Building Department Guide to Creating and Processing Electronic Construction Documents

INTRODUCTION

Advances in technology have made electronically created documents commonplace in today's construction industry. Computer Aided Design (CAD), Building Information Modeling (BIM), word processing (Word), Portable Document Format (PDF) management and other computer programs are familiar to most design professionals, contractors, and building code officials. A paperless online building permit process is now possible through advances in technology and updated state statutes and licensing regulations.

Utilization of electronic documents in the building permit process provides opportunities for cost savings for all parties through improved work flow efficiency, reduced printing costs, eliminating archiving costs, reducing shredding cost and fewer trips by the contractor's representative to the building department. While personal contact will always be important, the reality is that building department employees can be more productive without a customer sitting at their desk while they are processing permit documents.

The building permit process builds an official public record of construction activity that relies on the authenticity of information. Certain documents must bear the mark of the person, persons or agency that created, reviewed or authorized them. Legislation and associated administrative rules mandate signatures, notarized signatures, and in the case of architects and engineers, an encrypted signature and seal must be affixed. It is the authenticity of these documents that must be safeguarded in an electronic building permit process.

For these electronic documents to be used for permitting construction projects, design professionals, contractors and code officials must learn how to electronically secure, sign, and seal various documents to guarantee that the documents are authentic and cannot be altered.

The BOAF/AIA-Florida/FES Joint Task Force has developed this document to provide guidance for design professionals, contractors, and code officials regarding the best practices recommended for the creation and handling of secure electronic documents, used in the building permit process.

COST/BENEFIT

COSTS – Transitioning from paper documents to electronic documents is not easy, quick or cheap. It is however, efficient and will shorten the turn-around time for processing most permits. The cost will be different for each jurisdiction, because of the large number of variables involved in the transition. With a little creativity, it is possible to chart a course that starts with simple affordable procedures that utilize existing technologies and capabilities and evolves over time to a fully web based process.

BENEFITS- The advantages of transitioning to electronic documents include:
1. Electronic signatures are easier to affix to documents than impression seals or wet seals
2. Documents can be signed as soon as they are complete, saving time spent waiting on the printer
3. Document printing cost is reduced or eliminated
4. Documents can be transmitted to the contractor online once they are electronically signed
5. Online exchange of electronic documents provides better customer service for applicants, by allowing documents to be dropped off or picked up 24/7
6. Electronic documents can be stored on a network server, allowing controlled access by authorized individuals within your jurisdiction that have plan review responsibility from their workstation
7. Processing applications without having the customer distracting the permit technician or plans examiner(s), creates a process that is more productive

PROCESSING CONSTRUCTION DOCUMENTS FOR PERMITTING

Construction documents required for permitting are assembled into an application package by the contractor. *For the purpose of this document the term "contractor" is used to represent the "applicant". While the contractor is ordinarily the applicant, in some circumstances the applicant could be a design professional or the owner.*

Documents fall into one of three categories:
1. Secure Signature Required - Drawings, calculations, and specifications documents, in electronic format, prepared by Florida licensed architects and/or engineers are required to be signed and sealed with an encrypted electronic signature. The encrypted signature must be verified by a third party or public/private key match feature of the PDF management software used by the building department
2. Notarized Signature Required – Application forms, and any other document required to be notarized must be received as a scanned copy of the paper document that has been signed and notarized. The applicant should keep the original paper documents on file.
3. No Signature Required – Cut sheets, product approval documents, shop drawings, pictures and other supporting information should be submitted in PDF format for consistency. If multiple formats are authorized, be sure that everyone that is required to participate in processing the documents has the software required to handle the documents.

Documents not prepared by an architect or engineer should contain an information block that identifies who created the document, and contact information if there are questions about the document.

Electronic construction documents can be delivered to the building department using a storage device (CD, DVD, flash drive) or internet document exchange portal. The contractor must take great care not to alter any document signed with an encrypted signature, because any alteration will void the document signature.

The contractor should assemble the following documents:
1. Permit application-
   a. A paper application can be downloaded from the building department's website, completed, signatures notarized, and scanned into an electronic file as a PDF file type.
   b. An online fill-able permit application can be completed online, printed, signed, notarized and scanned into an electronic file as a PDF file type. An online fill able application may also allow the completed form to be submitted; however a signed form that has been notarized may also be required.

2. Drawings-
   Drawing documents may be created by the contractor, or come from one or more sources; however, all of the drawings required to describe the proposed work must be collected into one package for submittal with the permit application. Make sure that drawings prepared by an architect or engineer are properly signed with a digital signature. Any alteration of the electronic document made after the document was electronically signed will void the signature.

