Smithsonian Facilities
3D BIM Design Review

November 2016 Edition
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## DOCUMENT REVISION LIST

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Section A - Project Design Reviews with 3D PDFs

1. OVERVIEW OF 3D PDF DESIGN REVIEWS

This document provides guidance for the Smithsonian’s 3D PDF design review processes by providing an overview for:

- Bluebeam PDF software, its installation and basic functionality
- Design Review Sessions with Bluebeam - the technical features, and how-to’s for helping SI Design Reviewers accomplish review tasks
- Processes for producing PDFs from project Revit files

1.1 What are 3D PDFs?

3D PDF is an open file format standard, and a part of the PDF ISO standards family. The format supports PDF document that include 3D data with metadata, text, images, video and forms. CAD and BIM files can generally be exported to PDF from their native authoring applications, such as AutoCAD or Autodesk Revit, to PDF files. PDF files are not used within BIM modeling applications such as Revit, but are useful for exchange, review and archiving purposes.

2. BLUEBEAM SOFTWARE FOR PROJECT REVIEWS

Multiple vendors offer software application for viewing and editing 3D PDFs. The Smithsonian has currently standardized on Bluebeam’s Revu software application supporting 3D design reviews and producing 3D PDF project archives.

Bluebeam software solutions support 3D PDF creation, reviewing, and editing, both 2D and 3D. Bluebeam applications in use at the SI include:

1. Bluebeam Revu

A full featured PDF editing and markup application suite, available in multiple editions. The SI utilizes Revu eXtreme, the solutions with the highest capabilities.

2. Bluebeam Vu

Vu is Bluebeam’s free viewing application, allowing users to open and read PDF’s. Vu also provides users with a means to participate in Bluebeam Studio Sessions for collaborative model reviews. The SI utilizes Vu for users needing “view only” capabilities, and those operating on older and/or less powerful PC platforms.

3. Bluebeam Revit® and Navisworks® Plug-in application

The installation process for Bluebeam Revu will also install a plug-in application into Revit and Navisworks (if these Autodesk applications have has been installed on the PC). The plug-in provides the Revit/Navisworks user with capabilities to create PDFs from the model (2D and 3D).
3. BEST PRACTICES FOR CREATING 3D PDFS FROM PROJECT BIMs

Creating PDFs from the project model will be the responsibility of the project consultant team. This section will review best practices for that workflow. Refer to the project scope for specific requirements on BIM deliverables.

The preferred workflow for creating 3D PDFs of project Revit model(s) will be via Autodesk’s Navisworks software - an application that is included in the Autodesk suite. Although 3D PDFs can be exported from Revit using the Bluebeam plug-in tool, PDF exports via Navisworks provide several advantages:

- Smaller 3D PDF files are produced by the Navisworks export process (in most cases)
- Navisworks incorporates “linked” discipline models as separate element categories in its PDF exports (Revit does not). This allows the PDF reviewers to manipulate PDF models by top level discipline categories. Reference the screen shot below on the right, showing the “A” - architectural model tree exported from Navisworks.

![Figure 3-1: Comparison of 3D PDF model trees produced via Revit (left) and Navisworks (right)]
Smaller Bluebeam 3D PDFs can be generated directly from the Revit application’s Bluebeam plug-in, depending on the project size, complexity and number of disciplines involved.

When exporting the project model, additional best practices for creating 3D PDF files with manageable sizes are to:

- Clean up the Revit model before exporting to Navisworks by eliminating repeated elements and arrays that are not required for design review process from the export view. For example - hide solar panels, sprinkler heads (small assets), landscape plants, entourage, etc.
- Limit the use of groups in the Revit model to help decrease file size in the exported PDF
- Eliminate imported DWG files in the Navisworks export view for 3D PDF purposes
- Divide very large buildings into smaller areas or zones, as per architectural or mechanical or construction phase zones or sub-sections (whichever best suits the project needs).

**Note:** 3D PDF file size should be smaller than 50 MB so that the 3D PDF can be manipulated and viewed easily.

### 3.1 Preparing the Revit Model for Export to a 3D PDF

Before exporting a project model to a 3D PDF, establish the any zones or sub-sections (if required by the project) of the Revit model as views in Revit. Export the model via those views to either the Navisworks (.nwc) files and then to PDF - the recommended workflow, or directly from Revit to PDF.

1. As the first step in the Bluebeam export workflow, determine the size and location of the zones for each building. These subdivisions will be used throughout the project.
2. Create 3D views for each zone/subsection in Revit, keeping all the linked models that are to be exported, visible

The ideal way to create 3D views for each zone is by using **scope boxes**:

3. Scope boxes can only be created in plan views
4. After a scope box is created, modify its size and position in a 3D view, as needed
   - In a plan view, click: **View tab > Create panel > Scope Box**
   - On the **Options** bar, enter a name and specify a height for the scope box, if needed
   - To draw a scope box, click in the upper left-hand corner to start the box. Click in the lower right-hand corner to finish it.
   - Open a 3D view to further adjust the size and position of the scope boxes.
5. Tip: You can change the name of the scope box after creating it. To do so, select the scope box and on the Properties palette, enter a value for the **Name** property.
6. Create views using scope boxes with the help of the **Auto Section Box** tool so that only elements within those scope boxes are visible in the 3D view in Revit
   - **Auto Section Box** is a free third party plug-in tool available at Autodesk App Store (URL: [https://apps.autodesk.com/RVT/Detail/Index?id=appstore.exchange.autodesk.com%3Acoinsauto-sectionbox%3Aen](https://apps.autodesk.com/RVT/Detail/Index?id=appstore.exchange.autodesk.com%3Acoinsauto-sectionbox%3Aen))
3D views can also be created manually without the Auto Section Box plug-in, however the views are created much more easily and quickly with the plugin than manually.

