Virginia Tech

Virginia Polytechnic Institute and State University
Facilities Information Systems

CAD Standards
For New Construction and Renovation Projects

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Section 1 – General Requirements

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1.1   **Overview:** These standards are issued to promote the development of AutoCAD™ drawings suitable for use in the Virginia Tech Facilities Information Systems CAD environment. Consistency and compatibility with existing Virginia Tech AutoCAD™ documents can only be achieved when these standards are strictly adhered to. Electronic drawings produced and submitted in accordance with these standards have significantly greater value to the university, Architects, Engineers and Contractors delivering AutoCAD™ documentation to Virginia Tech. Virginia Tech A/E contracts and Design Guidelines may reference this document.

      All design and construction drawings submitted to Virginia Tech shall follow the CAD standards outlined in this document. Each of the following sections contains the most essential criteria for developing AutoCAD™ drawings for use in the Virginia Tech CAD environment. Refer questions to the Facilities Information Systems Department at Virginia Tech: Christina King at cking@vt.edu

1.2   **Drawing Format:** Only the CAD drawing file formats listed below are acceptable, other formats are not acceptable without the prior consent of Facilities Information Systems Department at Virginia Tech.

- AutoCAD™ R2004 – 2008 DWG format only.
- AutoCAD™ - DWF format may be requested in addition to the DWG (see Section 1.11)

1.3   **Drawing Composition:** AutoCAD™ drawings created outside of Virginia Tech sometimes contain more than one drawing sheet per file. While this may facilitate the production of construction documents, it can impede the archival process, and create content discrepancies. To minimize potential problems:

- Prior to delivery to Virginia Tech, AutoCAD™ files containing multiple drawing sheets shall be broken down into separate drawings containing single sheets.
- Each drawing file shall be named with the sheet number first followed by the title of that sheet. (example: A1.1 Architectural Floor Plan First Floor)
- AutoCAD™ files delivered to Virginia Tech shall contain only one drawing and one title block per file.
- All AutoCAD™ drawings shall be purged of empty, unused, or non-essential drawing data prior to submittal to Virginia Tech. This includes all unused layers, linetypes, blocks, fonts and entities.
- AutoCAD™ drawings shall not contain any frozen layers. All unused entities on frozen layers should be erased, and the empty layers purged.
- AutoCAD drawings shall not contain multiple overlaid lines or lines with multiple segments unless the overlaid lines or adjacent line segments are assigned to different layers.
- Survey data shall be included in the AutoCAD drawings and placed on the appropriate layers (see Section 1.5).
- Survey data collected and used in designing the project shall be submitted as a text file(s) (e.g. ASCII files).

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1.4   Title Block Information: All title blocks used in AutoCAD™ drawings submitted to Virginia Tech
contain the following information:

- Original issue date - this date should not change once the drawing has been issued.
- Sheet number.
- Title - description of drawing and location information. Location information should include all
  building, floor and room numbers as applicable.
- Revision history – as applicable.
- Drawing phase – drawings submitted as As-Builts should clearly be marked as such.
- Virginia Tech Project number – if applicable.
- A/E/C – Consultant responsible for producing the drawings should be clearly identified.
- Contractor – As-builts should clearly indicate the general contractor.

1.5   Layering Standards: The intent of the layering standard is to promote consistency between CAD
drawings, and maximize the reusability of drawing data. The effective use of CAD layering
standards also facilitates the grouping of shared graphical information for display, editing and
plotting purposes. The Virginia Tech layering standards are based on the **National Cad
Standards** (NCS), latest edition, Layering Guidelines. More detailed layering information and
helpful background material is available at http://www.nationalcadstandard.org .

All AutoCAD™ drawings submitted to Virginia Tech shall follow the CAD layering standards
outlined in this document. CAD layer standards, including layer descriptions, line types, and line
colors, are provided in this document. These layering standards must always be followed:

- Use only NCS layer names.
- Use the minimum number of layers necessary to adequately separate entities in each
  drawing. The number of layers contained in each drawing will vary depending on the scope
  and complexity of the drawing, however drawings should not contain extraneous, redundant,
  or overly detailed layer names.
- Purge each drawing of unused layers prior to submittal. The drawing file should contain only
  those layers necessary for displaying and plotting the information and drawing entities
  contained in each drawing. To ensure that subsequent prints made from each AutoCAD™
  drawing match the original, unused or unnecessary layers must be purged from the drawing
  prior to delivery.

The effective use of CAD layering standards should:

- Allow users to isolate systems and drawing elements by controlling the visibility of objects -
  improving system performance and eliminating visual clutter.
- Facilitate the sharing of information between drawings and disciplines.
- Allow users to control display and printing characteristics such as color, line type, line weight
  etc.

1.5a   **A single layer shall be created in each drawling and shall be named "rm**". This layer will contain
only polylines that outline each room in the drawing. The polyline for each room will follow the wall
surface and will be a closed polyline. These polylines on this layer will be the link to our facilities
management program. This layer and its polylines are only required in the CAD submittals
beginning when the project enters the construction phase.

