WV GIS Technical Center
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WV DIVISION OF HIGHWAYS PLAN SCANNING PROJECT

BASIC OPERATIONAL MANUAL

West Virginia GIS Technical Center
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CONTENTS

This is a basic guide intended for internal use by the WV GIS Technical Center to summarize the procedures of the DOT Scanning Project. All work progress should be recorded in the proper Performance Tracking Database. For comprehensive instructions, refer to the main Operational Manual.

SHEET SCANNING

SCANNER SETUP

The scanning software used is SmartWorks Pro for both ColorTrac SmartLF SC 42e Xpress Scanners. Turn on the scanner and open SmartWorks Pro scanning software. Ensure the scanner settings are correct.

SCANNING SETTINGS	
Size	22 x 34 Sheets: Full Auto Size 12 x 18 Sheets: Manual Width with Auto Length
Width	22 x 34 Sheets: N/A 12 x 18 Sheets: 480mm
Auto BW points	Off
Color Mode	256 Colors with auto palette (8-bit or indexed color)
Resolution	300 dpi
Quality	1
Auto Naming	Off or Add Numerical Suffix
Auto Overwrite	Type new name if file exists
File Name	S1XXXX-XXXX.tif
File Type	TIFF LZW
Folder	E:\DOT\Imagery\Original Scans\S1XXXX

SCANNING PROCEDURES FOR 22x34 AND 12x18 SHEETS

1) **Select the top Project Book Folder from the named books area (from the most recent shipment) and bring it to your assigned working pile inside the scanning room.**
2) **Move a Project Book to the scanner workstation.**
3) **Write the Scan Order Number (e.g. S12345) with a Sharpie marker on the supplied colored paper.**
4) **Remove clips/tape/staples/sharp objects from sheets and unlatch the binder.**
5) **Clean the scanner lens.**
6) **Check that scanner settings are correct**.
7) **Scan sheet.**
   a) Wipe the sheets clean and remove any sharp objects or debris as you go to protect the scanner and improve the image quality of the scan.
   b) Fix any tears or holes with reinforcement labels or document tape if necessary.
      i) Use a “D-size” document protector found in the map case if sheets are dirty, excessively waxy or sticky, too torn, brittle or any other reason it can’t be scanned like regular sheet.
   c) Check digital image: Make sure it is straight and free of any streaks or artifacts made by the scanner, folds over the neat lines or other data, no information is cut off, or that there is any other reason you will have to rescan the page for.
8) **Repeat step 7 until all sheets have been scanned.**
9) **After the entire Project Book is scanned, the TIFF scans must be transferred from the local workstation to the *IncompleteBooks* folder.**

a) Mark plan as Yellow on the Performance Tracker when the file has been transferred.

10) **Replace prong fasteners for the Project Book**.
    a) Ensure the plan is as securely fastened as possible.
        i) Use new prong fasteners if the old ones are too damaged or otherwise unacceptable.
11) **Place Project Book within large folder that it originally came from**.
    a) Make sure the Project Books are in order in the folder.
    b) If you are not finished with a plan, keep it separated from the plans that are finished and the plans that have yet to be scanned in a manner that makes sense to you. Do not leave unfinished folders or Project Books on the center scanning cabinets.
12) **When all Project Books in a folder are scanned, write the Scan Order Number range of the Project Book Folder with a Sharpie marker on the colored paper provided and tape it to the large folder.**
    a) One sheet will be the list of all the projects in that large folder, if there are multiple projects in one folder add the first and last Scan Order Numbers to that list (e.g. S12345 – S12355)
13) **Clean the scanner lens when you finish scanning for the day.**
14) **Update DOT Performance Tracker Google Sheet:**
15) **Update DOT_Operator_64 Tracking Database in MS Access**:

IMAGE PROCESSING

IMAGE PROCESSING PROCEDURES

1) **Open File Explorer.**
   a) Navigate to the IncompleteBooks folder on \\gistc-infilesrv1-22\DOTScanning\Scanning\IncompleteBooks
   b) Open the Project Book to be image processed.
   c) Create three new folders on your desktop. You will not have to do this more than once. Name them as follows:
      (1) GeoTIFF
      (2) PDF
      (3) TIFF
      ii) For every Project Book you do, copy these folders from your desktop and paste them into the Project Book folder in the IncompleteBooks folder on the network drive.
      iii) Move the original scans into the TIFF folder.
2) **Copy the Project Book files from IncompleteBooks on to your desktop.**
3) **Open the tif files in the TIFF folder in Photoshop by selecting them in the folder on your desktop and dragging them to the program.**
4) **Making sure you are on the Crop tool, highlighted below.**
   a) Align the page by holding Ctrl or clicking the “ruler” icon and dragging your mouse from one corner to another on the straightest line possible.
   b) Ensure the text is as level and straight as possible.
   c) If there is no neat line, use your best judgement to find the next best reference.
5) **Crop the image to around a centimeter (estimate it) away from the neat lines by using the crop tool while making sure to include any text, diagrams, or additional information that is outside the neat lines while minimizing whitespace and the scanner background.**
6) **Use the Autocontrast and Save tool by hitting the function key (F2) you assigned it to.**
7) **Go to the next page by hitting ctrl+tab or clicking the next file at the top of the work area.**
8) **Repeat steps 4-7 until finished with all the TIFF files.**
   a) As you go, make sure there are no artifacts, folds over the neat lines or other data, no information is cut off, or that there is any other reason you will have to rescan the page for.
9) **Upload processed images to IncompleteBooks from the folder on your desktop.**
10) **Update DOT Performance Tracker Google Sheet:**
11) **Update DOT_Operator_64 Tracking Database in MS Access:**

PDF BOOK

PDF CREATION PROCEDURES

1) **Open Adobe Acrobat Pro.**
2) **Open the folder with the processed images from the copy of the plan on your desktop.**
   a) *Do NOT work out of IncompleteBooks.*
3) **In Adobe Acrobat, click on Tools > Combine files.**
   a) Generally, Acrobat can handle ~50 pages of the 22x34 sheets and ~100 of the 12x18 sheets. This number can vary.
   b) If it cannot handle the number of pages, split the project into however many PDFs as needed. (e.g. 400 small sheets should have four 100-page PDFs.)
4) **Highlight all the processed files you want to combine into a PDF in the TIFF folder.**
   a) Drag and drop them into Adobe Acrobat with the Combine tool open.
5) **Make sure all files are in the correct order, then click Combine.**
6) **In the OCR tools, run recognize text tool > In this File > Recognize Text (Blue button.)**
7) **Save and name the PDF to match the number of the Project Book (e.g. S12345.)**
8) **After that is finished, open the File Optimization tool and run Reduce File Size or Compress PDF depending on your software version.**
9) **Save and check all the pages for errors.**
   a) Make sure that all the pages are the right orientation.
      i) Open the thumbnail view on the left side and use the rotate arrows to correct the page's orientation.
   b) Make sure there are no OCR errors generated from the text recognition process.
   c) Make sure there are no artifacts, folds over the neat lines or other data, no information is cut off, or any other reason you will have to rescan and reprocess the page for.
      i) In this case, find the page, rescan it, replacing the page in the OriginalScan Project Book folder.
      ii) Upload that individual file to the IncompleteBooks folder and replace the former scan.
      iii) Process the new page in Photoshop as usual.
      iv) Replace the old page in the PDF with the new page you rescanned.
10) **If there are multiple PDFs from too many pages, repeat steps 5-11 till all pages have been built into a PDF.**
   a) Combine them into one singular PDF using the Combine tool, making sure they are in the right order. There should only be one PDF in the incomplete books folder.
   b) Save and name the PDF to match the number of the Project Book (e.g. S12345.)
   c) Re-run the Reduce File Size or Compress PDF tool.
11) **Upload finished PDF to IncompleteBooks from your desktop.**
12) **Update DOT Performance Tracker Google Sheet.**
13) **Update DOT_Operator_64 Tracking Database in MS Access:**

