

News to Use

Design Requirements Manual

The formulae $\frac{\partial \mu}{\partial x} + \frac{\partial (\rho U)}{\partial x} = \frac{\partial \rho}{\partial x} + \frac{\partial (\mu \frac{\partial U}{\partial x})}{\partial x} + \mu (\rho - \rho_0)$ for building $\frac{\partial (\rho U)}{\partial x} = \frac{\partial \rho}{\partial x} + \frac{\partial (\mu \frac{\partial U}{\partial x} - \rho \mu \frac{\partial U}{\partial x})}{\partial x} + \mu (\rho - \rho_0)$ state of the art $\frac{\partial (\rho U)}{\partial x} = \frac{\partial \rho}{\partial x} + \frac{\partial (\mu \frac{\partial U}{\partial x} - \rho \mu \frac{\partial U}{\partial x})}{\partial x}$ biomedical research facilities.

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'.

Please address questions or comments to: shawm@mail.nih.gov

Construction Drawing Graphics and Graphic Presentation

Graphics and graphic presentation are crucial aspects of construction drawings which are often overlooked by architects and engineers. Drawings have to be clear, concise and easily readable. Drawings should be developed with consideration for the end user: a contractor in the field in dim lighting working from a coffee-stained half-sized set of drawings. If the drawings are not legible and understandable they are not meeting their primary purpose.

All drawings shall be produced with Computer Aided Design (CAD) software supporting the creation of .dwg and/or .rvt formatted files. 2D construction drawings are the typical deliverable, but CAD software supporting and incorporating Building Information Modeling (BIM) shall be used on larger, complex projects and as required by the Scope of Work (SOW). The National CAD/CIFM Standards <http://www.gsa.gov/portal/category/21590> shall be followed for all formatting. Regardless of the platform used, drawings shall be developed with the end goal of producing paper documents usable in the field.

In developing construction drawings a number of requirements must be met:

Sheet Organization: Drawing sheets shall be a standard size and include a standard NIH titleblock. All fields, including project identification, date and submission shall be completed.

The drawing set cover sheet shall contain the following information:

- NIH Building number
- Room number(s), if applicable
- Submission
- Date
- Work request number
- Area map
- Vicinity map showing project relative location
- Architect, engineer and other contributors to the set

The drawing set shall include a concise and accurate Table of Contents of all disciplines' sheets, organized in a rational and consistent sequence.

Lettering/dimension size: The lettering and dimensioning must be of a size that is readable on half-size drawings under site conditions. Lettering and dimensioning shall be a minimum of 1/8", in an easily readable font and line weight. Spacing of lines and letters, leaders, dimension lines and other graphic entities shall be distinct and clear.

Graphic scale, north arrows and column indicators: All scaled plans and details as appropriate must have a graphic scale, north arrows and column line indicators. It is important to be able to orient and navigate within a building, and be able to locate and reference items and locations using positional markers.

Projects within a large building shall have key plans on all plan sheets.

Dimension units and construction tolerance: Metric units must be used on new building projects, and on addition/renovation projects on buildings that were originally designed, or which have had major renovations, with metric units. Imperial units must be used on addition/renovation projects on buildings constructed with Imperial units. Dual metric/Imperial units can be used on all projects, but must be used consistently.

Metric dimensions shall be in millimeters, unless there is a specific reason to use another unit. On the drawings the unit symbol may be eliminated with an explanatory note such as "All dimensions are shown in millimeters" provided.

Imperial dimensions shall be in feet (') and inches (").

It is important that dimensioning recognize and address the limitations of construction tolerance that can be achieved in the field. In most conditions, it is not necessary or productive for dimensions to be of a greater tolerance than 1/2" or 10mm. It is recommended that metric dimensions end with a '0'. It should be recognized that a dimension to the millimeter is asking for a construction tolerance of 1/25th of an inch, which is an unrealistic and unnecessary expectation in most situations.

Line weights: Construction drawings must utilize multiple line weights which set a visually hierarchy to clearly differentiate drawing components. Line weights must be sufficiently dark to print and copy legibly without loss of detail. Shading and hatching can be used where necessary to convey information, but should not obscure underlying information.

Scale: Drawings must be of a scale that is appropriate for the level of detail of the drawing. Generally floor plans shall be 1/8" to 1'-0" scale (or the metric equivalent), plan details shall be 1/4" to 1'-0" scale, and construction details shall be at a scale sufficient to show connections, fasteners, material thicknesses and all other items clearly and distinctly.

Dimensions and dimension strings: Dimensions shall be in hierarchical strings, providing overall dimensions, wall dimensions and opening dimensions. Dimension lines shall be tied to column lines, exterior walls and other fixed components. Duplication of dimensions shall be avoided. In renovations, non-critical dimensions in a dimension string shall be denoted as '+/-', and critical dimensions shall be denoted as 'Verify in Field' or 'Minimum'.

Industry-standard symbols and abbreviations: All drawing sets shall have a list of abbreviations used, and all sheets shall have a legend of symbol used. Symbols and abbreviations shall be industry-standard where ever possible, and should be consistent throughout all disciplines' drawings. Notes, Symbols and abbreviations shall be project specific, with extraneous information removed.

Standardization between disciplines: Floor plans for all disciplines' work shall be at the same scale, and at the same orientation to make cross-discipline coordination easier.

Further details on this month's topic are available on the DRM website

<http://orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/Pages/DesignRequirementsManualPDF.aspx>

DRM Chapter 1, Section 12 Special Requirements & Procedure