7. Select a scope box for one of the created zones in a plan view. Navigate to the Add-ins tab and select the Auto-Section Box tool (assuming it has been installed).

![Auto Section Box - COINS Section Box](image)

Figure 3-2: COINS Section Box - Revit add-in menu

8. The following dialogue will appear:

![Section Box Size dialog box](image)

Figure 3-3: COINS Section Box Size dialog box

9. Size: Elements extents, plus buffer is the dimension that will form the extents of the section box around the Scope Box. Change the value, as needed, and change the name of the view under View selection.

10. Note that 3D views for each sub-section of the model can be created first, by duplicating the default 3D view and selecting the duplicated view from the drop down menu to orient to the correct size and location of the scope box.

11. Views can also be created using Room elements in Revit, instead of Scope Boxes. Thus, 3D views for interest areas, such as mechanical and electrical rooms, can be created to export these areas to 3D PDFs for coordination review purposes.

### 3.2 Procedure to Export Revit Models to Navisworks

There are two alternate workflows for exporting Revit models via Navisworks, to 3D PDFs:

**Workflow 1:** Export the entire federated Revit project model to a Navisworks (nwc) file. Load the .nwc file in Navisworks, and export to 3D PDF file.

**Workflow 2:** Export Revit models for each project discipline to separate Navisworks (nwc) files. Combine the .nwc files within Navisworks and export to a 3D PDF file.
3.2.1 Workflow 1 - Export the Entire Federated Revit Model to Navisworks

1. In Revit, make sure active window is displaying a 3D view

2. In the External panel of the Revit Add-Ins menu, select External Tool, then click on the Navisworks export tool and select Navisworks [version] on the drop down. (This will export the model to a Navisworks .nwc file.)

3. A pop-up - Export scene as... will be displayed. Click on the Navisworks settings... button on the bottom of this window

4. A pop-up Navisworks Options Editor - Revit will appear, listing multiple settings. Check Convert linked files to export the federated (e.g. linked) files to a .nwc file.

   Note that when the Convert linked files is checked, the links visible in that 3D view will be exported to the Navisworks along with the main model.
5. Make sure the Convert room as attributes option is checked as well. This insures that the linked files (visible in the 3D view) will be exported to the Navisworks .nwc file, along with the main model.

6. Click OK, browse to the desired location on your filesystem and save the file.

When the export file is opened in Navisworks, the selection tree appears as is shown below in Figure 3-6.

![Selection tree list in Navisworks showing separate disciplines component files](image)

Figure 3-6: Selection tree list in Navisworks showing separate disciplines component files

After the file is exported to a 3D PDF from Navisworks, the 3D Model Tree in Bluebeam appears as is shown in the figure below.

![Bluebeam 3D PDF model tree created from Workflow 1](image)

Figure 3-7: Bluebeam 3D PDF model tree created from Workflow 1
3.2.2 Workflow 2 - Export Revit Models for Each Project Discipline to Separate Navisworks Files

1. Open each file, using the Append or Open button, sequentially, to combine them or to federate them in the Navisworks worksession.

2. Once all of the project models have been loaded into Navisworks, export to PDF as in Workflow 1.

3. While exporting the .nwc files in Revit, make sure to uncheck the Convert linked files check box in the Navisworks Options dialog.

4. Make sure to check the Convert room as attributes option.

5. A sample 3D Model Tree in Bluebeam 3D PDF created from a Navisworks file with Workflow 2 is shown below.
3.3 Procedure to Export 3D PDF from Autodesk Navisworks Files

1. Create 3D PDFs from Navisworks (with .nwc .nwf or .nwd files) by selecting the elements to export
2. Select all the “.nwc” files, or alternatively, select elements in the tree, then navigate to the Bluebeam tab and select Create 3D PDF
3. Once the 3D PDFs are created, open the files in the Bluebeam and create additional views as required for areas of interest in each PDF, and save the pdf file
3.4 Procedure to Export a 3D PDF from a Revit Model

1. In Revit, switch to a 3D view from the project browser. The model will be exported from the view chosen.
2. Ensure that all the required discipline links and Revit elements are visible in the 3D view.
3. In the Add-Ins tab in the Revit menu, click the Create 3D PDF button in the Bluebeam toolbar.
4. Choose an output file name and location, and click Save

![Image of Bluebeam add-in tools in the Revit menu](image)

**Figure 3-11: Bluebeam add-in tools in the Revit menu**

---

<table>
<thead>
<tr>
<th>Revit (*.rvt)</th>
<th>1. 3D Model</th>
<th>Bluebeam (*.pdf)</th>
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<td><strong>Host Model:</strong></td>
<td>2. Floor Plan/Key Plan</td>
<td></td>
</tr>
<tr>
<td>Architectural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linked Models:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical</td>
<td></td>
<td></td>
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<tr>
<td>Electrical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plumbing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Protection &amp; Safety (if needed for clash)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telecommunications &amp; Security (if needed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landscape (if needed)</td>
<td></td>
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</tr>
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</table>

**Pros:**
- The 3D PDFs generated are comparably smaller size
- Faster, one step process

**Cons:**
- Disciplines/links cannot be segregated easily with one check box for entire discipline elements

**Note:**
- Discipline segregation and applying transparencies to entire trade easily will help in design review process
- This workflow makes this harder and time consuming

![Image of Revit to Bluebeam 3D PDF workflow - pros and cons](image)

**Figure 3-12: Revit to Bluebeam 3D PDF workflow - pros and cons**
3.5 Create a New View in Bluebeam

Use the mouse controls to manipulate the model into a 3D view you wish to export from. Note that the views can have custom transparencies, isolations, view angles, set. When satisfied with how the model is displayed:

1. Go to View > Tabs > 3D Model Tree or press ALT+3 to open the 3D model tree tab

2. In the Views section of the 3D Model Tree tab, click Create New View. The 3D View Properties dialog box appears.
Figure 3-14: Bluebeam View Creation Dialog

3. Enter a name for the view in the View Name field
4. Select either Orthogonal or Perspective from the Projection list
5. If desired, choose Display Settings to include in the view.
6. Click New

4. SI BEST PRACTICES FOR 3D PDF (BLUEBEAM) FILE NAMING

The rules below are general best practices for file naming; however, every rule may not be relevant to every record. SI Design Managers and the project team should exercise their best judgment in clarifying file naming that is best for each BIM project.

