1328
doi:10.1017/S1431927610053559
Microsc. Microanal. 16 (Suppl 2), 2010
© Microscopy Society of America 2010

Acoustic and Vibration Considerations for Advanced Microscopy Suites

Chris Papadimos*

* Papadimos Group, 818 Fifth Avenue, Suite 207, San Rafael, CA 94901

Transmitting electron microscopes (TEM) and other similar advanced microscopy instruments require very controlled, steady and low acoustic and vibration environments to allow utilization of the full range of their capabilities [1, 2, 3, 4]. From recent engagements on a number of such projects in academic research institutions, the author, in collaboration with end users, instrument manufacturers and building designers, has developed a thorough understanding of what is required to attain suitable acoustic and vibration environmental conditions for rooms that house such instruments. The process starts by carrying out acoustic and vibration monitoring to assess proposed building sites, establishing required setbacks from existing sources of noise and vibration, developing space layouts to place TEM rooms optimally in the building, and developing appropriate structural support including foundation systems; together with detailed room considerations. The latter entails selection of partition types and mechanical equipment noise and vibration control, including room ventilation, ductwork and pipe work layout and details of wall penetrations to meet the required level of acoustic and vibration performance.

An inherent difficulty that has been encountered from the most basic to sophisticated facilities has been the lack of proper acknowledgement of the design challenges imposed by the stringent criteria for ultra-quiet laboratories. This is particularly complicated where these spaces are not adequately separated from conflicting uses often due to poor planning decisions or limited understanding about acoustic and vibration requirements for such instruments as typically found in manufacturer pre-installation manuals [5, 6]. Resolution of strong disparities in the initial planning stage offers the potential for efficient design and close control of construction details, with the resulting cost savings and heightened assurance of a successful outcome. Refer to Table 1 that shows tasks to be completed for successful planning, design and construction for such spaces.

The information presented will be communicated through recent and ongoing case-studies for several examples that are considered state of the art designs for such research spaces. It is the intent to demonstrate that for such research spaces the entire building should be considered the instrument and treated as such during programming, planning, design and construction of facilities that house such advanced microscopy spaces.

References

[1] M. A. O'Keefe et al., Lab Design for High-Performance Electron Microscopy, Microscopy Today (May, 2004)
[2] J.H. Ferris et al., Design, Operation, Housing of Ultra-Stable, Low Temperature, Ultra-High Vacuum Scanning Tunneling Microscope, Review of Scientific Instruments, Volume 69 (2008)
[3] D.A. Muller et al., Room Design for High Performance Electron Microscopy (2006)
[4] L.F. Allard, Oak Ridge National Laboratory Advanced Microscopy Suites (2007)
[5] FEI Tools for Nanotech, Pre-Installation Manuals for Titan, Tecnai, Quanta, and Morgagni Instruments (2006 to 2009)
[6] JEOL Facilities Installation Requirements/Specifications, Various Instruments (2006 to 2009)

https://doi.org/10.1017/S1431927610053559 Published online by Cambridge University Press

Site Selection	Programming	Building Planning	Building Design	Construction Review
Carry out acoustic and vibration monitoring to establish baseline conditions for project site(s)	Review with users instrument manufacturer acoustic and vibration specifications	Review space planning throughout the building	Develop initial design guidelines and finalize space layouts for TEM Suites	Approve all contractor submittals for compliance with building design
Use monitoring data to assess site and exposure and identify appropriate locations for the TEM rooms	Confirm design goals in consultation with the users	Review locations for elevator and mechanical shafts, loading dock and other areas of high noise and vibration levels	Structural slab design and alternatives for TEM rooms including foundations	Perform periodic site visits to inspect constructions and issue reports with construction deficiencies
		Review and finalize vertical stacking in terms of space adjacencies	Architectural design for partitions, doors and penetrations for TEM rooms.	Carry out testing at key construction intervals to ensure that design goals are met
		Identify and resolve any remaining constraints with various design disciplines	Mechanical systems design and proper equipment selection and ventilation options	
			Coordinate with users and design team	

Table 1. Timeline for Planning, Design and Construction Sequence to be followed for Facility with TEM Spaces

https://doi.org/10.1017/S1431927610053559 Published online by Cambridge University Press