MONASH University

ERGONOMICS AT MONASH: COMPUTER WORKPLACE DESIGN GUIDELINES

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INTRODUCTION

Monash University has a range of information to assist staff with individual ergonomic issues. This information is also relevant to those responsible for designing and upgrading workplaces.

Please refer to the following publications or websites for further assistance:-

- **Ergonomics at Monash – Computer Workplace Design Guidelines**

- **Computer User Guide**
  A "do it yourself" guide to help you set up your own workstation.

Hard copies of these are available from OHSE, Telephone: 9905 1016 or at the following website: -
http://www.adm.monash.edu.au/ohse/documents/policies/Ergonomics_computeruserguide.html

- In addition, answers to more frequently asked ergonomic questions can be found at the following website:- ***http://ask.monash.edu.au***

This publication "Computer Workstation Design Guidelines", provides more details relating to the general design of workplaces to accommodate computer hardware. These guidelines are to be used when new building or refurbishment is being undertaken.

As each project will bring together a different range of design challenges, it is not possible to be prescriptive on exact measurements in all instances. The materials in this publication are to be used as guidance only.

Project Managers will also need to ensure that plans comply with other relevant guidance e.g. Building Code of Australia, OHS legislation and Australian Standards.

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1. Work Area Analysis

1.1 Space	When planning new offices there are two methods of calculating space per workstation in open plan areas. 1.1.1 Method One Determine total area of floor space and divide by the number of workstations. For open plan areas involving corridors, shared storage, amenities, etc the general recommendation is 10-14m^2 per person. 1.1.2 Method Two Determine floor space per workstation then add in additional space for storage amenities, corridors, etc. This generally requires 6-8m^2 per person plus the additional space. • Note that enclosed office space is determined by the functional needs such as technology needs, visitors' / meeting chairs, etc. A general allocation of 10m^2 per office is notionally expected.
1.2 Circulation spaces	Corridor widths dictated by:- 1.2.1 Building Code of Australia based on emergency escape requirements. Wider unobstructed corridors required closest to emergency exists 1.2.2 **AS1428.1-2001** stipulates minimum widths based on disabled access needs. Minimum recommended for access ways is an unobstructed width of 1000mm 1.2.3 Current ergonomic practice recommends • Entrance to workstations or offices 900mm-1000mm • Corridors with frequent use in open plan area-1200mm • Corridors with storage units along one side -1500mm
1.3 Storage spaces	1.3.1 Ergonomic principles specify storage allocations as: • Primary – items of personal nature or frequently accessed at workstation. • Secondary – items shared by team or requiring occasional access. In corridor or nearby storage area. • Tertiary – infrequently accessed items. Stored in compactus, storeroom, archives, or amenities areas.

	1.3.2 Shelving • Only light items (easily lifted with one hand) should be stored above shoulder height. • Heavier items should be stored between shoulder height and mid thigh height. • Bookcases should generally be no higher than 2100mm. However, if they are up to 2400mm in height they must be fixed to the wall securely. • Appropriate steps must be provided for use by shorter staff to access high shelves.
1.4 Head to head distances	1.4.1 This is the distance between heads of adjacent workstation users. The distance relates to "personal space" perception as well as functional interference due to noise and space needed to move around work area. Ideally, 1500mm or more should be provided from head to head of adjacent workstation occupants.

2. Desk Design

2.1 Shape of desks	2.1.1 L – shaped • 40% increase in useable surface area compared to a rectangular desk of same length • Deep sections at apex for large PC monitors • Enables multiple PC locations with laptop or flat screen monitors • Suits left and right hand users • Can be linked into clusters to facilitate team work, and cable management. 2.1.2 Rectangular desks • Requires PC across centre of desk to provide symmetrical posture • Needs at least 900mm deep if 15" or 17" standard monitors are used • Can be provided with a desk return to increase surface area 2.1.3 Irregular Shapes • A range of desk shapes are being introduced e.g. elliptical, kidney bean, semi-circular, wedge • Whilst new desks shapes may be acceptable, they must meet the basic ergonomic requirements for the application.