GEOREFERENCING HIGHWAY INDEX MAP

GEOREFERENCE PROCEDURES

1) **Select the best single TIFF file from the TIFF folder on your desktop.**
   a) This is preferably the cover page, but not always.
   b) Open the file in photo viewer.
2) **Copy the selected file into the GeoTIFF folder on your desktop.**
   a) Exception to the cover page include:
      i) Maps that are larger than 1 inch to 3 miles scale or it covers more than 3 counties.
         (1) If between 2-3 miles or 1 inch to 2000ft and 3000ft, crop the page down to just the map on the cover page.
      ii) Maps without cover pages. Find the next best page that shows as much of the plan as possible and use that.
      iii) Maps without any geo-information of a reasonable scale. The last resort is to crop out the inset map and georeference that.
      iv) Maps without any geo-information at all. Comment on the Performance Tracker that the plan has no geo-info. Move to step 15.
3) **Drag the TIFF into the Table of Contents from the GeoTIFF folder on your desktop.**
   a) Make sure to place it above the imagery layer so you can see the plan.
4) **In the Raster Layer tab and change the Transparency to ~30%.**
6) **Use the image you opened earlier to look for spatial references to match to the image in Arc such as roads, rivers, crossroads, etc.**
      i) You can use Google maps to aid you in looking for the area if needed.
      ii) Sometimes inserting the map and orienting it properly can help you find it. Refer to step 7 on how to do this.
   a) First, find the county the plan is in by referencing the top right corner map. Zoom to this county in ArcGIS.
   b) Next, use the inset map to find the more precise location in the county where the project is. It will often be depicted by a line, arrow, or circle.
   c) Once you have the general location, refer to project plan itself.
   d) For sheets depicting little to no spatial information, use these clues to aid in georeferencing:
      i) A North Arrow will aid in orienting the page correctly (Top left corner of example below.) Rarely the north arrow will be oriented incorrectly but normally it is correct.
      ii) Project Title often has more information corresponding to the location of the project, e.g. “Rafe Run Bridge.”
      iii) The scale bar can help you determine how small the plan is.
      iv) The DOT Access database “dbo_Scanning” can also supply more information concerning any routes/sub routes and other information. Ask the project lead for this information or consult the transmittal sheet attached to the physical Project Book.
      v) Another tip for reading DOT book plans. Roads that are dashes are generally the old roads and the solid line with the circles and dashes are the proposed plan and should be georeferenced rather than the dashes, unless it does not match.
   e) If the cover sheet does not supply enough spatial information, try to find a sheet in the project that does, but it should be a last resort.

If there are no sheets that can be used, leave an empty GeoTIFF folder in the Project Book folder. Leave a comment saying “No Geoinfo” in the Performance Tracking Sheet.

7) **Once you have found the area to which you plan to reference the image click Georeference from the Imagery tab and click Fit to Display.**
   a) Use the Rotate tool on the image to orient it using the north arrow and use the Move and Scale tools to help you get it into the general position. Do not go for perfect accuracy as that can make it more difficult to add control points.
8) **Once set in place, click the “Add Control Points” button and add control points as necessary.**
   a) Always assign control points using the imagery and not the base map.
   b) When you first click to add a control point, click on the section of the map itself and *then* on the corresponding point on the imagery.
   c) Add *at least* four (4) control points and make sure the main portion of the project (Usually outlined in sections of boxes) is what is being georeferenced (e.g. if the plan is an Interstate, match the Interstate road, and not the side roads.) *Do not exceed* ten (10) control points.
   d) Sometimes a point will not work as you wanted or will need removed.
      i) To do this, select the point by clicking the select tool in the review section of the Georeference tab. Once the point is selected, click on the Delete tool. These tools are highlighted in green.
      ii) If you only have one other point placed, this will transform the image to make it ridiculously small. You can either reset the image and start over or try to carry on if you think you can match the point well enough. It will automatically transform the image for you.
9) **General Tips:**
   a) The north arrow is not always oriented perfectly or correctly even, if you are having difficulty finding a location, try orienting the map in different directions.
   b) Check that you are trying to georeference the correct line on the map. Often the plan will be misleading and show the old part of the project in a more precise manner as the part you are most likely georeferencing had not been built yet. Generally, they will represent the new part with a bold line with dashes and circles throughout. Sometimes they will label it but not always.
   c) The scale bar can give you a hint as to how small or large the plan needs to be. Using the scale of the map on the bottom of ArcGIS Pro you can tell how zoomed in you should be before you fit the map to the display.
   d) Do not try to make every map as perfect as possible. Some maps are not scaled correctly. Sometimes it is the whole map, and sometimes it is part of the map. There are also times where the plan was not built as planned or perhaps not at all. Obviously, we want the best match we can get, but redoing the map over and over is a waste of your time.
   e) If you cannot find the location, ask for a second opinion. This is a skill that you develop by doing and will take time to get the hang of.
10) **Once done, click “Save as New” in the Georeference tab**
   a) Set the Output Raster Dataset to your project folder that should be pinned to your quick access bar. It should default to this.
   b) Make sure the coordinate system is set to NAD_1983_UTM_Zone_17N.
   c) Leave Geographic Transformations, Clipping Geometry, and Cell Size as it is.