- Avoid using special characters in a file name. (\ / : * ? “ < > | [ ] & $ ,)
- Whenever possible, refrain from using spaces in filenames. To separate words in file names, use underscores, hyphens, or camel case (unnecessary capitalization within a file name)
- Avoid long file names

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<tr>
<td>Example</td>
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<tr>
<td>Z1-ASMEP-NASM-160127.PDF (Zone 1- Architectural, Structural, Mechanical, Electrical &amp; Plumbing- Project Acronym-Date.PDF)</td>
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4.1 Common Abbreviations for File Naming

The table of abbreviations below list abbreviations currently in use at the SI which may be useful in detailing a BIM project’s PDF naming standards.

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<td>Des</td>
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5. SETUP AND ADMINISTRATION OF BLUEBEAM STUDIO

Bluebeam Revu’s Studio allows users to collaborate and share information in a controlled environment. When a new project is initiated at the SI, The SI BIM lead starts a Bluebeam Studio Project either during the project start or during the first (schematic) review of the project. The Bluebeam Studio Project allows the project lead to store, organize, update and share project related files with the project team while keeping track of every change that occurs throughout the project span. Bluebeam Studio Projects and Sessions can be based on an organization’s local server.

5.1 Bluebeam Studio Administration

Bluebeam Revu has an integrated collaboration solution called Studio. The Studio feature allows users from any location to participate in a collaborative review, and can provide a means for review teams to upload and share an unlimited number of PDF and any other file types.

Bluebeam Studio has two useful features for design reviews: Studio Project and Studio Session. Studio Project acts as a simple document management system. The files uploaded to a Studio Project are stored on Bluebeam server location within the SI’s firewall. This feature tracks all versions of an uploaded file and allows easy sharing among the team members invited to the Studio Project.

Studio Session offers a forum for PDF review, markup and collaboration. The project team members can start Studio Sessions by using/sharing the PDF files uploaded to Studio Project. Studio Session can also be initiated independently of Studio Project.

The SI BIM lead sets up a Studio Project for sharing project files and Project Session for review and collaboration of PDF files. He then invites the project team with set permission for each team member to Studio Project/Session.

The Studio tab contains tools for starting, managing, and joining Studio Sessions and Projects. Users can have one Session and one Project open simultaneously, though not more than one of either.

The Studio tab has three different views:

- **Home**: Where general Studio management tools reside, including the lists of Sessions and Projects User have started or previously joined
- **Session**: Where tools and information specific to the Session that is currently open can be found
- **Project**: Where tools and information specific to the Project that is currently open can be found

The color of Session icons will change depending on the Session’s status:

- Active Session
- Active Session that is marked for archival in three days
- Active Session that is marked for archive in two days or fewer
- Inactive Session
Inactive Session that is marked for deletion in nine to sixteen days

Inactive Session that is marked for deletion in eight days or fewer

![Session view](image)

**Figure 5-1: Bluebeam Studio tab, Home view showing projects and studios**

If a file in a Project has been added to a Session, the Session name will be shown below the Project as shown in the figure above.

There are two roles within a Bluebeam Studio: host and attendee. Studio sessions will need to be initiated from a user with host privileges from the Bluebeam Revu application. Studio Sessions cannot be initiated from Bluebeam Vu, the free PDF viewing application. Hosts can invite an unlimited number of attendees to join a Studio Project/Session. Bluebeam session attendees can use either the Revu or Vu application. Studio Project/Session attendees will have full access to the mark-up functionality if they are participating in a session accessed from a Studio Project /Session invitation. All attendees will receive an email invitation with the Studio Project/Session details along with download links for Bluebeam Vu for the first time users.

### 5.2 Downloading and Installing Bluebeam Vu


Follow the instructions below to install Vu:

1. Double-click the Bluebeam Vu installation file to start the installation process
2. Select the desired language, if it’s different than what’s selected and click Next in the InstallShield Wizard dialog
3. Read through the License Agreement carefully, click “I accept the terms in the license agreement” if you agree to accept, and then click Next

4. Select your Install Options: Click Install to accept the default destination folder of C:\Program Files\Bluebeam Software\Bluebeam Revu\2016

5. Click Finish when Installation Complete appears
   Note: Do not start Revu or the Bluebeam Administrator until after clicking Finish and the final installation window closes.

5.3 Importing SI Custom Bluebeam Profiles

In order to provide a useful User Interface (UI) for the all the SI reviewers and its contractors, SI developed custom Bluebeam Profiles. Bluebeam “Profiles” provide a means to create and store a set of customized toolbars, menus, and additional display settings, for use within Bluebeam Revu and Vu.

Multiple profiles have been set up for SI Revu users: a standard “SI Review” profile for use by reviewer, along with “SI View” and “SI Design Review” profiles.

- **SI Review** – Customized for typical SI reviewers, who also marking up PDFs
- **SI View** – Assists reviewers viewing PDFs
- **SI Design Review** - Has tools for reviewing and marking up PDFs, plus additional toolsets/menus configured with drawing tools for complex reporting and RFI creations.