2.2 Desk length	2.2.1 There is no specified length from an OHS perspective. 2.2.2 For mixed function tasks, i.e. clerical and PC, an L-shaped desk 1800mm or 2100mm long is preferred. 2.2.3 Call centres, or desks totally PC focussed tend to be shorter.
2.3 Desk depth	2.3.1 If a standard 15", 17" monitor is used, a desk depth of 900mm is required. This is normally achieved at the apex of an L shaped desk with side surfaces 750mm-800mm deep. 2.3.2 If a desk is only used with laptops or flat screen monitors a desk depth of 700mm-800mm is adequate.
2.4. Desk height – seated tasks	2.4.1 Desks can be fixed or adjustable in height • **Fixed heights** These should be set around 710-720mm. A footrest will be required by short operators, together with a gas adjustable chair. - It will be necessary to raise these desks for the tallest users. • **Adjustable heights** If adjustable, the entire desk surface should adjust rather then one segment e.g. keyboard shelf - If the keyboard shelf adjusts separately, the keyboard and mouse should be located at the same height – either both on the shelf, or elevate shelf to desk height; mechanism must not obstruct knee space. - Primary adjustable range is 610-760mm for seated users with gas adjustable chairs. Additional range is desirable if the mechanism allows.

2.5	**Desk / bench heights – stand/sit tasks**	2.5.1 Fixed height A bench height fixed between 900-1000mm is generally acceptable for both sitting and standing tasks although the lower height is recommended for prolonged PC use. The higher height is used where security risks indicate a need for a higher barrier between staff and customers. 2.5.2 Adjustable height Adjustable mechanisms for work at standing height should range from 850-1050mm. 2.5.3 Foot supports – Seated tasks If drafting height chairs enable sitting at a bench, an angle foot support surface should be provided for the full width of the leg space. The front edge of this support should be 720mm below the bench height and recessed back from the front of the bench at least 300mm. It should be angled at 15^0.
2.6	**Leg space**	2.6.1 Clear leg space should be provided under all desks where operators sit. This also applies to laboratory benches. 2.6.2 The minimum clear leg space width should be 800mm. 2.6.3 The minimum depth at the thighs should be 450mm and at the feet should be 600mm.
2.7	**Strength of desk**	2.7.1 **AS/NZS4443-1997**, requires that the design of the desk should be sufficiently strong to withstand up to 90kg of load. 2.7.2 Where practical, the manufacturer should provide certification relating to the design of desks through an independent agency e.g. AFRDI (Australian Furniture, Research and Design Institute)
2.8	**Edges, corners and desk thickness**	2.8.1 Edges or corners should be rounded to avoid contact injuries. 2.8.2 Recommended thickness for desk surface is 25-35mm.
2.9.	**Furniture requirements**	2.9.1 Desks will be used over the years with a range of technologies and operators. Hence, their design should be adaptable to meet a wide range of applications. The provision of a single surface desk is now

	preferred to desks with multiple cut out segments which restrict their use to specific layouts and technology items.

3. Reception Desks

3.1 Sit/stand desks	3.1.1 Desk depth / reach distances If required to sit at the desk and reach to the hob a reach distance less than 700mm is recommended. Hence, the reception desk work surface depth should be less than 700mm and, preferably 500-600mm to the hob where the reaching occurs.
3.2 Computer location	3.2.1 If flat screen monitor is used, it can be positioned to suit the work flow. 3.2.2 If conventional 15" or 17" monitors are used, they should be offset at 45^0 to the serving position and recessed into the hob to maximise visual sightlines to the user. • A return desk surface would be required if the 15" or 17" monitor is used to provide for symmetrical posture at the computer, and facing customers. 3.2.3 Recessing monitors into the desk surface and covering with glass is not recommended due to reflections on the glass from lighting and excessive downward neck angles for the operator.
3.3 Desk height	3.3.1 **AS/NZS4443-1997** requires the fixed working height of the reception desk should be approximately 950mm. The hob should be 1020-1200mm high to avoid over shoulder reaching for the seated operator. • Height of work surface may be: - 720mm if used to sit at a clerical desk arrangement - 900mm-950mm if used for stand / sit serving
3.4 Desk depth	3.4.1 Apart from a depth 500-600mm where reaching occurs, the remaining desk surface can be 750-800mm deep. A depth of 900mm at the apex is required if conventional 15" or 17" monitors are used.

