CAD Standard

English version

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p.barrett
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Introduction:

This standard is for the preparation and presentation of HDA CAD files.

While primarily focusing on the preparation and presentation of drawings in AutoCAD, much of this standard is designed to be applied to both AutoCAD and Rhino (and possibly other design software programs which may be used, depending on project requirements), with the aim of increasing compatibility between the two.

(This standard is primarily designed for small to medium size design/engineering/architectural companies. The priority was to design a standard that remains simple enough to be practical for small companies and small projects, while being sufficiently comprehensive to cope with the complexities of larger projects and the more detailed requirements of larger sized companies.)

When considering CAD standards for HDA it is necessary to take into account the following factors:

- HDA projects are undertaken in different countries, and with companies of different nationalities, therefore any one national standard implemented would not be compatible with all projects. Using multiple standards for different countries is impractical and unworkable.

- There is no single, globally accepted standard that every company worldwide uses.

- HDA CAD files are worked on by architects, designers, drafters and engineers. In the same way as a drafter does not have the same skills as an architect or engineer, architects and engineers do not have the same skills as an experienced drafter. This standard has been designed to be as minimal as possible in certain areas, to make it more accessible to less experienced users and to lessen the scope for errors and differences in presentation styles.

- HDA projects vary in size and scope, therefore a large detailed system that is necessary for a large project will be unnecessarily complex for a small project, and vice versa. This standard has been designed, where possible, to be adaptable to different sizes and types of projects.
As explained in the 'Project Folder Organisation' document, HDA graphical files are broken down into the following sub-folders:

- **02_GRAPHICS**
  - **01_AutoCAD**
    - 2D models (dwg).
    - 3D models (dwg).
    - Temporary files exported to other programs.
    - Borders, title blocks, plot styles, templates (dwg).
    - Numbered HDA drawings with borders/titles (dwg).
    - In progress work (dwg).
  - **02_RHINO**
    - All work done in Rhino.
    - 2D models (3dm).
    - 3D models (3dm).
    - Temporary files exported to other programs.
    - Grasshopper scripts (ghx).
    - Borders, title blocks, plot styles, templates (3dm).
    - Numbered HDA drawings with borders/titles (3dm).
    - In progress work (3dm).
    - Other scripts prepared in Rhino.
  - **03_XXXXX**
    - All work done in XXXXX.
    - 2D models (XXX).
    - 3D models (XXX).
    - In progress work (XXX).
    - XXXXXX (XXX).

- **10_IMAGES**
  - Rendered images and images prepared in Photoshop/Illustrator.

- **20_VIDEOS**
  - Animations prepared in Rhino or other modeling programs.

- **30_HAND-SKETCH**
  - Scanned images of hand-drawn sketches.

This standard concerns itself specifically with sub-folders '01' (AutoCAD) and '02' (Rhino), and theoretically with all subfolders up to '09' that may be used for design software programs.
File Composition
Overview:

This section of the guide explains how HDA CAD files should be composed.

It explains the difference between ‘Model’ files and ‘Drawing’ files, and how drawing files are prepared from model files.

- **Model** files are all 2D and 3D files of models such as structures, objects/elements and assemblies, and plans, sections and elevations.

- **Drawing** files are drawings with borders, titles and annotations, and represent the plotted output (including notes, reference information and dimensions).

As explained in the ‘Project Folder Organisation’ document, HDA graphical files are broken down into the following sub-folders:

- **02_GRAPHICS**
  - **01_AUTOCAD**
    - 2D
    - 3D
    - EXPORT
    - HDA-BASE
    - HDA-DRAWINGS
    - IN-PROGRESS
  - **02_RHIN0**
    - 2D
    - 3D
    - EXPORT
    - GRASSHOPPER
    - HDA-BASE
    - HDA-DRAWINGS
    - IN-PROGRESS
    - SCRIPTS
  - **03_XXXX**
    - 2D
    - 3D
    - IN-PROGRESS
    - XXXXXX
  - **10_IMAGES**
  - **20_VIDEOS**
  - **30_HAND-SKETCH**

2D/3D drawings/models, sketches, renderings, images, animations.

- All work done in AutoCAD.
- 2D models (dwg).
- 3D models (dwg).
- Temporary files exported to/from other programs.
- Borders, title blocks, plot styles, templates (dwg).
- Numbered HDA drawings with borders/titles (dwg).
- In progress work (dwg).
- All work done in Rhino.
- 2D models (3dm).
- 3D models (3dm).
- Temporary files exported to/from other programs.
- Grasshopper scripts (ghx).
- Borders, title blocks, plot styles, templates (3dm).
- Numbered HDA drawings with borders/titles (3dm).
- In progress work (3dm).
- Other scripts prepared from Rhino.
- All work done in XXXXXX.
- 2D models (XXX).
- 3D models (XXX).
- In progress work (XXX).
- XXXXXX (XXX).
- Rendered images and images prepared in Photoshop/Illustrator.
- Animations prepared from Rhino/3DS/other modeling programs.
- Scanned images of hand-drawn sketches.

This standard concerns itself with sub-folders ‘01’ to ‘09’ that are used are used for design software programs.
'Model' Files and 'Drawing' Files:

The aim here is to establish the difference between 'Model' files, which can be considered as the object/element/structure/building information (drawn/modelled at true/1:1 scale, either in 2D or 3D), and 'Drawing' files, which are a representation what the plotted/printed sheet will look like.

Model Files:

- 'Model' files are 2D or 3D models (whether done in AutoCAD, Rhino or other programs), such as structures, objects/elements and assemblies, and 2D plans, sections, and elevations (and details if required).