To import custom SI profiles into Revu, open the application and follow the steps below.

1. Choose the View menu and click on the Profiles icon
   Note: click on the image of person, not the triangle next to it

2. A pop-up dialog box will appear – click the Import button
3. Navigate to the file directory location where the SI Revu profiles have been downloaded and click on Open.
4. Click Yes or Accept on all pop ups.
5. Click Ok to close out Manage Profile window.
6. On the Bluebeam menu - click on the triangle next to the image of the person

7. Select the *SI Review Profile* to change the user interface which has the toolsets required for SI’s review process

---

**Figure 5-5: Selecting the SI Review profile**

- **SI View**

- **SI Review**

- **SI Design Review**

---

**Figure 5-6: The three customized SI Revu toolbars within SI Profiles**
5.4 Creating a Bluebeam Studio Account and Logging In

Before creating or joining a session, every user who wants to participate in Studio Project/Session will need to create a Studio account as listed in steps below:

1. Open Vu and access the Studio tab (at right, top bar).

2. Click on the Connection icon (icon on the left side of the image to the right) and choose Work Online. This opens the Login dialog.

3. Next, choose Create Account, and fill out the following information.

4. Your email address, used for accessing Bluebeam Studio.

5. Password of your choosing (between 8 and 32 characters long, with at least one uppercase letter, one lowercase letter, one number and one special character, such as !@#$%^&*).

6. Click the Remember password checkbox if you want Revu to log in to Studio whenever you open the program.

   Note: Only click the Use Windows Authentication checkbox if your company uses Bluebeam Studio Enterprise Server, as this won’t work with studio.bluebeam.com. If you’re unsure contact your IT department for further instructions.

7. When filling out the Name section, it is ideal to use first and last name instead of netID, as this will show on all comments.

8. Once the OK button is selected, your account will be created.

9. The user will receive a “Welcome to Bluebeam Studio” email containing a link for validating their new account. The account will be disabled if it isn’t validated within 7 days.

10. Once logged in, the Studio interface will be as shown in the picture where one can start or join the sessions as per the Bluebeam license.
11. When user is logged in, the *Work Offline/Online* icon will be display a green light. Conversely, it will appear as two disconnected cables with a red light when user is offline.

### 5.5 Starting a Studio Project and a Studio Session

To start a Studio Project:

1. Click **View > Tabs > Studio** or press ALT+C to show the **Studio** tab.
2. Under Home section of **Studio** tab, click **Start > New Project**.
3. Enter a name for the Project and click **OK**. The **Studio** tab changes to show the empty Project.
4. To add initial Project files, select from the **New Folder** or **Upload Files** or **Upload Folder** options.
5. To invite Attendees, click **Invite** on the **Studio** tab while in the Project. Add emails of the Attendees by using the **Add Email Address** icon in the **Project Invitation** dialog box and click **OK**.
6. To add multiple Attendees in one click using **Groups** feature. **Groups** allow for a set of permissions to be defined or email invitations to be sent to many people at once instead of each person individually. Once a Group is defined in the Studio Project/Session, it can be used in all future Sessions and Projects. Users can belong to multiple **Groups**.
7. Enter a Message to add to the invitations, if desired.
8. Click **OK**. Email invitations will be sent to all the invitees from the SI Studio server.

![Figure 5-10: Bluebeam Studio tab displaying the new project interface](image)

The Studio Session can be started in two ways:

1. By using the **New Session** from the **Start** icon in Home section and adding the PDF files and inviting the Attendees as done in the Studio Project.
2. From an existing Studio Project: Right click a PDF from the existing Studio Project and select \textit{New Session} from the right click menu. Follow the steps to add PDF files and invite Attendees as done in the Studio Project.

5.6 Joining a Bluebeam Revu Studio Session

Joining a session can be done in two ways:

1. By clicking on the \textit{Session ID number} in the Bluebeam Studio session invitation (shown below – Session ID is in blue).

2. If the user has not received an email similar to the example shown above, they can log in with a \textit{Session ID} number (if known) by following the steps:
   a. Open Vu and navigate to the \textit{Studio} tab (or use the keyboard shortcut Alt+ C).
   b. Click \textit{Join} and enter the 9-digit \textit{Studio ID} number when prompted.
   c. Click \textit{OK}.
6. FEATURES OF THE BLUEBEAM STUDIO FOR REVIEWERS

This section will describe a few of the features within Bluebeam Studio that will be helpful for SI project reviewers. Depending on the project needs the SI BIM lead will create a Studio Project or Studio Session. When the project is large and complex, and different file types are to be shared and reviewed among the SI review team - a Studio Project will be ideal. Using the PDFs in the Studio Project, new Studio Session can be started. If the project files are only reviewed in the PDF format, then a Studio Session fulfills the needs of reviewing such projects.

The table below provides a short summary of the features and how reviewers might utilize them.

<table>
<thead>
<tr>
<th>Table 6.1: Bluebeam Studio Feature Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluebeam Studio Feature</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>Access and Permissions in Studio Projects/Sessions</td>
</tr>
<tr>
<td>Documents List</td>
</tr>
<tr>
<td>Attendees List</td>
</tr>
<tr>
<td>User Status</td>
</tr>
<tr>
<td>Record, Notifications and Pending Tabs</td>
</tr>
<tr>
<td>Markups: List</td>
</tr>
<tr>
<td>Markups: Status</td>
</tr>
<tr>
<td>Markups: Filtering</td>
</tr>
<tr>
<td>Markups: Summary</td>
</tr>
</tbody>
</table>

6.1 Access and Permissions in Studio Projects/Sessions

Permissions can be defined in Studio Projects/Sessions to grant or deny users to specific Projects/Sessions and to define what users can do in those Projects/Sessions. Permissions can be defined for individual users or groups of users. To accessing the settings dialog:

- Within the Project, click Settings on the Studio tab. The Project Settings dialog box appears
6.2 Documents List

The Documents List within Studio Project/Session allows the host and some or all Attendees of the Studio Project/Session (depending on the Attendee Permission Settings) to upload project.