   Drawing pages should be saved as individual files, so that future re-works or revisions can be accomplished by replacing single sheets in a package (folder), not the entire package.

3. Support Documents-
   Support documents including specifications, calculations, photographs, forms, and other documents must be converted to an electronic PDF format and organized in folders with file names that clearly describe what the document is.

Document flow ⟹

| Design Professional(s) | Contractor | Building Department | Contractor |

The following sections will explain the responsibilities of design professionals when electronic construction documents are used in the permitting process.

TECHNOLOGY REQUIREMENTS

Building departments will need basic hardware, software, and internet service to create and assemble documents for permitting.

Hardware
1. Computer
2. Internet connection
3. Scanner
4. Dual monitors for plans examiners and permit technicians

Software
1. Permit software
2. PDF management program
3. E-mail

Internet
1. Internet service
2. Mail exchange
3. Online permit application website with FTP capability

FORMATING DOCUMENTS

Electronic construction documents can be created by any software as long as the documents produced can be saved in a file format that can be opened by the building department. Instructions to contractors should include a defined list of electronic document formats that your process allows. While some building departments may have sophisticated file management software that can open a variety of file types, it is recommended that files be saved to a common file type that does not require special or expensive software to view and manage. It is recommended that most documents be saved in a PDF format.

When drawings and other documents are required to be signed and sealed by a design professional it is important to keep those documents together as one document or one set of documents.   Many commercial projects may have multiple design professionals for different aspects of the project, in which case the individual design document sets would need to be assembled as sub-sets of the project set.

First Submittal (Current)

    Master Folder (Project Name)
          Sub-Folder (Permit Application)
          Sub-Folder (Plan Drawings)
               Sub-sub-folder – Civil/Site
               Sub-sub-folder – Architectural
               Sub-sub-folder – Structural
               Sub-sub-folder – Plumbing
               Sub-sub-folder – Mechanical
               Sub-sub-folder – Electrical
               Sub-sub-folder – Fire Sprinkler
               Sub-sub-folder – Fire Alarm

Sub-Folder (Structural Calculations)
Sub-Folder (Energy Calculations)
Sub-Folder (Product Approvals)
Sub-Folder (Specification Cut-sheets)

Multiple page drawing sets present challenges for the building departments for two reasons:

1. Storage space – A set that has multiple pages and is sealed as one package, must be replaced as a set. A set that has multiple pages where each page is individually sealed, can allow individual pages to be replaced. If the policy of the department is to retain obsolete drawings during the life of the project, or beyond, consideration must be given to the amount of electronic data storage space available for both the official record set and obsolete documents. Keep in mind that the objective is to always have one official record set of drawings that represent the approved design for the project.

2. Document handling – The benefit of electronic documents for the building department should be a reduction in the amount of time spent handling documents. In the paper process when a document is submitted to update a previously submitted document, it is the responsibility of a plans examiner(s) to compare the two documents and evaluate the information for code compliance. A change on one sheet would not necessarily require the replacement of multiple sheets; but when the replacement page is approved, time must be taken to remove the obsolete page and insert the replacement page. With PDF management software it is possible to compare two pages on the monitors with the software highlighting the differences. When the replacement documents have been approved, it is a simple step to save the new document(s) and discard the obsolete document(s).

Please note that design professionals have the same issues when they are creating the project. The completed design can be produced as individual signed and sealed PDF pages or as one multiple page PDF document that is sealed once. For the convenience of the design community and efficiency in the building department it is suggested that adequate short term and long term electronic data storage space is reserved to allow complete sets to be signed and sealed electronically. This process would then require all future reworks/changes/revisions from that design professional to be submitted as a complete set.

DIGITAL SIGNATURES BY ARCHITECTS AND ENGINEERS

Seals and signatures are used by state of Florida licensed Architects and Engineers to identify authentic documents. An electronic or digital signature serves the same purpose as wet seals and embossed seals. An electronic or digital signature is an approved method of authenticating a document as long as it complies with applicable rules.

Currently, Architects and Engineers must comply the respective licensing board's rule and with Florida Statute 668 when using an electronic signature. The statute requires that an electronic signature be unique to the signee, be under the control of the signee, be created using an "asymmetric cryptosystem", and be recognizable through the use of a process called "Key pair" technology.

As mentioned earlier, when the requirements of FS 668 are met, both the signee and the recipient can be assured of the authenticity and integrity of the electronic signature. An electronic signature is password protected and cannot be copied or used by anyone except the signee.