3.5	**Computer monitor**	3.5.1 If a computer is used at the desk, an LCD flat screen is preferred due to its low profile depth. • Determine if the customer needs to view the monitor and how the monitor will swivel to enable this.
3.6	**Foot rest**	3.6.1 If a stand / sit surface is used, provide a foot rest across the entire width of the serving area. Mount it 720mm below the work surface, angled at 15° and recessed back at least 300mm from edge of desk.
3.7	**CPU**	3.7.1 Provide for the hard drive (CPU) to be located off the counter surface; preferably mounted away from the leg space under the counter surface. It needs to be accessible by computer technicians.
3.8	**Leg space**	3.8.1 Maintain a clear leg space at least 800mm wide, 450mm deep at thighs and 600mm deep at feet of seated user.
3.9	**Document storage**	3.9.1 Frequently accessed forms etc. should be within the secondary reach (up to 700mm) from the seated position. They may also be positioned under the desk surface, but away from the leg space. The reach should be between the chair seated height and the desk. • Although users can spin on their swivel seat to retrieve documents, they should not need to twist or over reach.
3.10	**Security**	3.10.1 If the desk is in a public interface area, consider if: • duress alarm is required • physical barriers to prevent persons reaching across or jumping the counter, are required.
3.11	**Cable management**	3.11.1 Secure loose cables away from the leg space of the seated user. • Allow access to technology under the counter to minimise manual handling risks for technicians.

4. Computer Laboratory

4.1	**Workstation height**	4.1.1	The desk for PC use should be set as a single surface around 720mm high.
4.2	**Depth of desk**	4.2.1	The depth when using a conventional PC monitor should be at least 800mm but 900mm if a large profile monitor is used. If a flat LCD monitor is used, then a desk 700-800mm can be used.
4.3	**Desk arrangement**	4.3.1	The orientation of the technology should enable the user a clear sightline to the lecturer and teaching displays.
4.4	**Monitor height**	4.4.1	The centre of the monitor should be around 400mm above the desk height. This may require raising the monitor on a fixed height stand or the CPU depending on their size.
4.5	**Leg space**	4.5.1	Clear leg space 600mm deep at floor level and 450mm deep at the under desk surface should be provided. This should also be at least 800mm wide.
4.6	**Cable management**	4.6.1	All cables to the hardware should be supported clear of floor level. They should be accessible to computer technicians, possibly from the walkways.
4.7	**Desk width**	4.7.1	The actual desk surface width is dependent on the layout and shape of the laboratory desk. A minimum width of 900mm is required for the keyboard, mouse and personal space. Additional width should be provided if reference materials are required.
4.8	**Chairs**	4.8.1	Height adjustable chairs, operated by a gas piston should be provided to allow for individual postural needs.

5. Working from Home

When staff work from home as part of their work agreement, the same ergonomic principles should be considered.

A checklist has been developed by the OHSE Unit at Monash University. A copy is available on the website: ***http://www.adm.monash.edu.au/sss/equity-diversity/work-life/***

6. Technology Section / Workstation Design

As desktop computer technology develops, the workstation requirements necessitate a high degree of adaptability. The range of current technologies include:

6.1 Large monitors
6.2 LCD flat screen monitors
6.3 Laptops
6.4 Palm pilots
6.5 Large CPU
6.6 Compact CPU
6.7 Mouse selection
6.8 Keyboard selection
6.9 Voice activated technology
6.10 Scanners

It is appropriate that workstations be designed to suit all these technology options, as well as remain adaptable for future advancements.