d) Change the raster size columns and rows to 6000. The cell size will change when columns and rows changes. That is fine.
e) Leave Pixel Type alone.
f) Change NoData to 0.
g) Leave everything else as it is.
h) Click Export

11) When exported, you will find four files in the project folder pinned to your quick access bar on your file viewer.
a) Rename them all to S1XXXX-[FILENUMBER]_UTM17N83 (e.g. S10899-0001_UTM17N83).
i) The bottom two files will select the extra file extensions, make sure you keep all of them and only rename the file itself.
b) ***It is a hyphen between S1XXXX and [FILENUMBER] and an underscore between [FILENUMBER] and UTM17N83. The [FILENUMBER] is FOUR digits.***

12) Select all four files, right click on the .tif file with them all selected and click "Send to Compressed (Zipped) Folder".
a) Make sure the zipped folder is named the same as files and the file type is ONLY ".zip". (e.g. S02939-0028_UTM17N83.zip)

13) Put the zipped file into the Project Book GeoTIFF folder on your desktop.
a) Delete the copy of the .tif and the two files generated in the GeoTIFF folder by ArcGIS Pro when you loaded the image into the map.
b) Delete the four tiff files and the .zip file from the DOT_GR project folder.

14) Upload finished GeoTIFF to IncompleteBooks from your desktop.

15) Update DOT Performance Tracker Google Sheet.

16) Update DOT_Operator_64 Tracking Database in MS Access:

QUALITY CONTROL & FILE RENAMING

QUALITY CONTROL PROCEDURES

1) **Navigate to the IncompleteBooks folder and choose a folder to QC.**
2) **Open the TIFF folder:**
   a) Check that all files are accounted and that the quantity listed is correct.
   b) Check that there are no non-TIFF files in the folder.
3) **Open the PDF folder and open any PDF's within the folder.**
   a) There should only be one which has the whole plan. Delete any extra PDFs.
   b) Check the PDF to make sure it has the correct number of pages.
      i) If there are discrepancies with the page number, flag the file on the Performance Tracker describing the problem.
   c) Check that all pages have been image processed.
      i) Check that no information has been cropped out or has folds over it, the page is cropped within approximately a centimeter along all neat lines and information outside the neat lines, and the page is reasonably straight.
         (1) If there are discrepancies, flag the file on the Performance Tracker noting which pages need processed or fixed.
   d) Check that all pages face the correct direction.
      i) If there are discrepancies, flag the file on the Performance Tracker noting which pages need rotated.
   e) Check that no pages are askew or have OCR errors.
      i) If there are discrepancies, flag the file on the Performance Tracker noting which pages need replaced.
   f) Check that no pages have artifacts or other imperfections that do not come on the original plan.
      i) If there are discrepancies, flag the file on the Performance Tracker noting which pages need examined or rescanned.
   g) If there is an error and you are sure it needs fixed mark the whole plan section as red. If you are unsure there is an issue and need more information mark the whole plan section as orange.
4) **Open the GeoTIFF folder and extract all files into the GeoTIFF folder.**
5) **Open ArcGIS Pro and your DOT_GR project.**
   a) Drag the TIFF file into the Table of Contents.
   b) Right click that layer and click on Zoom to Layer.
   c) Check that the Georeferenced index page matches the area to which it is referenced.
      i) Ensure that the Georeference does not cover a large amount of a county/state. (Over 1in:3m scale or covers more than 3 counties.)
      ii) Ensure that the Georeference does not have a black background (No data not set to 0.)
         (1) Flag the file on the Performance Tracker noting the issue with the GeoTIFF.
   d) After confirming that the georeference is correct, remove the GeoTIFF from ArcPro.
      i) Select the extracted files that make up the GeoTIFF in the GeoTIFF folder in the IncompleteBooks folder and remove them.