  - Current versions of principle model files should be in the '2D' and '3D' folders, and have the document type abbreviation 'MOD'. These include files which may be required to be located by other persons, and files referenced to other files (e.g. XREFs in AutoCAD). File names should be clear and concise.

    eg. HDA-287-MOD_1ST FLOOR PLAN.dwg - Plan of 1st floor - current version (AutoCAD) - '2D'
    HDA-287-MOD_GRID.dwg - Overall site grid - current version (AutoCAD) - '2D'
    HDA-287-MOD_3D-Facade Panel.dwg - 3D facade panel - current version (AutoCAD) - '3D'
    HDA-287-MOD_staircase.3dm - 3D staircase model - current version (Rhino) - '3D'
    HDA-287-MOD_building facade.3dm - 3D facade model - current version (Rhino) - '3D'
    HDA-287-MOD_staircase section.3dm - 2D staircase section - current version (Rhino) - '2D'

  - In-progress files internal files that are continually being changed and overwritten should be in kept in 'IN-PROGRESS' and can be named more or less at the author's discretion.

    eg. staircase_2010-05-24.3dm - In-progress staircase model (Rhino)
    facade section_4.dwg - In-progress section of facade (AutoCAD)

  - All old or superseded versions should be put in the accompanying 'Remplacé' sub-folder.

- Model files that are issued or sent out from HDA should be considered as being for information purposes only. The date of issue should be attached to the file.

Drawing Files:

- 'Drawing' files are drawings with borders, titles and annotation (primarily prepared at HDA in AutoCAD, but can be prepared also in Rhino or other programs), and represent the plotted output (including notes, reference information and dimensions).

  They have the document type abbreviation 'DRG', and should be in 'HDA-DRAWINGS'.

  - Only current versions should be in the 'HDA-DRAWINGS' folder.

    eg. HDA-287-DRG_GA-001.dwg - G.A. drawing No. 001 - current version (AutoCAD)
    HDA-287-DRG_DE-007.dwg - Detail Drawing No. 007 - current version (AutoCAD)

  - All old or superseded versions should be put in the accompanying 'REMPLACÉ' sub-folder.

    eg. HDA-287-DRG_GA-001_01.dwg - G.A. drawing 001 - superseded Rev '01' (AutoCAD)
    HDA-287-DRG_DE-007_R2010-05-24.dwg - Detail Drawing 007 - superseded version (AutoCAD)

  - HDA drawings should be issued as paper versions or as non-editable PDF files only, rather than in their native format. Current versions should be plotted to PDF and their revision number added.

    eg. HDA-287-DRG_GA-001_01.pdf - G.A. drawing 001 - Rev '01' (PDF)
    HDA-287-DRG_DE-007_01.pdf - Detail Drawing 007 - Rev '01' (PDF)
Example of a drawing file composed of 3D model files:

- In this example, no models exist in the final drawing file, all models are externally referenced into the drawing. Therefore any changes to the model files will result in the drawing being automatically updated.

- 2D elevation and 2D plan in the drawing are top and side views of the 3D model, therefore the drawing is composed of 3 different views of the same model assembly.

- All model files (MOD) are externally referenced to the drawing, in MODEL SPACE. All borders and title blocks are inserted directly into the drawing file, in PAPER SPACE.

- All notes, text and dimensions have been added only in the final drawing file.

- Dimensions that are associative will update automatically when the model is modified in the model file, though as good working practice the drawing file should be checked again for discrepancies whenever referenced model files are modified.

- While this is the preferable method of file composition, there may be circumstances when it is considered more practical to have the 'models' drawn directly in the drawing files, depending on project requirements.

- The version of the drawing to be sent out or issued should be in a non-editable PDF format.
Example of a drawing file composed of 2D model files:

- In this example no models exist in the final drawing file, all models are externally referenced into the drawing. Therefore any changes to the model files will result in the drawing being automatically updated.

- All model files (MOD) are externally referenced to the drawing, in MODEL SPACE. All borders and title blocks are inserted directly into the drawing file, in PAPER SPACE.

- All notes, text and dimensions have been added only in the final drawing file.

- Dimensions that are associative will update automatically when the model is modified in the model file, though as good working practice the drawing file should be checked again for discrepancies whenever referenced model files are modified.

- While this is the preferable method of file composition, there may be circumstances when it is considered more practical to have the 'models' drawn directly in the drawing files, depending on project requirements.

- The version of the drawing to be sent out or issued should be in a non-editable PDF format.
Example of a drawing file composed of 2D model files:

- In this example no models exist in the final drawing file, all models are externally referenced into the drawing. Therefore any changes to the model files will result in the drawing being automatically updated.

- All model files (MOD) are externally referenced to the drawing, in MODEL SPACE. All borders and title blocks are inserted directly into the drawing file, in PAPER SPACE.

- For detail drawings such as this it is also accepted that it can more convenient to draw the details directly in model space within the drawing file, depending on project requirements.

- All notes and text have been added only in the final drawing file. In this example most dimensions were added in the model file as it was more convenient to dimension the model directly as it was drawn, though the choice of whether to dimension in the model file or the drawing file is at the author's discretion.

- The version of the drawing to be sent out or issued should be in a non-editable PDF format.
Example of a 'light' (sketch-type) drawing file:

- These drawing files are considered as 'light' or sketch-type drawings, without the formalities of full drawings, but with sufficient information that enables them to be identified and retrieved.

- These drawing files can be named more or less at the author’s discretion, but should be as clear and concise as possible to enable them to be identified and retrieved.

- In this example no models exist in the final drawing file, all models are externally referenced into the drawing. Therefore any changes to the model files will result in the drawing being automatically updated.

- All model files (MOD) are externally referenced to the drawing.
  All title blocks are inserted directly into the drawing file.

- All notes and text have been added only in the final drawing file.

- This example is shown using Rhino files, but the same border and title blocks can be used to produce AutoCAD drawings, depending on project requirements.

- The version of the drawing to be sent out or issued should be in a non-editable PDF (or JPEG/TIF) format.
Layer Naming System
Overview:

This section of the guide explains the layer naming convention for CAD files prepared by HDA.

This system is applicable to both AutoCAD and Rhino (and theoretically to other design software programs).

The aim of this layer naming system is to create a logical naming structure that allows different OBJECTS/ELEMENTS within CAD files or to be identified and isolated.

The file name is made up of the following components:

AUTHOR - author of the layer.
CONTENT - ‘object/element’ (beam/column/wall/cable) and/or ‘material’ (steel/concrete/glass).
PRESENTATION - ‘annotation’ (DIM/TEXT/REF/CENTRE) or ‘view’ (standard/hidden/cut through).