It is no longer recommended to provide workstations with cut out, separately adjustable sections. One single work area surface is recommended.

The ergonomic requirements of these specific technologies are summarised below.

6.1 Large monitors	6.1.1	Locate at the apex of an L shaped desk. The 21" monitor requires a depth at the apex between 900-1000mm.
	6.1.2	The visual distance to the monitor is determined by the character size and display clarity of the software, not the size of the monitor.
	6.1.3	The monitor should be elevated with the top of the display at the eye height of the seated user.
6.2 LCD flat screen monitors	6.2.1	This technology provides greater flexibility in arranging a workstation layout. The smaller foot print size enables their use on narrower desks than conventional monitors.
	6.2.2	LCD screens can be used in high illumination areas where screen reflections may have occurred on conventional monitors.
	6.2.3	When purchasing LCD screens consider an adjustable height stand.

6.3	**Laptop/Note books**	6.3.1 While laptops are useful when moving between workplaces, their prolonged use has ergonomic implications. Laptops should not be used continuously for more than 30 minutes at a time and not for more than 2 hours in one day. In preference, a docking station with a PC configuration should be used. 6.3.2 Other options for layout include: • Use the laptop keyboard, separate mouse and elevate a monitor above and behind the laptop. • Raise the laptop on a stand and use a separate keyboard and mouse.
6.4	**Palm pilots**	6.4.1 Palm pilots have dexterity requirements resulting in the user needing to stabilise the arm supporting the palm pilot to avoid accumulated fatigue.
6.5	**Large CPU**	6.5.1 Utilise a CPU holder under the desk at one end of the leg space to support the CPU in a tower unit configuration. 6.5.2 If used under a monitor on the desktop ensure the top of the monitor is not elevated above seated eye height.
6.6	**Compact CPU**	6.6.1 Locate under a monitor if the seated eye height principle is retained (refer 6.1.3). 6.6.2 Locate at the rear of the desk surface in a horizontal or tower unit orientation. 6.6.3 Check with the computer technician to ensure the CPU can be used in the vertical configuration.

6.7	**Mouse selection**	6.7.1 A wide range of mouse designs are now available. There is not one specific design that is ergonomically superior. Each has its features. Some considerations include: • hand size compatibility • functional needs for programmable buttons, scroll wheel, roller ball, etc. need to be considered • ability to alternate mouse on left hand side or right hand side of keyboard **Note:** The integrated mouse in keyboard is not recommended for prolonged use due to restricted working posture.

6.8	**Keyboard selection**	6.8.1 The conventional QWERTY keyboards are acceptable for the majority of users and applications. Other keyboard options eg. smaller keyboard without the numeric keys, may be considered in some instances. 6.8.2 When selecting a keyboard consider: • Force to activate keys • "Tactile feedback" of keys • Size of frequently used keys e.g. backspace, space bar, delete, shift. • Matt finish and colour contrast
6.9	**Voice activated technology**	6.9.1 This technology has advantages for users with a preference not to use tactile inputs i.e. keyboard and mouse. 6.9.2 Suitable for use in enclosed spaces rather than open plan areas where acoustic interference may occur. 6.9.3 Extensive rehearsing and programming of software is required.
6.10	**Scanners**	6.10.1 These should be located on a work surface to avoid excessive overhead reaching to lift the cover. 6.10.2 Lid should be down when scanning.
6.11	**Dual monitors**	6.11.1 If more than one monitor is required, the primary, frequently accessed monitor should be located in the desk apex to best meet the ergonomic requirements. Both monitors should be placed side by side at the same height.