An important feature of an electronic signature is that it can be verified as authentic when it is attached to an electronic file in a PDF format. Construction drawings or documents bearing an electronic signature may only be submitted to a jurisdiction in an electronic format for use in permitting a project. An electronic signature on a printed copy of an electronic document cannot be verified as authentic, and is not valid as a permit submittal. Electronic documents bearing an electronic signature may be printed for use in the field only after the jurisdiction has electronically stamped and secured the document.

Electronic signatures used by Architects and Engineers shall comply with the "Electronic Signature Act of 1996 (ss.668)." The legislature's intent in creating this legislation is to:
> (1) Facilitate economic development and efficient delivery of government services by means of reliable electronic messages.
> (2) Enhance public confidence in the use of electronic signatures.
> (3) Minimize the incidence of forged electronic signatures and fraud in electronic commerce.
> (4) Foster the development of electronic commerce through the use of electronic signatures to lend authenticity and integrity to writings in any electronic medium.
> (5) Assure that proper management oversight and accountability are maintained for agency-conducted electronic commerce.

Terms defined in the act:
(1) "Certificate" means a computer-based record which:
> (a) Identifies the certification authority
> (b) Identifies the subscriber
> (c) Contains the subscriber's public key
> (d) Is digitally signed by the certification authority

(2) "Certification authority" means a person who issues a certificate

(3) "Digital signature" means a type of electronic signature that transforms a message using an asymmetric cryptosystem such that a person having the initial message and the signer's public key can accurately determine:
> (a) Whether the transformation was created using the private key that corresponds to the signer's public key.
> (b) Whether the initial message has been altered since the transformation was made.

A "key pair" is a private key and its corresponding public key in an asymmetric cryptosystem, under which the public key verifies a digital signature the private key creates. An "asymmetric cryptosystem" is an algorithm or series of algorithms which provide a secure key pair.

(4) "Electronic signature" means any letters, characters, or symbols, manifested by electronic or similar means, executed or adopted by a party with an intent to authenticate a writing. A writing is electronically signed if an electronic signature is logically associated with such writing.

Unless otherwise provided by law, an electronic signature, as described above, may be used to sign a writing, and shall have the same force and effect as a written signature.

The head of each agency shall be responsible for adopting and implementing control processes and procedures to ensure adequate integrity, security, confidentiality, and audit ability of business transactions conducted using electronic commerce.

Read the Architect's rule 61G1-16.005 at:
https://www.flrules.org/gateway/ChapterHome.asp?Chapter=61G1-16
Read the Engineer's rule 61G15-23.003 at:
http://www.fbpe.org/images/phocadownload/legal/61g15%20as%20of%201%206%2012.pdf

There is plenty of information online about this subject. Start with the tutorials provided by your current software company, and the information provided by the third party services, before you attempt to create your signature.

Additional information can be found at the Fiatech website. Fiatech is a membership association dedicated to solving process problems through technology. Their white paper on developing a strategy for implementing digital signatures provides valuable context to understanding digital signature technology.
http://www.fiatech.org/images/stories/techprojects/project_deliverables/Updated_project_deliverables/APracticalDeploymentStrategyforDigitalSignaturesandSeals.pdf

SIGNATURE VERIFICATION
Each jurisdiction will need to determine how they will verify encrypted signatures used by Florida Architects and Engineers. Since signature verification relies on a comparison between the signature file embedded in the electronic document (private key) and the users master identifier (public key), the jurisdiction has a choice of two options, or could use both options.

Options: a) Third Party Verification – This process is a premium service purchased by the user. When the plans examiner opens the electronic document the PDF management software will access the third party verification database via the internet and authenticate the signature. If the document has been modified since it was electronically signed the verification process will invalidate the signature file. The document would need to be replaced with new document that has not been altered.
b) Public Key Verification – This process requires the design professional to provide the building department with the public key file to use when verifying his/her electronic signature. The building department would need to maintain a design professional database that identifies the contact and licensure information for each design professional. The PDF management software, such as Adobe Pro, BlueBeam, ProjectDox, etc., will compare the design professional's public and private keys to verify the authenticity of an electronic signature.

Document Integrity Confirmed   Document Tamper Detected
Valid signature: Invalid signature:
John Miller   John Miller
January 15 2011 3:32 PM   January 15 2011 3:32 PM

DOCUMENT SECURITY SETTINGS

Electronic documents created by a design professional will by necessity pass through the contractor, and perhaps the owner, before being delivered to the building department. The documents will need to be saved, marked by the building department and possibly printed by the contractor. When a PDF file is created there is an opportunity to set the rights others will have when handling it. It is acceptable to lock the pages that include a digital signature so that the information cannot be altered (a digital signature does not lock the document); however, it will be necessary for the building department to establish the security settings policy it needs to be able to verify that the document is authentic, mark the drawings as the official documents, and return the job copy to the contractor for use on the job.