• The ‘Author’ component of the layer name identifies the author of the layer, and enables us to distinguish between HDA layers and those prepared by others.
  It should always be the first component of the layer name.
  All layers containing objects/elements prepared HDA will start ‘HDA’.
  According to AEC/ISO Standards, ‘A’ is used for Architects, ‘SF’ for Façade Engineers, ‘S’ for Structural Engineers, and ‘Y’ for Specialist Designers. Considering HDA works across different disciplines it is simpler for us to use just ‘HDA’. (This can be changed depending on specific project requirements.)

• The ‘Content’ component of the layer name describes the content of the layer.
  It can be either a single part that describes the object/element or it can be expanded to include the material. It can then be further expanded to group elements into hierarchical assemblies and sub-assemblies depending on project requirements.
  (For further explanation see page 16.)

• The ‘Presentation’ component of the layer name indicates either the ‘annotation’ type of the layer (such as dimensions, text/notes, centre lines), or the ‘view’ of the layer (standard, hidden or cut through).
  It should always be the final component of the layer name.
  For presentation ‘views’, the standard view (i.e. not cut through or hidden behind), is taken as the default view, and does not require this component.
  (For further explanation see page 18.)

“AUTHOR” _ “CONTENT” _ “PRESENTATION”
General Guidelines:

- All layers containing elements prepared HDA will start 'HDA_' (Author).

- The 'Content' component can be composed of more than one part, depending on project requirements.
  - It can be either a single part that describes the object/element:
    eg. HDA_PANEL
        HDA_COLUMN
  - or it can be expanded to include the material:
    eg. HDA_PANEL_GLASS
        HDA_COLUMN_CONCRETE
        HDA_BASE-PLATE_STEEL
  - If necessary it can then be further expanded to group elements into hierarchical assemblies and sub-assemblies, depending on project requirements:
    eg. HDA_FACADE_PANEL_GLASS
        HDA_ESCALIER_COLUMN_CONCRETE
        HDA_ESCALIER_BASE-PLATE_STEEL

- The 'Presentation' component should always be the final component of the layer name:
  eg. HDA_CONTENT_PRESENTATION

- Layers with the 'Presentation' component can be divided into two types:
  1. 'Annotation' (such as 'DIMENSION', 'TEXT', 'CENTRE', 'REF', 'REV').
     eg. HDA_DIMENSION
         HDA_TEXT
         HDA_REV
         HDA_CENTRE
  2. 'View' (whether the object/element/line is being shown in standard view (no extension), cut through ('CUT'), or hidden behind ('HIDDEN').
     eg. HDA_PANEL_GLASS_CUT - thicker line showing cut through section.
        HDA_PANEL_GLASS_HIDDEN - thinner, dashed line showing hidden behind.

     Elements/lines shown in 'standard' view do not require this component.

     An exception to this is hatching ('HATCH'). In graphical terms it is considered as 'annotation', but when linked directly to the element being show cut through it is preferable to consider it as a 'view'. Therefore it can be shown either way, depending on project requirements.
     (Annotation) HDA_HATCH
     (View) HDA_PANEL_GLASS_HATCH

- All letters and numbers for HDA layers are to be in capitals.

- ' ' (underscore) is to be used between each component.

"AUTHOR" _ "CONTENT" _ "PRESENTATION"
CONTENT  ('Object/Element' and/or 'Material'):

- The 'Content' component of the layer name describes the content of the layer. It can be a single part that describes the object/element or it can be expanded to include the material.

  eg.  HDA_PANEL or HDA_PANEL_GLASS
       HDA_COLUMN or HDA_COLUMN_CONCRETE
       HDA_BASE-PLATE or HDA_BASE-PLATE_STEEL

- Object/element names/descriptions should be as clear and concise as possible, both as general good working practice and to enable them to be identified by those without detailed knowledge of the project.

- Examples of basic 'objects/elements':

  BEAM
  COLUMN
  PROFILE
  PLATE
  STRUT
  CABLE
  TUBE
  BAR
  FRAME
  PANEL
  FIN
  SPACER
  CLADDING
  FLASHING
  DUCTING
  INSULATION
  GUTTER
  SLAB
  PAVING
  KERB
  WALL
  STAIRS
  LIFT
  DOOR
  WINDOW
  PERSON
  TREE
  CAR
  FURNISHINGS
  FIXINGS
  GRID

This list is just a sample list of possible object/element names and can be added to when necessary to suit project requirements.
• Examples of more detailed 'objects/elements':

   FRONT PANEL
   ANCHOR PLATE
   BASE PLATE
   FRAME SUB-ASSEMBLY
   BEAM_HB200
   TUBE_273DIA
   BAR_24DIA
   DEVELOPED SURFACE
   DEVELOPED BLADE
   FIRE HOSE

   Again, this list is just a sample list of possible element names and can be added to when necessary to suit project requirements.

• Exceptions:

   HDA_CAD   - all lines and text used in the drawing borders and title blocks
   HDA_EXTG_ - existing elements

• Material names/descriptions should again be as clear and concise as possible, and some abbreviations are used where appropriate.

• Examples of 'materials':

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEEL</td>
<td>-</td>
</tr>
<tr>
<td>IRON</td>
<td>-</td>
</tr>
<tr>
<td>ALUMINIUM</td>
<td>ALU</td>
</tr>
<tr>
<td>WOOD</td>
<td>-</td>
</tr>
<tr>
<td>PVC</td>
<td>-</td>
</tr>
<tr>
<td>PERSPEX</td>
<td>-</td>
</tr>
<tr>
<td>R.C. *</td>
<td>RC</td>
</tr>
<tr>
<td>CONCRETE *</td>
<td>-</td>
</tr>
<tr>
<td>FIXINGS</td>
<td>FIX</td>
</tr>
<tr>
<td>SEALING **</td>
<td>-</td>
</tr>
<tr>
<td>MASONRY</td>
<td>-</td>
</tr>
<tr>
<td>BLOCK</td>
<td>-</td>
</tr>
<tr>
<td>BRICK</td>
<td>-</td>
</tr>
<tr>
<td>STONE</td>
<td>-</td>
</tr>
<tr>
<td>CANVAS</td>
<td>-</td>
</tr>
<tr>
<td>GLASS **</td>
<td>-</td>
</tr>
</tbody>
</table>

   This material list can be added to when necessary to suit project requirements.