1.6   Entity Properties: To ensure the integrity of the original drawing when viewing or printing, it's
essential that AutoCAD™ entities are created following these standards:

- Entity colors shall be defined by layer, not by entity.
- Blocks shall be defined (created) on layer 0 (zero).
- All attributes shall be defined on layer 0 (zero).

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1.7   Model and Paper Space Usage: These guidelines are suggested for using model and paper space effectively:

- Place title blocks, schedules and general notes at full-scale in paper space whenever possible.
- Label scaled viewports with the appropriate scale in model space.
- Do not place or draw model-related blocks, tags and objects in paper space.
- Draw all model space objects at full scale.
- Scale objects using paper space viewports – zoom viewports to the appropriate scale.

1.8   External References - XREF's: External References (XREF's) contained in AutoCAD™ drawings created outside of Virginia Tech can result in content discrepancies in the drawing set. To ensure the integrity of the drawing set, and minimize potential problems:

- AutoCAD™ drawings to Virginia Tech shall not contain any XREF's.
- XREF's shall **not** be "bound" to drawings prior to delivery.
- If drawings contain XREF's, they should be inserted as blocks prior to submittal to Virginia Tech.
- Layers contained in XREF's inserted as blocks shall conform to these standards.

1.9   AutoCAD™ Drawing Support Files: Drawings created using non-standard AutoCAD™ fonts, linetypes, and hatch patterns can result in content discrepancies in the delivered drawing set. To ensure the integrity of the drawing set, and minimize potential problems:

- Only native AutoCAD™ or AutoCAD Land Desktop™ fonts, linetypes, and hatch patterns or the CAD Symbology provided by the National CAD Standards is acceptable.
- Custom fonts, linetypes, and hatch patterns, including those provided by 3rd party software, are not acceptable.
- Only these TrueType fonts are acceptable: Arial, Courier New, Times New Roman.
- Postscript fonts shall not be used.

1.10   File Transmittal: The content of electronic drawings provided by the A/E must match the delivered original hard copy set as closely as possible, if not exactly. To ensure the integrity of the electronic drawing set upon delivery to Virginia Tech:

- Ensure the drawings adhere to the guidelines presented in this document. Review the procedures for preparing drawings for submittal as detailed in the preceding paragraphs.
- Include a hard copy index containing filenames and sheet numbers for each submittal. This ensures the completeness of the drawing set and assists in archival procedures.
- Include a transmittal sheet with all submittals indicating Virginia Tech Project number, Virginia Tech Project name (if applicable) and complete listing of all materials submitted.
- Include hard copy half-scale prints of all drawing submittals.
- Include AutoCAD™ .PC2, .PCP or .CTB plot configuration.
- Include all field survey data as indicated in Section 1.3.

1.11   Submittal Requirements: All AutoCAD™ drawings forwarded to Virginia Tech shall be submitted in accordance with the design schedule. The delivery of AutoCAD™ documentation during various project stages (schematic, preliminary and working drawing phases) shall be submitted in the appropriate formats to ensure that Virginia Tech ultimately receives the most accurate information available for review. The receipt of electronic AutoCAD™ drawings alone does not alleviate the responsibility of the Architect, Engineer or Consultant for providing hard copy documentation to Virginia Tech.

The A/E is responsible for submitting a complete set of Construction Record Documents, including electronic specifications and updated drawings reflecting revisions issued during construction, in DWG, PDF, TIF and hardcopy formats in accordance with the A/E contract.

Recognizing the diverse nature of university projects, A/E's shall meet jointly with the Virginia Tech Project Manager and the Facilities Information Systems Records Manager to discuss specific CAD requirements for the project at the initial negotiation meeting with the A/E. All A/E's should also take this opportunity to relay the project scope to the Records Manager so Virginia Tech can provide the A/E with existing university records that will benefit the design team.

The following documentation shall be delivered to Virginia Tech at the following project milestones:

Design - Schematic/Preliminary/Working Drawings
Virginia Tech requires a complete set of Review Documents in AutoCAD™ on CD-ROM or flash drive, in DWG, DWF, and hard copy formats. Virginia Tech Facilities Information Systems (FIS) will review for conformance to these CAD Standards. During the design phases of the project, various Virginia Tech departments that review the design may use the DWG or DWF to provide design/conceptual comments/questions.

Bid Documents
AutoCAD drawing files in DWG, DWF, TIF and PDF format as well as electronic (PDF) specifications shall be submitted to the Virginia Tech Project Manager on CD-ROM or flash drive for posting on the Planning Design and Construction website prior to the pre-construction meeting or start of the project.

Record Drawings
A/E shall submit, on CD-ROM and hardcopy format, final/approved As-Built Documents to Virginia Tech in accordance with the A/E contract. The CD-ROM shall contain the as-built information on the project and is to include DWG, TIF, and PDF formats of the CAD Drawings in accordance with the Virginia Tech CAD Standards, as well as electronic (PDF) specifications. In accordance with Section 1024.4 of the A/E Manual, all Record Drawings, including Civil and Site drawings, require a professional seal (signed and dated) be applied to each drawing.

Refer to Section 1.10 for specific transmittal requirements.

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