In a Studio Project, the available Project files are listed below the Project Name and Studio ID. Files can be arranged in a folder structure to make organization easier. Studio Projects may contain any type of file, not just PDFs. PDF files will open in Revu while other file types will open in the default program associated with it on your device.
In Studio Projects the documents can be checked out to make edits and then check in back once edits are completed in a Studio Project. When a document is checked out it is not available to edit for other attendees in the Studio Project. The Studio Project files that are opened, but not checked out are in read-only mode. User can check out the file after making edits by right-clicking and selecting Check Out option.

The tables below summarize the options available for Studio Project Files depending if they are checked out or not. Right-click on a file in the Project file list to bring up the available options.

<table>
<thead>
<tr>
<th>Table 6-2: Project File Options When Not Checked Out</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tool</strong></td>
</tr>
<tr>
<td>![Open Icon] Open</td>
</tr>
<tr>
<td>![Check Out Icon] Check Out</td>
</tr>
<tr>
<td>Download Copy</td>
</tr>
<tr>
<td>Rename</td>
</tr>
<tr>
<td>![Cut Icon] Cut</td>
</tr>
<tr>
<td>![Copy Icon] Copy</td>
</tr>
<tr>
<td>![Paste Icon] Paste</td>
</tr>
<tr>
<td>![Delete Icon] Delete</td>
</tr>
<tr>
<td>![Add to New Session Icon] Add to New Session</td>
</tr>
<tr>
<td>![Add to Session Name Icon] Add to session name</td>
</tr>
<tr>
<td>![Share Link Icon] Share Link</td>
</tr>
<tr>
<td>![Revision History Icon] Revision History</td>
</tr>
<tr>
<td>![Properties Icon] Properties</td>
</tr>
</tbody>
</table>
### Table 6-3: Project File Options - When Checked Out

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Opens the file for viewing and/or editing</td>
</tr>
<tr>
<td>Open Project Copy</td>
<td>Opens the server copy of the Project file in a new tab</td>
</tr>
<tr>
<td>Download Copy</td>
<td>Downloads a copy of the document to a local or network drive</td>
</tr>
<tr>
<td>Check In</td>
<td>Saves the file to the Project and makes it available for another user to check out</td>
</tr>
<tr>
<td>Update Server Copy</td>
<td>Updates the Project file with changes User have made but does not check it in</td>
</tr>
<tr>
<td>Undo Check Out</td>
<td>Releases User’s Check Out (making it available for another user to check out) and discards any changes that User made to the file</td>
</tr>
<tr>
<td>Replace File</td>
<td>Allows User to replace the server copy of a Project file with one from a local or network drive</td>
</tr>
<tr>
<td>Revert Changes</td>
<td>Reverses any changes that User have made to the Project file that are not checked in, essentially opening the server copy again</td>
</tr>
<tr>
<td>Copy</td>
<td>Copies the file so User can paste another copy into another folder in the Project</td>
</tr>
<tr>
<td>Share Link</td>
<td>Allows User to provide a link to the Project file that can be used by somebody outside the Project to open and view the file</td>
</tr>
<tr>
<td>Revision History</td>
<td>Shows the revision history of the file and allows User to open a previous version of the file</td>
</tr>
<tr>
<td>Properties</td>
<td>Shows the properties of the file, including its name, project path, status, creation date, and size</td>
</tr>
</tbody>
</table>

In a Studio session, all documents available in the Session are listed below the Attendees List. The documents can be accessed by simply double clicking on the document (example shown below). This opens the document in Bluebeam’s main window.

![Bluebeam Documents list](Figure 6-3: Bluebeam Documents list)

The user can save as a copy to download the document for reviewing. Session documents are not checked in and out they do not have different statuses like Project files.
Users can check the status of documents while in a Bluebeam Session, through icons (shown in the table below).

<table>
<thead>
<tr>
<th>Icon</th>
<th>Status Indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>Indicates that the PDF is a Project file that User checked out</td>
</tr>
<tr>
<td>✏</td>
<td>Indicates that the PDF is a Project file checked out to another user. Right-click on the file and select Properties to find who has the file checked out</td>
</tr>
<tr>
<td>🔒</td>
<td>Indicates that the PDF is a Project file that User opened, but not checked out</td>
</tr>
<tr>
<td>📜</td>
<td>Indicates that the PDF is a Project file that has been added to a Session</td>
</tr>
<tr>
<td>🌌</td>
<td>Indicates that the PDF is a Session file</td>
</tr>
</tbody>
</table>

### 6.3 Attendees List

The **Attendees** list in the **Studio** tab lets you know who else is in the Session and what they are doing. The list shows the name of the Attendees, the document they are viewing, and their current Status. The document name will change to *Following Attendee (name of other Attendee)* if they are following another Attendee or *Offline* if they are not currently in the Session.

The **Attendees** section lists:

1. Current attendees who have joined the Studio Project/Session
2. Attendee’s *Online/Offline/ Following Attendee (name of other Attendee)* status
3. The document name the user has open for review, if any
4. The page in the document they are currently viewing

Placing the cursor over the Attendee name will display their email address and the full document name and status that they are viewing, as well as other information such as if they are *Following Attendee (name of other Attendee)* another attendee, or *Offline* if they are not currently in the Session.