IMPLEMENTAION STRATEGY

Transitioning the permit process from paper to electronic requires developing a strategy specifically tailored to your department. The strategy will have to address multiple issues that may need to be addressed differently in your jurisdiction than in other jurisdictions.

- **Work flow** – The transition will result in fewer customers in your office. The role of the permit technician will change from customer service (front line) to data processing (back office). The electronic plan review process will allow multiple reviews to take place at the same time. Other departments or agencies that have review/approval responsibility may have access to the plans as soon as they are notified that they have been submitted. Diagram your workflow process before and after the transition to identify changes that staff will need to understand.
- **Integration of systems**- Permitting software, inspection request systems, network servers, internet capabilities, e-mail capabilities, handheld devices, etc. Make sure your technology support specialists are included in the design of the process as well as the installation requirements.
- **Graduated implementation by permit type** – Start with the easy permit types that do not require lots of documents or drawings to avoid being overwhelmed while staff is learning the process. Progress gradually until the process accepts any type or size project.
- **Training** - Everyone will need to be trained on the new workflow. This includes elected officials, administrators, customers, and staff.
- **Publicize the change** – Produce printed guidance that will help your customers understand their role in the new process. Issue press releases highlighting the broad benefits of a streamlined electronic process
- **Establish a timeline** – Create a schedule or timeline that considers the acquisition and installation of software and hardware, integration of various components, training
- **Monitoring and evaluation** – Create benchmarks that can help everyone recognize how the transition is progressing.
- **Control the urge to expand the scope of the project**- Scope creep will cause problems with both the budget and the schedule. Plan for a second phase of the project to tweak the process after the initial phase is complete.

FOLDER STRUCTURE

An orderly submittal of drawing files will assist the building department in determining the folders that contain drawing files from the folders that contain support information files. The folder structure is applicable when submitting files on a portable storage device or uploading them directly via the internet or FTP site. Upon permit approval, the building department will provide approved documents to the contractor using a similar folder structure.

Submittal Folder Structure

The submittal folder structure is the format used by the design professional to organize and submit their documents to a building department. This format is applicable to the first submittal; subsequent rework submittals will only contain reworked documents. It is important to maintain the same naming protocol and page numbering throughout the permitting process.

First Submittal (Current)
Master Folder (Project Name)
- Sub-Folder (Permit Application)
- Sub-Folder (Plan Drawings)
  - Sub-sub-folder – Civil/Site
  - Sub-sub-folder – Architectural
  - Sub-sub-folder – Structural
  - Sub-sub-folder – Plumbing
  - Sub-sub-folder – Mechanical
  - Sub-sub-folder – Electrical
  - Sub-sub-folder – Fire Sprinkler
  - Sub-sub-folder – Fire Alarm
- Sub-Folder (Structural Calculations)
- Sub-Folder (Energy Calculations)
- Sub-Folder (Product Approvals)
- Sub-Folder (Specification Cut-sheets)

Rework Submittal
Master Folder (Process Number)
- Sub-Folder (Reworked Plan Drawings)-YYMMDD
- Sub-Folder (Reworked supporting documents)-YYMMDD

Revision Submittal
Master Folder (Master Permit Number)
- Sub-Folder (Revised Plan Drawings)-YYMMDD
- Sub-Folder (Revised Supporting documents)-YYMMDD

As-built Submittal
Master Folder (Master Permit Number)
- Sub-Folder (As-built Plan Drawings)-YYMMDD
- Sub-Folder (As-built Supporting documents)-YYMMDD

FILE NAMING PROTOCOL
File Naming/Format

File Naming refers to the name given to each individual electronic file which contains a drawing. Each plan page shall be saved as a separate PDF. CAD drawings shall be saved into a PDF file formatted in single layer Black and White (Monochrome) setting. At a minimum, a file name should intuitively indicate the file contents. Abbreviations shall be used to classify and group related drawings.

Documents such as Structural Calculations, Product Approvals, Energy Calculations, and Specification cut-sheets may be provided as a single multiple-page PDF and named accordingly.

Drawing Abbreviations:

CS	Cover Sheet / Index
G	Government Sheet
SP	Site Plan
C	Civil
L	Landscape
IR	Irrigation
DE	Demolition
A	Architectural
M	Mechanical
E	Electrical
P	Plumbing
S	Structural
FS	Fire Sprinkler
FA	Fire Alarm
LS	Life Safety

The design professional may elect to further describe a file by adding to the minimum naming convention a description of the page.