(1) Make sure the GeoTIFF .zip folder and the subfiles are named correctly. If not, flag this and have the technician rename them properly.

6) **Once the Project Book is verified as complete, move to the renaming process.**

FILE RENAMING TO PROJECT KEY

RENAMING PROCEDURES

1) **Navigate to the IncompleteBooks folder and find the folder to be renamed.**
2) **Open the folder and remove any "*Thumbs.db*" from the Project Book folder and its subfolders.**
   a) Make sure it has all three of the subfolders (GeoTIFF, PDF, TIFF) or else the tool will not run.
   b) Navigate out of the folder to be renamed.
3) **In the DOT Access database open the dbo_vw_ProjectKeyLookup.**
   a) Locate the Scan Order Number of the plan you are renaming. The corresponding key is what you need.
4) **Open ArcGIS Pro:**
   a) Find the DOT File Rename for Pro Tool.
      i) Open the File Rename Tool and type in the name of the folder to be renamed exactly as it appears in the IncompleteBooks in the Old Project Key box of the Rename Tool
      ii) Copy the ProjectKey of the folder to be renamed from Access and paste it into the New Project Key box of the Rename Tool.
      iii) Make sure the ProjectBook Structure box is checked.
      iv) Run the tool with the Validation Only box checked.
   b) If there are no issues with the validation, uncheck the box and run the rename tool.
5) **Check to ensure the files renamed properly in all the subfolders and inside the GeoTIFF .zip file. They will look like this:**
6) **After the file has been properly renamed, it must be moved from the IncompleteBooks folder to the ProjectBookFolders folder.**
   a) Drag the correctly renamed book in the IncompleteBooks folder and drop it in the ProjectBookFolders folder. Mark the plan number Blue on the Performance tracker noting it has been QC'd.
   b) If there was an issue with renaming the file, mark the plan number Light Blue.
      i) The most likely error is a permission error. Have the technician who processed the plan restart their PC.
7) **Update DOT Performance Tracker Google Sheet.**
8) **Update DOT_Operator_64 Tracking Database in MS Access:**

Note: When running the rename tool, make sure you are outside the folders when in the Project Book. You can be inside the Project Book but not in TIFF, PDF, or GeoTIFF.

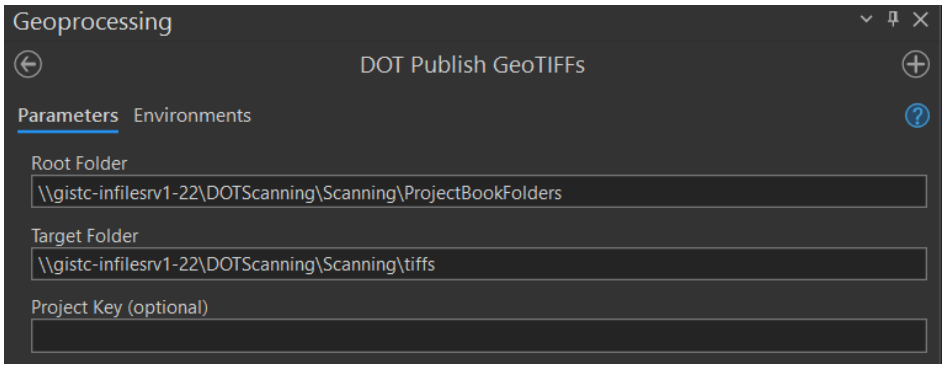
- If there are any issues with the validation, address them and run the validation again.

PUBLISHING (includes WEB QC & BACKUPS)

PUBLISHING GEOTIFFS

The georeferenced TIFFs from each Project Book are combined into raster mosaics in ArcGIS for easy viewing. To begin the process, expand the toolbox named *Pro_DOT_Tools* and open the *DOT Publish GeoTIFFs* tool.