The **Attendees** list also allows a user (Attendee) to see what another Attendee is viewing. To do so, a user will select an Attendee’s name in the list and click on the *Follow Attendee* icon to the right of the name. This will display the selected Attendee’s current worksession view in the user’s worksession. A large target cursor 🌌 will be displayed, indicating the location of the other attendee’s cursor. The Attendee’s name will be highlighted, and the following icon 🧕 appears before their name.
6.4 Setting User Status

Bluebeam has a *Status* feature to connote the status of each reviewer that has access to the session. A user can set their status by selecting an entry in the drop down *Status* menu located above the *Attendees* section (example shown to the right).

![Figure 6-4: Bluebeam Status indicator](image)

6.5 Record, Notifications and Pending Tabs

The *Record* tab in the bottom right corner displays a running description of what is going on in the session at any given time. It can also function as a Chat Box if user needs to communicate with another online user.

The *Record* allows the Attendee to follow other Attendees actions and comments as the Session progresses and follow the history of how an open Session progressed when they were not attending. The *Record* is a combination of chat between Attendees, a record of when Attendees joined and left the Session, and a record of markups as they were added and changed.

The ![Filter button](image) lets you show only certain types of *Record* entries. Click the *Filter* button and enable or disable *Chat, Markup, Document, Attendee, or Alert* as desired.
If user is tagged in a comment, a notice of this will be displayed under the Notifications Tab. The Notifications tab lists the Markup Alerts send to the Attendee either specifically or as part of a group. Clicking on the Alert, opens and zooms into the markup in question. Once it is addressed, the Attendee can right click and set its status to Read or Unread.

The Pending tab lists all the changes to the documents in the session when User makes them offline. These pending changes are automatically synced with the Session once the User is online. Any online changes made to a PDF in the Session (such as, adding markups or comments) are updated in real time.
6.6 Markup List

At the bottom of the Bluebeam UI is a Markups List. The Markups list is formatted as a table with each row representing a markup that has been added to the active PDF and each column showing a particular piece of information about the markup. Every markup that is made to a PDF will be automatically displayed on this list. A user may sort the list by any column by clicking the triangle icon next to the column name.

As a row is selected, the view of the PDF in the workspace will jump to the location of the associated markup. This makes it easy to use the Markups list to step through the markups in PDF using either the Previous and Next buttons or the UP ARROW and DOWN ARROW keys.

![Figure 6-7: Bluebeam Markup List interface](image)

The Markups list toolbar contains tools for organizing, processing, importing, and exporting data.

<table>
<thead>
<tr>
<th>Table 6-5: Markups List Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Markup List Tool</strong></td>
</tr>
<tr>
<td>+ Expand All - Collapse All</td>
</tr>
<tr>
<td>▲ Previous ▼ Next</td>
</tr>
<tr>
<td>▼ Filter □ Clear Filters</td>
</tr>
<tr>
<td>☑ Hide Markups</td>
</tr>
<tr>
<td>🔍 Search</td>
</tr>
<tr>
<td>📚 Columns</td>
</tr>
<tr>
<td>☑ Manage Columns</td>
</tr>
</tbody>
</table>
Table 6-5: Markups List Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drag</td>
<td>Dragging and dropping column headers.</td>
</tr>
<tr>
<td>Delete</td>
<td>Deletes a selected reply from the Markups list or a selected markup from both the PDF and the list.</td>
</tr>
<tr>
<td>Reply</td>
<td>Replies to the selected markup. Replies appear on a new indented row below the markup in question.</td>
</tr>
<tr>
<td>Status</td>
<td>Sets the status of the markups. The default statuses are Accepted, Rejected, Completed, Cancelled and None. Custom states can be created.</td>
</tr>
<tr>
<td>Manage Status</td>
<td>Creates and manages custom states. This icon is located next to the Status indicator.</td>
</tr>
<tr>
<td>Checkmark</td>
<td>Checks/unchecks the box associated with the selected markup, and also provides a command to clear all checkboxes.</td>
</tr>
<tr>
<td>Import</td>
<td>Takes the markups from a PDF, BAX or an XML file and includes them in the active PDF (this is useful for incorporating and reviewing markups or feedback from multiple sources). FDF files containing annotations generated from other PDF applications may also be imported.</td>
</tr>
<tr>
<td>Export</td>
<td>Exports all markups to a BAX or FDF file. The BAX file can be imported into another PDF so that the markups will be shown in the target PDF. The BAX file can also be imported into Excel. Markups can also be exported to the FDF format for interoperability with other PDF applications.</td>
</tr>
<tr>
<td>Summary</td>
<td>Publishes a summary report of all the markups in a PDF. A PDF summary can be saved as a separate PDF, or appended to the end of the current PDF. Summaries can also be exported to CSV or XML data files for use in Excel, or other programs.</td>
</tr>
</tbody>
</table>

6.7 Changing Status of a Markup

To change the status on a markup, the user will select the markup, and choose from the status drop down menu in the “Status” column. (example shown below). Any change in status will be recorded in the Status column.

6.8 Filtering Markups

Markups may be filtered by the user by clicking on the “Filter” icon, and then choosing the column to filter by. All other markups will be grayed out on the document.
7. REVIEWS TASKS AND BLUEBEAM REVIEW TOOLS

Bluebeam Revu provides a set of tools for processing and managing PDF documents, along with markup tools. In this section of the document, some of the tools that are useful for design review will be described.

For the additional detail and step by step instructions to use these tools, refer to the Bluebeam Help document located at http://support.bluebeam.com/online-help/revu2016-5-1/Default.htm.

The table below provides a summary of a few tasks a reviewer might perform during the design review process, along with the Bluebeam tools helpful for those workflows.