Examples of optional drawing file naming:
A101-Ground Floor.pdf
A102-Reflected Ceiling.pdf

Reworks
Reworks are classified as corrections made to plans during the current review process prior to permit approval. The same file naming convention should be used with the addition of "rwk" and the date of the rework following the file naming example below. When sorted all reworked pages of similar types will group and ordered by date.

Example of rework files naming:
A101-rwk-YYMMDD.pdf (YYMMDD is the two digit year, month and day format)

Permitted
This establishes the documents that the permit was based on.

Example of permit files naming:
A101-per-YYMMDD-agency.pdf (Where "AGENCY" is a 6 letter acronym for the issuing entity)

Revisions
Revisions are classified as changes made to the scope of work after permit issuance. Revised drawings are submitted following the same naming convention established with the addition of "rev" and the date of the revision following the file naming example below. When sorted all revised pages of similar types will group and ordered by date.

Example of revision files naming:
A101-rev-YYMMDD.pdf (YYMMDD is the two digit year, month and day format)

As-built (Final Updated Plans)
These documents represent the as-built plans.

Example of as-built file naming:
A101-asb-YYMMDD.pdf (YYMMDD is the two digit year, month and day format)

FILE TRANSFER METHODS
Digital documents may be delivered using any of the following methods;
1) Internet - Via electronic file transfer
2) Delivered to the building department
   a. CD,
   b. DVD,
   c. Flash drive, or
   d. Other storage device

PLAN REVIEW
A plans examiners workflow is usually driven by a report or queue process within the permit software that lists the permits that need a review. In a paper process the physical location of the plan set is notated in the permit software. In an electronic document process, the documents may be accessed through a tab that links to the electronic documents, or a notation that identifies where to find the documents on the network server.

Dual monitors are essential when reviewing electronic plans. One monitor used to navigate a plan should be at least 24 inches measured diagonally. 30 or 40 inch monitors are recommended to allow more of the document to be visible. The second monitor can be used to access the permit software, internet, codes and references, and checklists. High definition monitors or televisions are lower in resolution and can create eye strain during long term use. It is recommended that high resolution computer monitors be used to reduce this effect.

The software used to navigate the documents should have measurement and notation tools that allow the plans examiner to scale the drawings and make notations. Adobe Acrobat Professional, BlueBeam or ProjectDocs are examples PDF management programs that will adequately handle the plan review task.

Understand that any notation or comment placed on a drawing that has been signed with an encrypted signature will void the signature, requiring a replacement page to be submitted. The best way to preserve the integrity of the original document is to open each document, and save it with a unique file name (for instance add "review" to the file name).
When drawings need to be re-worked to achieve code compliance, a marked up drawing and/or narrative can be transmitted to the contractor for correction and re-submittal.

When a rework drawing is received and approved it should replace the defective drawing in the official "approved" drawing set. The obsolete drawing(s) should be placed in a sub-folder labeled "Obsolete".

MARKING DOCUMENTS FOR THE JOBSITE

Each jurisdiction will need to create an approval stamp image to watermark approved documents, for use in the jobsite. In a paper process an ink impression stamp is normally used to identify official documents that are returned to the contractor to be used on the jobsite. In an electronic process, marked electronic documents are returned to the contractor via the internet or storage device. The contractor can then have a jobsite paper set of documents printed for use by the building inspector(s). When the building inspectors have the ability to access official documents via the internet a printed set of documents may not be needed.

DECISION CHECKLIST

a) What file format will be mandated?   Limit choices to common formats
b) How will documents be exchanged?   Establish an online document exchange if possible
c) Where will documents be stored?   Within permit software, network server or cloud server
d) How will files be named?   See naming protocol
e) How will documents be reviewed?   BlueBeam, Adobe Acrobat Pro, ProjectDocs, etc.
f) How will signatures be verified?   Public key match by the department or a Third party
g) What hardware will be required?   Dual monitors for plans examiners
h) What software will be required?   PDF management for plans examiners
i) How will documents be marked?   PDF management stamp template
j) How will payment be accepted?   Online, offline and escrow account

The transition to an electronic permitting process is not easy or cheap, but it is inevitable. Once the process is successfully operational in a neighboring jurisdiction, the speed and efficiency of electronic permitting will inspire your customers to demand the same service in your jurisdiction. Don't wait for that to happen. Begin now creating a strategy for electronic permitting.

It is important to include any agency or department that is involved in the permitting process in your planning and implementation process. Understanding the capabilities and limitations of these partners may help you create a system that has maximum functionality for everyone involved.