Double-Click *DOT Publish GeoTIFFs* Tool to open the script, the following box will appear:



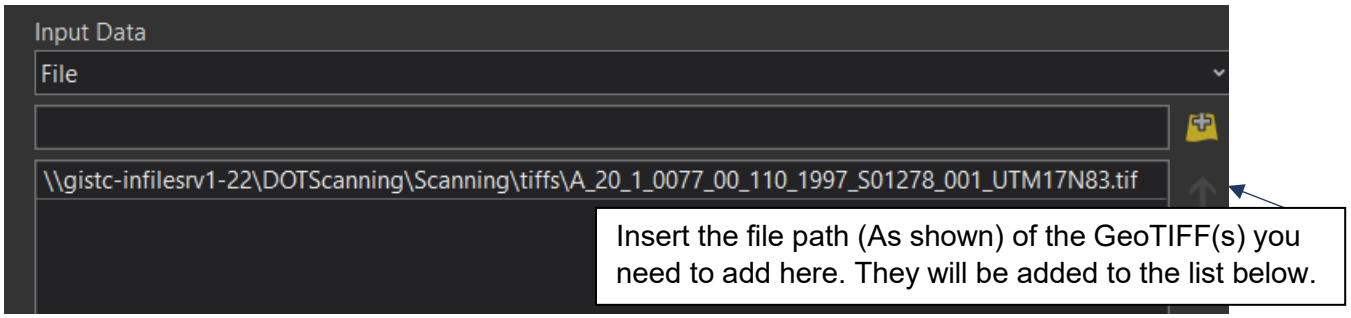
Click OK and the Tool will run, placing all the GeoTIFF folder contents from ***\ProjectBookFolders*** into ***\tiffs*** so that they can be added to the Mosaic dataset.

When the process is completed, check to see the website is functioning correctly.

ADD RASTERS

The first step is to use the Data Management Toolbox, click Raster, Mosaic Dataset, and the *Add Rasters to Mosaic Dataset* tool will appear.

Normally, when adding rasters to the mosaic, the “File” option should be selected in the “Input Data” section of the “Add Rasters” dialog. Each raster can be selected individually and added to the “Source” list. It is important to use the full UNC pathname so that the ArcGIS server can access the images.



Under the Advanced Options, the “Add New Datasets Only (optional)” drop down should be set to “Exclude duplicates” for regular publishing steps or “Overwrite duplicates” for republishing during the Website QC process.

Click OK to run the tool and add the GeoTIFFs extracted in the last step to the mosaic dataset. This process takes approximately 30 minutes for 10,000 plans. Check to see the website is running when it completes.

BUILD FOOTPRINTS

After the rasters are added to the mosaic dataset, the footprints of each georeferenced image need to be created. The next tool removes all existing footprints then rebuilds the feature class by scanning the rasters and generating new features. Expand the toolbox named *Pro_DOT_Tools.pyt* toolbox and open the *DOT Build Footprints* tool.

Open the tool and click OK. Expect it to take around an hour minimum as of 10,000 plans.

Finally, verify that the website is functioning correctly when the process has completed.

UPDATE FOOTPRINT EXTENT

To copy the footprint extents, the technician uses the *DOT Footprint Extent Update* tool in the *DOT_Tools.pyt* toolbox.

It is important to note that the *DOT Footprint Extent Update* tool will only run on the plans that are specified in the Scan Order row. To update all Scan Orders, follow the directions in the tool and place an asterisk (*) in the Scan Order row. It is also necessary to check the “Update Database” checkbox at the bottom of the dialogue box to properly update footprint extents.

Click OK and the tool will populate the XY coordinates in the database. This should take no more than 10 minutes as of 10,000 plans. Check to see the website is running.

Publication Status

The last step is to update the PublicationStatusID column of the Scanning table to ‘2’ or if you are using the Access interface open the table and set the PublicationStatus to ‘*Published’.*

Make sure the ScanCount and GeoTIFFSheet columns of the Scanning Table include the accurate page number.

At this point you should be able to see the new footprints on the website, check to see that it is running.

FINAL WEBSITE QC

1) **Navigate to the website**: http://mapwv.gov/DOTplans/
2) **Search for one specific plan at a time, which you published in the last batch.**
   a) Click and check each of the four links for each Project Book.
3) **Note any errors that are found in the Web QC Google Sheet.**
   a) Refer to Website Troubleshooting for information about errors.
4) **Make any corrections and continue to Backup procedures.**