   All materials will be at "standard" thickness, except:  * Thicker than standard lines
                                                        ** Thinner than standard lines

   (See section ‘Colour and Lineweight’ for further details.)
PRESENTATION (‘Annotation’ or ‘View’):

- The ‘Presentation’ component of the layer name indicates either the ‘annotation’ of the layer (such as dimensions, text/notes, centre lines), or the ‘view’ of the layer (standard, hidden or cut through).

‘ANNOTATION’ - eg. ‘DIMENSION’, ‘TEXT’, ‘CENTRE’:

eg. HDA_DIMENSION
    HDA_TEXT
    HDA_CENTRE

‘VIEW’ - whether the element/line being shown is cut through (‘CUT’), or hidden behind (‘HIDDEN’).

eg. HDA_PANEL_GLASS_CUT - thicker line showing cut through section.
    HDA_PANEL_GLASS_HIDDEN - thinner, dashed line showing hidden behind.

(Elements/lines shown in ‘standard’ view do not require this component)

As noted before, an exception to this is hatching (‘HATCH’), which can be considered as either ‘annotation’ or ‘view’, depending on project requirements.

(Annotation) HDA_HATCH
(View) HDA_PANEL_GLASS_HATCH

- Presentation - ANNOTATION:

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIMENSION</td>
<td>DIM</td>
<td>- dimensions.</td>
</tr>
<tr>
<td>TEXT</td>
<td>-</td>
<td>- text and notes.</td>
</tr>
<tr>
<td>HATCH</td>
<td>-</td>
<td>- hatching and shading.</td>
</tr>
<tr>
<td>CENTRE LINE</td>
<td>-</td>
<td>- centre lines and lines of geometry.</td>
</tr>
<tr>
<td>CONSTRUCTION</td>
<td>CONSTR</td>
<td>- construction lines.</td>
</tr>
<tr>
<td>VIEWPORT</td>
<td>VP</td>
<td>- paper space viewports.</td>
</tr>
<tr>
<td>REFERENCE</td>
<td>REF</td>
<td>- reference data (eg. section mark, datum).</td>
</tr>
<tr>
<td>REVISION</td>
<td>REV</td>
<td>- revision clouds and notes.</td>
</tr>
<tr>
<td>BREAK LINE</td>
<td>BRK</td>
<td>- break line.</td>
</tr>
</tbody>
</table>

This list can be added to when necessary to suit project requirements.

- Presentation - VIEW:

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUT</td>
<td>-</td>
</tr>
<tr>
<td>HIDDEN</td>
<td>-</td>
</tr>
<tr>
<td>HATCH</td>
<td>-</td>
</tr>
</tbody>
</table>

An extra option for standards lines can also be included, depending on project requirements:

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE</td>
<td>-</td>
</tr>
</tbody>
</table>
Appendix 1:  Layer name conversion from previous HDA system:

(REMOVED)
Appendix 2:   Existing CAD Layer Standards consulted

**AEC (UK) CAD Standard for Basic Layer Naming** Version 2.4 (2005) and Version 3.0 (2011)

"A unified CAD Standard for the Architectural, Engineering and Construction industry in the UK, based on the guidelines laid down in **BS1192 - Part 5** (1998) and ISO 13567, using the RIBA Uniclass classification system." This is a standard developed in collaboration with a number of large architectural, engineering and construction practices in the UK. While based primarily on BS 1192 and ISO 13567, and adaptable to the full length conventions they use, it seeks to create a layering convention "in a simple format applicable for both small practices and minor projects".

**BS 1192 - Part 5** (1998) and **BS 1192 - Part 5** (2007)

British Standard guide for structure and exchange of CAD data. As CAD software uses have changed, parts 1-4 were discontinued, and Part 5 updated in 2007. Similar ISO 13567, it works on a basis of using 7 different 'components' for each layer name, with 1-3 being mandatory, and 4-7 being optional.

**ISO 13567** (1998)

International computer-aided design (CAD) layer standard. It works on a basis of using up to 10 different 'components' for each layer name, with 1-3 being mandatory, and 4-10 being optional.

**UNICLASS** (1997) (Unified Classification for the Construction Industry)

Classification scheme for the construction industry, produced by the CPIC (Construction Project Information Committee, which represents RIBA, RICS, CIBSE and the Construction Confederation).

It consists of 15 tables or alpha-numeric codes, each representing different areas of construction information.
Colour & Lineweight
Overview:

This section of the guide explains the colours and lineweights used for CAD files prepared by HDA.

The aim is to create a clear and logical system that ensures all HDA CAD output is plotted to a consistent graphic standard. It is also designed to allow as much flexibility as possible with a limited number of constraints, and to allow maximum compatibility between AutoCAD and Rhino.

The following lineweights are generally to be used:

<table>
<thead>
<tr>
<th>Lineweight:</th>
<th>Description:</th>
<th>Typically used for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>Super Fine Lines</td>
<td>Anything requiring especially feint lines.</td>
</tr>
<tr>
<td>0.13</td>
<td>Extra Fine Lines</td>
<td>Centre lines, break lines, dimension lines/arrows, leader lines/arrows. Standard/fine hidden lines, standard/fine hatching.</td>
</tr>
<tr>
<td>0.18</td>
<td>Fine Lines</td>
<td>Dimension text, small text/notes, reference symbols. Thicker hidden lines, thicker hatching.</td>
</tr>
<tr>
<td>0.25</td>
<td>Standard Lines</td>
<td>Standard view 2D or 3D elements or lines.</td>
</tr>
<tr>
<td>0.35</td>
<td>Thick Lines</td>
<td>Standard cut section lines, standard outlines.</td>
</tr>
<tr>
<td>0.50</td>
<td>Extra Thick Lines</td>
<td>Thicker cut section lines, thicker outlines.</td>
</tr>
<tr>
<td>0.70</td>
<td>Super Thick Lines</td>
<td>Anything requiring especially thick lines.</td>
</tr>
</tbody>
</table>

The basic principle is as follows:

To use the universally recognised ‘base colours’ (which exist in both AutoCAD and Rhino) for all presentation ‘type’ layers (such as dimensions, text/notes, hatching, centre lines, break lines, reference symbols, drawing border layers, etc.)

To allow all other colours to be used for all layers representing 2D or 3D objects/elements or lines, in standard views, hidden views and cut through views.

