The National Institutes of Health | Division of Technical Resources | Office of Research Facilities

Design Requirements Manual **News to Use**

May 2017

Vol. 02, No. 5

The formulae $\frac{\partial \rho U_i}{\partial t}+\frac{\partial}{\partial x_j}(\rho U U_j)=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial U_i}{\partial x_j}\right)+g_i(\rho-\rho_0)$ for building $\frac{\partial}{\partial x_j}(\rho\overline{U}\overline{U_j})=-\frac{\partial\overline{P}}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial\overline{U_i}}{\partial x_j}-\rho\overline{u_i'u_j'}\right)+g_i(\rho-\rho_0)$ state of the art $\frac{\partial}{\partial x_i}(\rho\overline{U}\overline{H})=\frac{\partial}{\partial x_i}\left(\lambda\frac{\partial\overline{T}}{\partial x_i}-\rho\overline{u_i'h'}\right)$ biomedical research facilities.

A/E Submission Requirements: DRM Appendix E

Construction documents (CDs) are critical elements in any construction project. Although the primary purpose of CDs is to convey the design intent of the designers to the contractor, CDs serve many other important functions, including:

- Providing the Division of Technical Resources (DTR) and other review offices with the information needed to review the documents for compliance with the Design Requirements Manual (DRM) and applicable codes and standards.
- Providing the Project Officer with information to ensure that all aspects of the contract are being met, that applicable Interim Life Safety Measures (ISLM) and Construction Risk Assessment (CRA), phasing and other aspects of the project are being addressed.
- Providing the facility users information to confirm that their programmatic requirements are being met, as defined in programming meetings and documented in the Basis of Design.
- Upon project completion, providing a basis for as-built drawings, to be used as a record of construction and for future maintenance work and renovation projects.

To address all of these prerequisites, Appendix E of the DRM, *A/E Submission Requirements* provides direction for the development and submission of CDs. Appendix E is not intended to establish the Scope of Work for individual design contracts but to provide baseline principles and good-practice requirements for CDs that can be applied appropriately for all projects.

Coordination, Constructability, Phasing and Maintainability

CDs are developed to be constructed, and their development must address the issues of coordination, constructability, phasing and maintainability, all of which impact construction schedule, cost and operations.

Coordination is required to ensure that the documentation of all disciplines, and of the documents within each discipline (plans, sections, details, specifications, Basis of Design) agree with each other, convey the same information, and do not have conflicts. It is a requirement that A/E dedicates the appropriate time and staff to fully review and ensure coordination of all project documents before submission to avoid request for information (RFI), change orders and delays.

Constructability is the ease and efficiency of the construction process. All construction documentation must be reviewed to optimize constructability by eliminating or minimizing potential obstacles, including incompatible systems, untried techniques or details, overly long-lead items, uncoordinated or incomplete CDs or overly complex phasing.

Phasing is the planned sequential construction of portions of a project so that areas come on-line and/or off-line in stages for the benefit of building operations or occupancy. The A/E must work with Project Officers to eliminate or simplify phasing where possible. The A/E shall develop clear and concise phasing documents for all disciplines so that the work during and at the end of all phases is complete and coordinated.

Maintainability means the facility is designed and constructed in a manner which promotes efficient and high quality maintenance procedures with minimal impact to facility function and operations. The A/E must review design concepts for maintainability with facility personnel early in the project to obtain their input. A facility design with maintainability as part of its central planning will result in increased user satisfaction, greater equipment longevity and lower life cycle costs.

Drawings

The construction drawings shall convey the required information in a manner that is easy to understand, follows industry standards, and is legible in all standard formats (digital and paper, in full and half-size). Drawings shall be prepared in CAD following the National CAD/CIFM Standards, and in Building Information Modeling (BIM) for large and complex projects, or as required in the Statement of Work (SOW). Specific NIH drawings standards, as outlined in Appendix E, shall be followed to ensure consistency and completion of information provided.

Specifications

Specifications shall be edited to reflect the specifics of the project. Each specification section must be carefully cross-referenced with the drawings and with other sections to ensure completeness and coordination. AIA MASTERSPEC® shall be used as the base document, and the A/E shall edit all MASTERSPEC® sections to ensure appropriate standards of quality for materials and systems, for conformance to the *DRM*, and to address specific project requirements.

Basis of Design (BOD) and Calculations

The BOD is a permanent record of the design process, including all requirements, decisions and rationales upon which the design is based. General BOD information include the Scope of Work, codes and standards, program, cost estimate and other required project-defining information. A BOD has discipline-specific sections that include narratives, equipment cut sheets, engineering calculations and other required discipline-defining information. Appendix E includes an outline of BOD requirements.

Metric Standards for New Construction

All final drawings and specifications for new construction shall be expressed in metric units or dual units (metric and imperial), unless other requirements are specifically provided by the project officer. The General Services Administration (GSA) Metric Design Guide, latest edition, and the Metric Guide for Federal Construction shall be used for guidance on how drawings, specifications, and other elements of metric implementation are to be addressed. All facility renovations and addition design projects shall be based on the unit type (i.e., metric or imperial) for which the facility was originally designed. Units in all design documentation (drawings, specifications, calculations, etc.) shall be consistent and shall not be mixed.

'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

Further details on this month's topic are available on the DRM website
https://www.orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/Pages/DesignRequirementsManual2016