Division of Technical Resources
Office of Research Facilities
The National Institutes of Health
Vol. 01, No. 39
June 2013
News to Use
Design Requirements Manual
The formulae for building state of the art 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: ms252u@nih.gov

Wall Construction in Vivariums

Vivarium walls have extremely stringent performance requirements. The Guide for the Care and Use of Laboratory Animals requires walls to be "*…smooth, moisture resistant, nonabsorbent and resistant to damage from impact*". The DRM requires that all laboratory walls be "*…capable of withstanding washing with strong detergents…*", and that vivarium walls specifically be "*…constructed of concrete, concrete block, or surfaced with a heavy duty, impenetrable veneer…*".

The performance of vivarium walls is crucial due to a number of factors:

1. Durability: Vivariums are subject to extreme wear and tear, including impacts, pressure washing and strong detergents.
2. Cost: Vivariums are very expensive to build and to operate. Delays during construction and downtime after completion are to be avoided.
3. Criticality: Vivarium operations are critical to research programs, and once in operation should not be disrupted for repair and maintenance.

A number of wall construction systems have met these requirements, and their selection should be based on the parameters and conditions specific to the project.

Base Walls

Base walls can be concrete (concrete masonry units (CMU) or formed concrete), or steel framing. Advantages and disadvantages include:

Concrete Advantages:

- Impact resistance. This is important in areas subject to heavy cart, cage and other wheeled traffic.
- Water resistance. This is important in areas that are subject to high humidity and wash downs.
- High mass: The high mass of concrete walls gives them good sound damping characteristics.

Concrete Disadvantages:

- Difficulty routing piping and conduit. Surface-mounted services are to be avoided, so services must be cast in concrete or routed through hollow CMU cores. This will negatively impact construction schedule and cost.
- Difficulty making modifications. Concrete and CMU, by its nature, is not easy to cut and patch, and modifications are costly and disruptive.

Steel Framing Advantages:

- Fast construction. Steel framing is a familiar and fast construction method. One advantage is the ability to route services through the walls. Vivarium-specific detailing is required, including the capping and sealing of hollow wall spaces
- Ease of modifications. Steel framed walls and components can be modified, patched and repaired more easily than concrete.

Steel Framing Disadvantages:

- Light weight. Steel framing is a relatively lightweight system, which is subject to impact damage. This can be mitigated by the use of heavier gauge framing and impact-resistant substrate and finishes.
- Water damage. Steel framing and substrate material is subject to corrosion, degradation and mold growth. This can be mitigated with proper material selection and detailing.
- Low mass. Low mass results in high sound transmission. This can be mitigated with sound insulation and detailing to add mass and break vibration paths.

Wall Finish

Of equal importance to the base wall system is the wall finish. Options include:

Concrete Wall Finishes: The typical finish is epoxy paint, which is a durable non-absorbent finish. The concrete or CMU surface must be smooth and free of pits and voids. For CMU, consideration should be given to smooth surfaces, radiused outside corners and flush joints. CMU must be finished with at least 2 coats of a high-quality block filler to provide a pinhole-free substrate for the paint. Before application, the painting contractor must check all environmental and physical conditions to ensure that the requirements of the paint are met. The base of the wall is detailed with coved bases integral with the floor, and wall protection rails are installed to protect the paint finish.

Steel Framing Wall Finishes: The typical substrates on a steel frame wall are gypsum wall board or cementitious hard board. Steel framing and substrate must be carefully detailed to provide a wall that will withstand the expected forces of impact and pressurization, be water resistant and vermin-proof. Standard gypsum board is not appropriate; the substrate must be a specialty high-impact and water resistant product.

The wall finish can be epoxy paint or a pre-manufactured sheet system (fiberglass reinforces polyester (FRP) or similar). Epoxy paint is similar to that described in Concrete Wall Finishes. Epoxy paint on steel frame walls can be installed with a fiberglass mat reinforcing layer to increase impact resistance. Sheet systems consist of pre-finished resilient sheets (typically 4' x 8' or 4' x 10' in size) which are adhered or mechanically fastened to the wall, with sealed perimeters and joints. Sheets are engineered to be durable and chemical resistant, and require no further finishing after installation. The base of the wall is detailed with coved bases integral with the floor, and wall protection rails are installed to protect the finish.

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 4, Section 4-3 Interior Architectural Elements