- When setting setting lineweights in AutoCAD, CTB plot style tables are used.
  The lineweight for the ‘base colours’ will be assigned directly to the colour in the plot style table, while the lineweight for all other indexed colours will be set to ‘Use Object Lineweight’, thus allowing the lineweight to be set by layer (or by object if required).
  (see ‘AutoCAD’ section for further details.)

- Lineweight assignment in Rhino is by layer (or by object if required), similar to the ‘use object lineweight’ method used in AutoCAD. Layers in files exported from Rhino to AutoCAD convert automatically to AutoCAD’s CTB plot style tables, therefore all layers (except the ‘base colours’) will have the same lineweight in AutoCAD that they had in Rhino.
  (see ‘Rhino’ section for further details.)

- At HDA we work with a variety of materials. Many of these materials are typically represented by the same lineweight (materials such as steel, aluminium, wood, brickwork, blockwork and stone), while some specific materials are better represented using thinner lineweights (materials such as glass, as well as seals and fixings), and some are better represented using thicker lineweights (such as concrete).
General Guidelines:

- The six universally recognised ‘base colours’, along with their assigned lineweights, are shown below:

<table>
<thead>
<tr>
<th>RGB Value</th>
<th>Index Colour</th>
<th>Plot Colour</th>
<th>Lineweight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>G</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>255</td>
<td>0</td>
<td>0</td>
<td>RED</td>
<td>BLACK</td>
</tr>
<tr>
<td>255</td>
<td>255</td>
<td>0</td>
<td>YELLOW</td>
<td>BLACK</td>
</tr>
<tr>
<td>0</td>
<td>255</td>
<td>0</td>
<td>GREEN</td>
<td>BLACK</td>
</tr>
<tr>
<td>0</td>
<td>255</td>
<td>255</td>
<td>CYAN</td>
<td>BLACK</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>255</td>
<td>BLUE</td>
<td>BLACK</td>
</tr>
<tr>
<td>255</td>
<td>0</td>
<td>255</td>
<td>MAGENTA</td>
<td>BLACK</td>
</tr>
</tbody>
</table>

- These ‘base colours’ exist in both AutoCAD and Rhino:

- **Annotation layers** use ‘base colours’ and their lineweight is defined by colour.

- **Object/Element layers** use all colours other than ‘base colours’ and their lineweight is defined by layer.

- The assigned lineweight for object/element layers is generally defined by a combination of their material and the type of view (standard, hidden or cut through) they are representing.

- As noted in the ‘Layer Naming System’, hatching, though considered as ‘annotation’ in graphical terms, is generally considered as part of a cut view, and therefore generally considered as an Object/Element layer.
<table>
<thead>
<tr>
<th>Object / Element Layers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element and/or Material Hatching (HATCH)</td>
</tr>
<tr>
<td>thinner' elements (eg. glass, sealings)</td>
</tr>
<tr>
<td>standard' elements</td>
</tr>
<tr>
<td>thicker' elements (eg. concrete)</td>
</tr>
<tr>
<td>Element and/or Material Hidden View (CACHE)</td>
</tr>
<tr>
<td>thinner' elements (eg. glass, sealings)</td>
</tr>
<tr>
<td>standard' elements</td>
</tr>
<tr>
<td>thicker' elements (eg. concrete)</td>
</tr>
<tr>
<td>Element and/or Material Standard View (default)</td>
</tr>
<tr>
<td>thinner' elements (eg. glass, sealings)</td>
</tr>
<tr>
<td>standard' elements</td>
</tr>
<tr>
<td>thicker' elements (eg. concrete)</td>
</tr>
<tr>
<td>Element and/or Material Cut View (COUPE)</td>
</tr>
<tr>
<td>thinner' elements (eg. glass, sealings)</td>
</tr>
<tr>
<td>standard' elements</td>
</tr>
<tr>
<td>thicker' elements (eg. concrete)</td>
</tr>
<tr>
<td>Object Colour/Classes/Phantoms</td>
</tr>
<tr>
<td>Existing Elements/Objects</td>
</tr>
<tr>
<td>Elements/Objects By Others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annotation Layers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre Lines</td>
</tr>
<tr>
<td>Grid Lines</td>
</tr>
<tr>
<td>Dimension Lines and Arrows</td>
</tr>
<tr>
<td>Leader Lines and Arrows</td>
</tr>
<tr>
<td>Break Lines</td>
</tr>
<tr>
<td>Limit Lines</td>
</tr>
<tr>
<td>Reference Symbols</td>
</tr>
<tr>
<td>Standard Text/Notes (2.5mm)</td>
</tr>
<tr>
<td>Dimension Text (2.5mm)</td>
</tr>
<tr>
<td>Leader Text (2.5mm)</td>
</tr>
<tr>
<td>Large Text/Titles (3.5mm)</td>
</tr>
<tr>
<td>Shading/Fill/Patterning</td>
</tr>
<tr>
<td>Revision Notes and Symbols</td>
</tr>
</tbody>
</table>
AutoCAD:

AutoCAD has 255 ‘indexed’ colours (plus a True Colour Palette of 16.7 million colours). As noted before, the lineweight for the six ‘base colours’ will be assigned directly to the colour in the plot style table, while the lineweight for all other indexed colours will be set to ‘Use Object Lineweight’, thus allowing the lineweight to be set by layer (or by object if required).

3D objects/elements will all be on ‘standard’ (default) view layers, and can be any colour other than the ‘base colours’ (with the exception of those others noted on page 27).

2D objects/elements (including 2D representations of 3D objects/elements) will be on either ‘standard’ (default) view layers, ‘hidden line’ layers, or ‘cut line’ layers. ‘Standard’ and ‘cut-line’ layers of an object/element will share the same colour, but will be assigned different layer thicknesses in Layer Manager.

To display the different layer thicknesses on the screen, toggle the “SHOW/HIDE LINEWEIGHT” setting to ‘on’.

AutoCAD’s ‘default object lineweight’ is typically set to 0.254. This is as close as makes no difference to our ‘standard line’ lineweight of 0.25 and will therefore be accepted as the default object lineweight.