<table>
<thead>
<tr>
<th>Bluebeam Tool</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Markup Tools</strong></td>
<td>Lists all the tools to add comments, measurements and quantification</td>
</tr>
<tr>
<td><strong>Tool Chest</strong></td>
<td>Saves the customized tools once used for commenting for future use</td>
</tr>
<tr>
<td><strong>Measurement Markup Tool</strong></td>
<td>Provides access to the measurement modes, allows setting the document scale and measurement precision, setting up and clearing Viewports for multiple scales in the same document, and other measurement options</td>
</tr>
<tr>
<td><strong>Snapshot Tool</strong></td>
<td>The Snapshot tool copies text and raster or vector content to the clipboard</td>
</tr>
<tr>
<td><strong>MultiView and MultiView Extended</strong></td>
<td>Enables breaking the workspace up into multiple splits that can be synchronized. And, MultiView Extended allows a document tab to be separated from the main workspace into a stand-alone, detached workspace. This allows Reviewer to work on and refer multiple files at the same time</td>
</tr>
<tr>
<td><strong>Visual Search</strong></td>
<td>Visual searches allow for the searching of graphical symbols in PDFs. This enables the reviewer to search scanned PDFs as well and this feature is most useful in quantification in a faster and efficient method</td>
</tr>
<tr>
<td><strong>Document and Drawing Comparison</strong></td>
<td>Helps version comparison of the documents quickly and efficiently by side by side comparison or by overlay comparison. Changes are highlighted as markups.</td>
</tr>
<tr>
<td><strong>Spaces</strong></td>
<td>Assists in area, perimeter and volume calculations. PDFs saved from Revit automatically brings Revit rooms into the Spaces tab in Bluebeam, with basic space information, such as room name, area, etc. This information is very useful - identifying spaces for the reviewer. Also, the markups added in the PDF can be sorted by spaces.</td>
</tr>
<tr>
<td><strong>3D PDF – Features</strong></td>
<td>The 3D feature of the Bluebeam helps reviewer to visualize areas of interests in the three-dimensional model. User can rotate, spin, zoom, isolate and examine areas in a way that cannot be done in 2D.</td>
</tr>
<tr>
<td><strong>3D PDF – Model Tree</strong></td>
<td>Displays a list of the components in a 3D model. Reviewers can hide or unhide the components, isolate elements, apply transparencies, etc.</td>
</tr>
</tbody>
</table>
### Table 7-1: Bluebeam Review Tools Summary

<table>
<thead>
<tr>
<th>Tool Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D PDF –Cross Section and Section Box</td>
<td>Allows the 3D model to be sliced along one of the three axes or slice the model using a box that can clip along each of the six sides of the model. This is useful for seeing inside a model.</td>
</tr>
<tr>
<td>3D PDF –Creating RFI’s</td>
<td>With the use of 3D Copy to Clipboard tool, reviewers can create interactive RFI’s isolating the area in question. (Copied components do not lose their 3D capabilities when pasted into other documents.)</td>
</tr>
</tbody>
</table>

#### 7.1 Markup Tools

*Markups and Measurement* tools provide a means for annotating PDFs. Markups are stored as within the PDF, but are separate from the underlying content. Therefore, they can be readily moved and edited without affecting the underlying content. Markups can be associated with layers within the content, if desired. Some of the Markup tools are shapes, highlighter, pen, cloud, type writer, measurement tools, etc.

![Figure 7-1: List of Bluebeam Markups and Measurement tools](image-url)
7.2 Tool Chest

The Tool Chest is a powerful feature that makes marking up documents much more efficient, giving Users a place to store their most used markups in a central, easily accessible location. Markups can be reused to annotate other PDFs by saving them to Tool Chests. The Tool Chest function stores and organizes frequently used markups for use and reuse. Users can reapply a markup in its entirety, or by using its properties, and automatically scale tools to fit different drawings without having to recreate the tool to match the drawing’s scale.

The Tool Chest also contains other predefined tools called Tool Sets such as: Symbols, Shapes, color coded review markups for disciplines in construction industry, Sequences and Actions, etc. Other pre-made Tool Sets can be downloaded from the Bluebeam website at http://support.bluebeam.com/revu-extensions/tool-sets/

Figure 7-2: Bluebeam Tool Chest tab
7.3 Measurement Markup Tool

The Measurements tab contains measure tools to create measurements in any of several measurement modes. Measurements can persist as markups, allowing for processing and summarization through the Markups list, which is useful for estimation and takeoffs, or be temporary, which is useful for quickly measuring and adding up measurements without creating a visual record on the PDF. Some measurement tools useful for quantity takeoffs are Calibrate tool, Count and Cutout tool along with Area, Perimeter, Volume, etc.

The Calibrate tool allows Revu to determine a PDF’s scale, enabling accurate measurements. Revu can calibrate a PDF to a single scale or to separate X and Y scales as needed.

![Figure 7-3: Bluebeam Measurement Tool tab](image)

The Count tool places a markup for each mouse click, associating a running total of counts with each markup as it is placed. It is somewhat similar to Sequences in the Tool Chest, except that it places a pre-configured (and usually less obtrusive) symbol on the PDF and keeps a running tally, per page, of each item counted, whereas Sequences count on the PDF, do not keep a running tally, and treat each markup placed separately rather than grouping them by page in the Markups List.

![Figure 7-4: Bluebeam Sequences & Actions tools in the Tool Chest tab](image)
The Cutout tool allows you to cut out or subtract an area from an existing Area or Volume measurement.

### 7.4 Snapshot Tool

The Snapshot tool copies text and raster or vector content to the clipboard. When a Snapshot is pasted in a PDF with Revu, vectors will remain editable. When pasted into an external application, a raster image will be pasted.