7. Workstation Accessories

The University has a list of preferred suppliers for the following workstation accessories – refer to: ***http://www.adm.monash.edu.au/procserv/suppliers/Furnishings/index.html***

Consider these points before purchasing:

7.1	**Chairs**	7.1.1	The University recommends a range of gas adjustable height chairs. Contact a preferred supplier and request a trial.
		7.1.2	Chairs will wear and require maintenance and repairs. These costs should be included in the budget.
		7.1.3	"Exercise balls" (Swiss balls) are generally not recommended due to safety risks. Further details refer to website: ***http://www.workcover.vic.gov.au***
		7.1.4	Glides should be used on chairs on hard smooth floor surfaces rather than castors due to safety risks.
7.2	**Foot rests**	7.2.1	Foot rests are recommended for shorter staff working with a gas adjustable chair at a fixed height workstation.
		7.2.2	Foot rests are also useful for staff who sit for prolonged periods to provide them with an alternative range of seated postures.
7.3	**Document holders**	7.3.1	These holders are used to elevate and angle documents to reduce neck angle. They should be located between the keyboard and the monitor in direct line with the user. The location beside the monitor, level with the screen, is also acceptable.
7.4.	**Telephone headset**	7.4.1	These are recommended for staff who participate in prolonged or frequent telephone calls. They also enable both hands to be free to use the computer keyboard when answering a telephone enquiry.
7.5	**Wrist rests**	7.5.1	These are not normally required for slimline standard keyboards. Some users find the wrist rest for the keyboard or mouse assist in minimising wrist / forearm fatigue by enforcing a straight wrist technique.

7.6	**Monitor stands**	7.6.1	Monitors need to be elevated with the top of the screen at seated eye height. A range of fixed height monitor stands are available to suit individual needs.

8. Work Environment

8.1	**Lighting quality**	8.1.1	The overall level of illumination required for VDU work is generally less than for clerical duties. The rear illuminated monitor is designed for use in 320-450 Lux work areas. Glare and reflections may develop in higher illuminance areas. LCD monitors perform better in these locations.
8.2	**Lighting – natural light**	8.2.1	It is desirable from a psychological perspective to retain an external view and maintain natural light. At times of direct sun glare, blinds may be used to control sunlight.
8.3	**Lighting – task**	8.3.1	A desk lamp or similar may be used to supplement light levels in certain circumstances. Orientation of globes should avoid a source of direct or reflected glare to the user. **Note:** All electrical appliances used on campus should be tested and tagged in accordance with Monash procedures. The Procedure for In-Service Inspection, Testing And Tagging Of Electrical Equipment is available at: ***http://www.adm.monash.edu.au/ohse/***

8.4	**Noise – open plan**	8.4.1	Open plan office areas may result in distraction from conversational noise. Each work area should develop protocols relating to use of meeting rooms, breakout areas and control of excessive background noise in the open plan area. Noisy equipment items, eg photocopiers should be located in utility rooms or similar, away from the workstation areas.

8.5	**Partition height – open plan**	8.5.1	Partitions between workstations do little to control noise but do provide some visual privacy. Heights between 1100-1350mm are recommended between members of work teams. High partitions, e.g. 1500mm can be used where partition shelving is required. Higher partitions are generally not recommended for open plan work areas. They should be perpendicular to windows where possible to enable occupants in open plan areas to retain a view of windows over the 1100-1350mm high partitions.
8.6	**Thermal comfort**	8.6.1	There are considerable individual differences between people regarding what is thermal comfort and it is unlikely that a single temperature or level of humidity will suit everyone. Avoid locating workstations directly in front of or below air conditioning outlets.

9. References

- AS/NZS4443-1997 “Office Panel Systems – workstations”
- AS1428.1-2001 “Design for access and mobility – Part 1: General requirements for access – New Building Work”
- Worksafe Victoria “OfficeWise,” 2001
- Worksafe Victoria “Code of Practice for Manual Handling”, No. 25, 2000
- Victorian WorkCover Authority Website at: ***http://www.workcover.vic.gov.au***