- Unless necessary to change for specific project requirements, all HDA AutoCAD drawings will be plotted using the CTB plot style table: HDA_STANDARD.ctb

- This plot style table should never be modified (and is therefore set to ‘READ-ONLY’).

- In recent versions of AutoCAD plot style tables are stored by default on the user’s computer, in:

  C:\Users\XXXX\AppData\Roaming\Autodesk\AutoCAD 20XX\R18.1\enu\Plotters\Plot Styles

- Should particular projects require different plot settings on occasion, modified CTB files should be renamed and be identifiable by their project number, eg ‘HDA_287.ctb’, ‘HDA_291.ctb’, etc.

- To ensure that anyone required to plot AutoCAD drawings can locate a copy of any plot style tables required for a particular project, a copy of all plot styles used on a project (including ‘HDA_STANDARD.ctb’) should be stored in the following directory:

XXX_PROJECT NAME
00_DOCS-OUT
01_REPORTS
02_GRAPHICS
01_AUTOCAD
  2D
  3D
EXPORT
HDA-BASE
HDA-DRAWINGS
IN-PROGRESS

Project number and name.
All project documents issued or sent out from HDA, in dated folders. Reports and brochures, and preparatory work for them.
2D/3D drawings/models, sketches, renderings, images, animations.
-------- All work done in AutoCAD.
------------ 2D models (dwg).
------------ 3D models (dwg).
------------- Temporary files exported to other programs.
--------------- Borders, title blocks, plot styles, templates (dwg).
-------------------- Numbered HDA drawings with borders/titles (dwg).
------------------- In progress work (dwg).
- **Primary plot style settings for 'HDA_STANDARD.ctb':**

<table>
<thead>
<tr>
<th>RGB Value</th>
<th>Index Colour</th>
<th>Plot Colour</th>
<th>Lineweight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>255 0 0</td>
<td>1 RED</td>
<td>BLACK</td>
<td>0.13</td>
<td>Extra Fine Lines</td>
</tr>
<tr>
<td>255 255 0</td>
<td>2 YELLOW</td>
<td>BLACK</td>
<td>0.18</td>
<td>Fine Lines</td>
</tr>
<tr>
<td>0 255 0</td>
<td>3 GREEN</td>
<td>BLACK</td>
<td>0.25</td>
<td>Standard Lines</td>
</tr>
<tr>
<td>0 255 255</td>
<td>4 CYAN</td>
<td>BLACK</td>
<td>0.35</td>
<td>Thick Lines</td>
</tr>
<tr>
<td>0 0 255</td>
<td>5 BLUE</td>
<td>BLACK</td>
<td>0.50</td>
<td>Extra Thick Lines</td>
</tr>
<tr>
<td>255 0 255</td>
<td>6 MAGENTA</td>
<td>BLACK</td>
<td>0.70</td>
<td>Super Thick Lines</td>
</tr>
<tr>
<td>255 255 255</td>
<td>7 WHITE</td>
<td>BLACK</td>
<td>OBJECT LINEWEIGHT</td>
<td>(generally not used)</td>
</tr>
<tr>
<td>128 128 128</td>
<td>8 DARK GREY</td>
<td>BLACK</td>
<td>0.18</td>
<td>Fine Lines</td>
</tr>
<tr>
<td>192 192 192</td>
<td>9 LIGHT GREY</td>
<td>BLACK</td>
<td>0.13</td>
<td>Extra Fine Lines</td>
</tr>
<tr>
<td>255 0 0</td>
<td>10</td>
<td>OBJECT COLOUR</td>
<td>0.25</td>
<td>Lines In Red</td>
</tr>
<tr>
<td>255 127 127</td>
<td>11</td>
<td>BLACK</td>
<td>0.10</td>
<td>Super Fine Lines</td>
</tr>
<tr>
<td>51 51 51</td>
<td>12 to 249</td>
<td>BLACK</td>
<td>OBJECT LINEWEIGHT</td>
<td>&lt;VARIABLE&gt;</td>
</tr>
<tr>
<td>51 51 51</td>
<td>250</td>
<td>OBJECT COLOUR</td>
<td>OBJECT LINEWEIGHT</td>
<td>&lt;solid fill&gt; &lt;Lines in Grey&gt;</td>
</tr>
<tr>
<td>80 80 80</td>
<td>251</td>
<td>OBJECT COLOUR</td>
<td>OBJECT LINEWEIGHT</td>
<td>&lt;solid fill&gt; &lt;Lines in Grey&gt;</td>
</tr>
<tr>
<td>105 105 105</td>
<td>252</td>
<td>OBJECT COLOUR</td>
<td>OBJECT LINEWEIGHT</td>
<td>&lt;solid fill&gt; &lt;Lines in Grey&gt;</td>
</tr>
<tr>
<td>130 130 130</td>
<td>253</td>
<td>OBJECT COLOUR</td>
<td>OBJECT LINEWEIGHT</td>
<td>&lt;solid fill&gt; &lt;Lines in Grey&gt;</td>
</tr>
<tr>
<td>190 190 190</td>
<td>254</td>
<td>OBJECT COLOUR</td>
<td>OBJECT LINEWEIGHT</td>
<td>&lt;solid fill&gt; &lt;Lines in Grey&gt;</td>
</tr>
<tr>
<td>255 255 255</td>
<td>255</td>
<td>OBJECT COLOUR</td>
<td>OBJECT LINEWEIGHT</td>
<td>&lt;solid fill&gt; &lt;Lines in Grey&gt;</td>
</tr>
</tbody>
</table>

- **PLOT COLOUR** for all colours is set to plot to **BLACK**, with the exception of those noted below:

  - To allow for varying levels of grey solid fill shading, AutoCAD index colours ‘250’ to ‘255’, have their ‘Plot Colour’ set to **OBJECT COLOUR**.

  - To allow for a revision number/notes/clouds to be printed in red, AutoCAD index colour ‘10’ (which has the same RGB value as Colour 1 - RED), has its ‘Plot Colour’ set to **OBJECT COLOUR**.

- **LINWEIGHT** is set in ascending order for the six ‘base colours’.  
  All other colours are set to **OBJECT LINWEIGHT**, with the exception of those noted below:

  - The two principle grey colours (AutoCAD index colours ‘8’ and ‘9’) are used for all hatching and hidden lines, and have their ‘Lineweight’ set to 0.18 and 0.13 respectively.