### 7.5 MultiView and MultiView-Extended

Revu’s exclusive MultiView feature enables breaking the workspace up into multiple splits that can be synchronized. Additionally, MultiView Extended allows a document tab to be separated from the main workspace into a stand-alone, detached workspace.

![MultiView Tools](image)

**Figure 7-5: Bluebeam MultiView Tools in the navigation tool bar**

### 7.6 Visual Search

Revu supports two methods for searching PDFs: Text Search and Visual Search. Text searches are generally faster and, when searching for text, more reliable, but they only work on actual text and not in scanned PDFs. Visual searches allow for the searching of graphical symbols in PDFs.

![Visual Search](image)

**Figure 7-6: Bluebeam search feature**
7.7 Document and Drawing Comparison

The *Compare Documents*... feature is used to compare two PDFs and highlight the differences. The differences are indicated with markups that can be reviewed easily using the *Markups* list. There is also a batch version of *Compare Documents* for comparing groups of PDFs. The drawings can be compared in two ways; overlay comparison and side by side comparison.

The *Overlay Pages*... process in Revu lets comparison of two or more PDF drawings by converting each drawing to a different color and stacking them on top of each other as layers in a new PDF. Each layer is transparent and blends with the layers below it. Where the colors are stacked directly over each other, they blend to create a darker color, making it easier to see which elements have changed and which ones have remained the same from revision to revision.

![Figure 7-7: Bluebeam Overlay Pages dialog box](image)

The default overlay settings in Revu are changeable. However, default colors have been specifically chosen to make the overlay process work more smoothly, thus it is recommended that the defaults be kept and not overridden.
In the side by side Compare Documents process, the PDF drawings are shown in split screen view. Depending on the comparison preferences, the differences will be indicated on either original document or second version of it or on a copy of the original PDF using shaded clouds that can be tracked and documented in the Markups list.

Figure 7-9: Bluebeam Compare Documents dialog box

7.8 Spaces

The Spaces tab provides a feature to define areas within the PDF that makes storing and sorting markups easier and more efficient. Spaces allow user to designate named parts of drawings on an invisible layer. Any markups placed inside a Space can be organized based on the Space they are in. For example, in a multiple page drawing where each page represents a floor of a building, and each floor contains many rooms, user can designate a space called "Floor 1" which encompasses the entire first floor, and inside Floor 1 can be many individual spaces corresponding to the rooms such as "Room 1," "Room 2," and so on.

Once the process of creating multiple markups for certain category (called punch process) is complete, the spaces will allow users to easily find and organize all the markups in a particular room or on a particular floor. Spaces are made and controlled within the Spaces tab.
Bluebeam PDFs for drawings that are created within Revit with Room elements visible automatically brings in all the Revit rooms into Bluebeam *Spaces* tab when the *Export Rooms to Spaces* (creates Revu Spaces that match the existing Revit Rooms in the PDF) option is checked in the *Bluebeam Conversion Settings* dialog box in Revit. Bluebeam also has options to *Export Rooms to Area Measurements* that creates Revu Spaces and also creates matching *Area* measurement markups in the PDF. Note that this option is only available when *Export Rooms to Spaces* is enabled.

*Subtract Openings* option creates Revu Spaces with *Area* measurement markups as described under *Export Rooms to Area Measurements* above, but subtracts any holes or voids in the Revit Room from the *Area* measurement markup in the PDF. This option is only available when *Export Rooms to Area Measurements* is enabled.

When a space is selected from the list in the *Spaces* tab, that space will be highlighted in the drawing page. This helps reviewers to get to that space without searching for it. The reviewer can also create snapshots for spaces by right clicking on it and selecting Snapshot option. These snapshots can be used to create a new PDF or a page to scale up the space for further detailing the space.
7.9 3D PDF Features

3D models appear in Revu as a rectangular 3D Model window within the PDF page. When a 3D Model window is present, 3D Hover Bar appears to provide additional controls. In addition, the 3D Model Tree tab offers advanced options.
7.9.1 Manipulating 3D Models with the Mouse

Click and drag the mouse to interact with a 3D model. The behavior of the mouse can be changed on the 3D Hover Bar or on the 3D Model Tree tab. The default behavior is for the mouse to rotate the model. Clicking the scroll wheel will pan and scrolling wheel will zoom in and out.

To change the mouse interaction model, select the desired mode from the Mouse Interaction menu (see Figure 9-14) on either the 3D Model Tree tab or the 3D Hover Bar.
7.9.2 3D Model Tree

The 3D Model Tree tab contains powerful tools for interacting with and marking up 3D content. The 3D Model Tree displays a list of the components in a 3D model. Users can select the specific model components they want to show and hide by checking or unchecking the box next to each component’s name. Toggle the box next to a parent category in the tree to display any child components. User can also select multiple parts in a 3D Model Tree and right-click them to use the context menu to isolate, apply transparencies, etc.

![3D Model Tree panel and context menu](image)

3D Model Tree panel contains a Views section and a Cross Section Properties section along with 3D Model Tree. The Views sections will contain predefined and new views created by users.
7.9.3 Cross Section and Section Box

The Cross Section and Section Box feature contains controls and options that enable slicing the view along one of the three axes or using a box that can clip along each of the six sides of the view. This is useful for seeing inside a model. The Cross Section Properties and Section Box Properties help to fine tune the slice location, tilt, offset, etc.
7.9.4 Creating a RFI from the 3D Elements of a 3D PDF

Elements from 3D PDF can be selected and copied to the clipboard by selecting \textit{Copy} from the context menu and \textit{Paste} using the 3D Editor tool in a new page or PDF to create interactive RFI.

Figure 7-18: Bluebeam 3D Editor Tool to copy and create 3D content
8. INCORPORATING REVIEWER COMMENTS FROM BLUEBEAM SESSIONS TO SI IMANAGE

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