define each character.

How do I know if my PDF has searchable text?

Before going into details, there is a quick test to determine if your PDF contains text. Press Ctrl+Shift+A, and all text in the PDF (both text and OCR text, which I'll explain) will highlight in blue. If the characters do not highlight, they are either raster or vector.

Why doesn't CAD use TrueType fonts and create real text?

The answer is because AutoCAD came first – it is older than both Windows and TrueType fonts. They needed to create their own system of text and fonts, resulting in SHX fonts, which are defined using line segments. Those line segments are translated into the PDF instead of actual PDF text.

Why are metadata standards important?

Metadata standards often start as schemas developed by a particular user community to enable the best possible description of a resource type for their needs. The development of such schemas tends to be controlled through community consensus combined with formal processes for submission, approval and publishing of new elements. Metadata definitions are generally stored and maintained in a controlled manner by the user community. Published specifications are often held in a central location, such as a reference document on a website or in a Metadata Registry, which may be accessible from a website. These generally contain semantic definitions of the elements and standardized ways of representing them in digital formats such as databases and XML (eXtensible Markup Language). The latter is rapidly becoming the de facto mark-up standard in many communities. Semantic definitions include both Metadata Structure Standards and Metadata Content Standards. The former ensure consistent structure to enable data sharing and searching, manage the creation process, record provenance and technical processes and manage access permissions, while the latter ensure effective machine searches through consistent data entry and the inclusion of access points using controlled vocabularies such as authority files, thesauri or encoding schemes.

Metadata Schemas develop in response to a community need and often gain wide acceptance, or are widely used while still in development. Maintenance by nationally or internationally recognized centers of excellence, such as the Library of Congress, or support from a professional body increases both visibility and take-up so that they become a community's standard schema. Some bodies, such as the Dublin Core Metadata Initiative or the Open Geospatial Consortium, actively develop schemas and ratify them as standards for their user community. Statutory bodies also develop schemas which once internally ratified may become the compulsory standard for metadata creation across the body. A number of schemas or standards are later ratified by professional, national or international bodies such as the ICA (International Council on Archives), BSI (British Standards Institution) and ISO (International Organization for Standardization

How-to Guides

Printing to PDF

This article works backwards from printing to paper to the setup when the PDF is created from AutoCAD.

1. Don’t scale the PDF when it’s sent to the printer.

- Click File > Print .
- Select None in the Page Scaling list.
- Acrobat X and XI
- On the File > Print.
- Click the Actual size check box in the Page Size & Handling section.
- Acrobat 6 to 9
- On the File menu, click Print.

- Select None in the Page Scaling list.

2. Check for scale settings in the printer or plotter driver.

- Click the Properties button in the Print window of the program you're printing from to see the settings for the printer driver.

- Check the settings in your printer driver for a scale or shrink to fit setting.

- Uncheck "shrink to fit" so the printer will be full scale. The layout of printer drives varies, so the setting may have a different name or might be a few levels down in the driver dialog.

3. Bluebeam Change Settings when creating the PDF using the plugin for AutoCAD.

- Click the Change Settings button in the Bluebeam section of the Output ribbon in AutoCAD. The plugin can Page Set setting defined in AutoCAD or it can override them by clicking the Page Setup tab of the plugin after clicking Change Settings .

- Select Custom or Global from the list to enable these settings.

- Select the correct Paper size.

- Plot Scale: Select 1:1 or the appropriate scale for real size PDF output.

If Native (AutoCAD) is selected in the Page Setup list, Bluebeam uses the settings from the AutoCAD Page Setup described below. Using these override settings is optional.

Click here to find out how to create a custom global page setup so you can quickly reuse predefined settings in the plugin.

4. AutoCAD Page setup

- In AutoCAD, click File, then Page Setup, or click the Layout tab, then right click the tab and then click Page Setup.

- Click the Layout Settings tab.

- Select the correct Page Size.

- Select the correct Plot Scale (this needs to match the Viewport scale below).

5. AutoCAD Viewport settings

- Double-click on the Viewport.

– or –

- Select the Viewport, right-click and click Properties.

- Select the desired scale for Standard Scale and Custom Scale in the Misc section of the Properties palette to control the scale of the model space in the Viewport.

Digital Signature Best Practices

To apply a digital signature to a document, a user must first have a unique digital certificate. A digital certificate is a form of identity like a driver's license or passport. As such, it must be kept secure, and the owner must not allow it to be used by anyone else. A digital signature is constituted when a user's unique digital certificate is applied to a given electronic document. When using digital signatures, the professional licensee is required to have their identity authenticated by a public Certification Authority and to assure the digital certificate used for signing is:

1. Unique to the person using it
2. Under the sole control of the person using it
3. Associated signatures are capable of verification

Linked to a document in such a manner that the associated digital signature and the corresponding document can be deemed invalid if any content in the document is changed

PDF documents are digitally signed when the professional licensee has applied their digital certificate to the document, thereby ensuring any changes to the content of the document after signing will invalidate the digital signature. It is important to understand that digitally signing a PDF document is different than locking a PDF document.

Locking a PDF document removes all the benefits described throughout these guidelines, while digitally signing keeps all the benefits and adds the properties described in this section. Best practices around digitally signing construction PDF documents are as follows:

Each design professional of record should own a digital certificate that is of sufficiently high authenticity to meet at least their State's rules. A X.509 v.3 Digital Certificate with at a minimum NIST Level 3 assurance is recommended, which can be obtained from an accredited public Certificate Authority.

All documents as described in section 6.1 above should be digitally signed utilizing software that complies with ISO/DIS 32000-2.4 Document Management - PDF - Part 2: PDF 2.0 standard. This type of international standard for digital signatures is legally binding. Each design professional must sign the documents they are responsible for as required by law.

When digitally signing, only apply the digital certificate. Do not certify or otherwise lock the document.

Do not encrypt the PDF or password protect it when signing.

Mark the PDF such that multiple signatures are allowed as the reviewing AHJ or other entities might also want to digitally sign the document at time of approval.

Mark the PDF as to allow markups to be appended to the document. This will not make your document less secure or authentic as markups are separate from the document content and the content will still be protected.

As for any specific additional requirements on how to apply a digital signature for construction PDF documents, please reference your relevant State professional board's standards.

Comments / Questions / New Best Practices