  - The AutoCAD index colour ‘11’ (pink) is used for exceptionally fine lines and has been set to 0.10.

- **White** is generally not used for elements/lines.  It is the default colour for Layer 0 and Defpoints in AutoCAD.
Rhino:

*Rhino has 145 'selectable' colours, plus a True Colour Palette of 16.7 million colours.*

All lineweights in Rhino are assigned by layer or by object, and these translate directly to the final plotted lineweight of the object/element.

To aid compatibility and file transfer issues between AutoCAD and Rhino, all objects/elements in Rhino should be created using colours other than the standard base colours (it is preferable to use the 'selectable' colours where possible).

When files are exported from Rhino to AutoCAD, the colours used in Rhino are automatically converted to the nearest equivalent AutoCAD indexed colour. This means that all objects/elements from Rhino will convert to 'standard' view lineweights in AutoCAD, and all print from AutoCAD with the same line thickness.

For annotation layers in Rhino, the same colours should be used as those used in AutoCAD.
(These colours are listed on the summary chart on page 25.)
Appendix:

AutoCAD CTB and STB Plot Style Tables

There are two different systems of plot style tables that can be used in AutoCAD:

From Autodesk:

Colour-dependent plot style tables (CTB) use an object's colour to determine characteristics such as lineweight. Every red object in a drawing is plotted the same way. While you can edit plot styles in a colour-dependent plot style table, you cannot add or delete plot styles. There are 256 plot styles in a colour-dependent plot style table, one for each colour.

Named plot style tables (STB) contain user-defined plot styles. When you use a named plot style table, objects that have the same colour may be plotted differently, based on the plot style assigned to the object. A named plot style table can contain as many or as few plot styles as required. Named plot styles can be assigned to objects or layers, just like any other property.

As the vast majority of the architectural and engineering consultancies we work with currently use the CTB plot style tables, HDA will continue to use CTB plot style tables. Rhino files exported to AutoCAD also convert automatically to CTB plot styles.
Text and Dimensions
Unless others are required for particular projects, HDA uses two text styles for CAD files:

**Trebuchet MS** ('HDA_TREB-MS')

*It is a 'True Type' font, and prints out at the same thickness whatever colour is assigned to it.*

*It is used for titles and reference symbol text in HDA CAD drawings.*

*This is our general 'HDA font' that we use for all company documents.*

**ISOCP** ('HDA_ISOCP')

*This is an 'SHX' font, and its thickness when printed depends on the lineweight assigned to it.*

*It is used for notes, dimension text and leader text in HDA CAD drawings.*

<table>
<thead>
<tr>
<th>Text Style</th>
<th>Text Height</th>
<th>Colour</th>
<th>Lineweight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard (small) Notes:</td>
<td>ISOCP</td>
<td>2.5 mm</td>
<td>GREEN</td>
</tr>
<tr>
<td>Large Notes:</td>
<td>ISOCP</td>
<td>3.5 mm</td>
<td>CYAN</td>
</tr>
<tr>
<td>Dimension Text:</td>
<td>ISOCP</td>
<td>2.5 mm</td>
<td>GREEN</td>
</tr>
<tr>
<td>Leader Text:</td>
<td>ISOCP</td>
<td>2.5 mm</td>
<td>GREEN</td>
</tr>
<tr>
<td>Small Titles:</td>
<td>Trebuchet MS</td>
<td>2.5 mm</td>
<td>GREEN</td>
</tr>
<tr>
<td>Standard (large) Titles:</td>
<td>Trebuchet MS</td>
<td>3.5 mm</td>
<td>CYAN</td>
</tr>
<tr>
<td>Extra Large Titles:</td>
<td>Trebuchet MS</td>
<td>5.0 mm</td>
<td>BLUE</td>
</tr>
<tr>
<td>Reference Symbol Text:</td>
<td>Trebuchet MS</td>
<td>2.5 mm</td>
<td>GREEN</td>
</tr>
</tbody>
</table>

- 'Width factor' is typically set to 1.00.
- 'Oblique Angle is typically set to 0.00.'
Dimensions and Leaders:

Unless otherwise required for particular projects:

- HDA CAD files will use the dimension style HDA_1-1.
- 'Unit Format' for dimensions is to be DECIMAL (mm).
- 'Measurement Scale' is to be at a factor of 1.00.

Dimension/Leader Text:

- 'Text Style' is to be HDA_ISOCP.
- 'Text Colour' is to be GREEN.
- 'Text Height' is to be 2.5mm.
- 'Text Placement' is to be CENTERED for 'Horizontal' and 'Vertical'.
- 'Text Placement' is to be offset 1.00mm from the dimension line.
- 'Text Alignment' is to be ALIGNED WITH DIMENSION LINE.

Dimension/Leader Lines and Arrows:

- 'Colour' is to be RED. (This will be set to BY BLOCK in AutoCAD.)
- 'Linetype' is to be CONTINUOUS. (This will be set to BY BLOCK in AutoCAD.)
- 'Lineweight' is to be 0.18mm. (This will be set to BY BLOCK in AutoCAD.)
- Extension Lines will 'extend beyond dim lines' by 2.0mm.
- Extension Lines will be 'offset from origin' by 2.0mm.
- Arrowheads are to be CLOSE FILLED.
- Arrow size is to be 2.5mm.

Dimension Scale:

For dimension styles at scales other than 1:1, the same settings as described above are to be used, but a new dimension style will be created with the 'scale for dimension features' increased.

HDA_1-1 Dimensions for objects to be displayed at 1:1 in model space. Dimensions for objects to be displayed at all scales in paper space.

HDA_1-5 Dimensions for objects to be displayed at 1:5 in model space.
HDA_1-10 Dimensions for objects to be displayed at 1:10 in model space.
HDA_1-20 Dimensions for objects to be displayed at 1:20 in model space.
HDA_1-50 Dimensions for objects to be displayed at 1:50 in model space.
HDA_1-100 Dimensions for objects to be displayed at 1:100 in model space.
HDA_1-200 Dimensions for objects to be displayed at 1:200 in model space.
Borders and Title Blocks
Overview:

Unless others are required for particular projects, HDA uses two types of border/title block combinations:

'Standard'  This is the general combination used for HDA drawings. It consists of two separate files:
- A drawing border (HDA_BORDER_Ax)
- A drawing title block (HDA_TITLE-BLOCK)

'Light'  This is the light/simplified version, which can be used when preferable. It consists of one file:
- Combined drawing border/title block (HDA_BORDER-LITE_Ax)

All borders and title blocks should be inserted as 'blocks' into the drawing 'layout' (‘Paper Space Layout’ in AutoCAD, ‘Page Layout’ in Rhino.)

Where possible it is preferable for HDA drawings to be prepared at an original size of A1, for simple conversion to an A3 plot size at 50% scale.

- A copy of all HDA drawing borders should be stored in the following directories:

  XXX_PROJECT NAME
  00_DOCS-OUT
  01_REPORTS
  02_GRAPHICS
  01_AUTOCAD
  2D
  3D
  EXPORT
  HDA-BASE
  HDA-DRAWINGS
  IN-PROGRESS
  02_RHINO
  2D
  3D
  EXPORT
  GRASSHOPPER
  HDA-BASE
  HDA-DRAWINGS
  IN-PROGRESS
  SCRIPTS
Standard Border:

*HDA has standard drawing borders for drawing sizes A4 to A0.*

*HDA drawing borders are divided in 50mm increments, with a scale in the bottom left corner and a sheet size indicator in the top left corner.*

*Shown below is a standard HDA A3 border:*

- *There are no editable attributes in this file, therefore it can be inserted into a drawing layout the same in AutoCAD as in Rhino.*
Standard Title Block:

HDA has a single standard title block which is used for drawing sizes A4 to A0.

Shown below is the standard HDA title block:

1. This section is for noting revisions to the drawing.
2. This section notes the name and contact details of HDA.
3. This section notes the Project Title.
4. This section notes the Drawing Title.
5. This section notes:  
   - Who has prepared (drawn) the drawing
   - Who has checked the drawing
   - Who has approved the drawing
   - The latest issue date of the drawing
   - The sheet size of the drawing
   - The scaled size of the drawing
6. This section notes:  
   - The Drawing Number
   - The Drawing Revision
7. This section notes the electronic file path of the drawing.

- In its AutoCAD version, this file contains editable 'attributes'.
  It should be inserted into the Paper Space Layout as a 'block', and edited via 'Attribute Editor' 
  (or simply by double-clicking on the block).

- Rhino does not accept 'attributes' in this way, therefore its Rhino version, this file should be inserted into 
  'Page Layout' and simply edited as standard text.

Shown below is the title block with an A3 border:
'Light' Border and Title Block:

HDA has 'light' (simplified) drawing borders for drawings sizes A4 to A0.

Shown below is a 'light' HDA A3 border:

- There are no editable attributes in this file, therefore it can be inserted into a drawing layout the same in AutoCAD as in Rhino, the text can simply be edited as standard text.
Plotting
Plotting HDA Drawings:

As noted in the ‘File Composition’ section, there are two types of CAD files:

- **Model** files are all 2D and 3D files of models such as structures, objects/elements and assemblies, and plans, sections and elevations.

- **Drawing** files are drawings with borders, titles and references, and represent the plotted output (including notes, annotations and dimensions).

‘Model’ files are sent out in their native format, and should be considered as being for information purposes only. They are primarily for integration into others’ models and do not need to plotted.

‘Drawing’ files should be issued or sent out in PDF format only, unless required otherwise for particular projects.

As all drawings are plotted to PDF, they will always be plotted at a scale of 1:1 relative to their sheet size. This negates the need for extra CTB files (to plot drawings at 50% original sheet size, for example).

- Drawings should be plotted from ‘Paper Space Layout’ (AutoCAD), or ‘Page Layout’ (Rhino).

- Drawings should be plotted using the ‘HDA_STANDARD’ CTB plot style (AutoCAD).

- Drawings should be plotted at a scale of 1:1 relative to their sheet size.
Templates
HDA CAD File Templates:

The following template files have been created for HDA CAD files:

AutoCAD: ‘HDA_TEMPLATE_AUTOCAD’.dwt

Rhino: ‘HDA_TEMPLATE_RHINO’.3dm

Each template file contains the following:

- A base set of HDA layers, with assigned layer settings.
- A base HDA dimension style (‘HDA_1-1’).
- Two HDA base text styles (‘HDA_TREB-MS’ and ‘HDA_ISOCP’).
- Unit type (DECIMAL - mm).

- In recent versions of AutoCAD template files are stored by default on the user's computer, in:

  C:\Users\XXXX\AppData\Roaming\Autodesk\AutoCAD 20XX\enu\Template

- To ensure that anyone can locate a copy of any CAD template file required for a particular project, a copy of all template files that maybe required for a project should be stored in the following directories:

    XXX_PROJECT_NAME
    00_DOCS-OUT
    01_REPORTS
    02_GRAPHICS
    01_AUTOCAD
       2D
       3D
    3D
    EXPORT
    HDA-BASE
    HDA-DRAWINGS
    IN-PROGRESS
    02_RHINO
       2D
       3D
    3D
    EXPORT
    GRASSHOPPER
    HDA-BASE
    HDA-DRAWINGS
    IN-PROGRESS
    SCRIPTS

    Project number and name.
    All project documents issued or sent out from HDA, in dated folders.
    Reports and brochures, and preparatory work for them.
    2D/3D drawings/models, sketches, renderings, images, animations.
    -------- All work done in AutoCAD.
    ------------ 2D models (dwg).
    ------------ 3D models (dwg).
    -------------- Temporary files exported to other programs.
    ------------- Borders, title blocks, plot styles, templates (dwg).
    ---------------- Numbered HDA drawings with borders/titles (dwg).
    ---------------- In progress work (dwg).
    -------- All work done in Rhino.
    ------------ 2D models (3dm).
    ------------ 3D models (3dm).
    -------------- Temporary files exported to other programs.
    -------------- Grasshopper scripts (ghx).
    ------------- Borders, title blocks, plot styles, templates (3dm).
    ---------------- Numbered HDA drawings with borders/titles (3dm).
    ---------------- In progress work (3dm).
    ------------ Other scripts prepared in Rhino.