

 Design Canada

The Environmental Requirements Of Office Users

A report prepared for the Department of
Industry, Trade and Commerce, in cooperation
with The National Design Council. A joint
venture by Environment Systems International
and Industrial Interiors Limited. June 1971

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(Canada)

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Environmental Requirements of Office Users

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Introduction

The office environment responds to changes in management philosophy¹. We can identify roughly, four different theories of management which have developed historically:

1. The classical theory of management
2. The human relations school
3. The task approach to management
4. Industrial Humanism

The classical theory of management treats work exclusively as an economic activity and is obsessed with productivity to the exclusion of other human considerations. It is an authoritarian model, rigid and inflexible in its outline, but it has been responsible for important advances in the organization of production.

The human relations school over-compensates for the classical theory by giving paramount consideration to the needs of the individual and primary working group. This model emphasises initiative, innovation and consultation, and rightly regards error not as an absolute evil, but as an inevitable by-product of initiative and innovation to be balanced against gains from these. Its fault is that it may encourage various forms of pseudo-participation which have no other purpose than to mystify real power relations, and that it

may effect a decline in over-all efficiency.

The task approach synthesizes elements from the two foregoing models by concentrating on tasks as the fundamental organizing reality. It eliminates much red tape and bureaucratic inefficiency, makes optimum use of specialists, blurs irrelevant distinctions by emphasizing work roles rather than status roles, and, by putting work to be done first, increases overall efficiency.

Industrial humanism is best understood not as an entrenched school of management but as a powerful, subversive tendency at work throughout business and industry. Its primary effect is to put values ahead of goals. It emphasizes participation, consensus decision making, free open expression of ideas and emotions, and the dignity and value of the individual and his needs.

Our enumeration of these theories indicates only the chronological order of their appearance as significant tendencies. This does not mean they replaced each other. A mix of elements drawn from each model would probably be found in most organizations. They are described here because the models in use obviously, decisively influence design requirements.

Office design has changed with management philosophy. Older offices, which reflect the classical theory of management, tend to be closed, highly geometric and reflect

clear status distinctions. Newer offices are more open, more flexible in their use of space, replacing grid layouts with more fluid, non-geometric patterns, which come closer to expressing the real communication needs of the office users.

The most significant, and certainly the most dramatic recent innovation has been the idea of Office Landscape, along with other roughly analogous concepts, like Helen Miller's Action Office. Office Landscape holds that "lines of communication are the significant and vital patterns in the reality of any organization. These are the patterns which should be expressed in the physical placement of staff work stations, people who need to communicate should be close, those who have little reason for communication need not be, regardless of the form of organization and departmental charts."² This leads to two important developments. First, a drastic departure from the entrenched idea of the neat, orderly office, since the landscaped office may often appear to the superficial observer both messy and disorderly. Second, a move away from a space which clearly and rigidly reflects status distinctions in the apportioning of private space, since in the landscaped office, even top executives may share the general open area with all other employees.

Office landscape is one attempt to come to terms with the complex of variables which influence office design. Changes in management philosophy, as outlined above, have resulted in a generally felt need for an open and manipulable environment. The pace of technological change has reinforced this need for adaptability and flexibility at another level. For example, as other forms of storage replace paper filing, the office must adapt to a new set of needs. Furniture must be adequate to the immediate and projected demands which new technology will place upon it.

Rising labour costs and absenteeism present another set of problems which must be taken into account. These may be due to either a basic dissatisfaction with the work situation, which has a variety of psycho-social causes, or to an environment which simply does not facilitate work.

There will be different solutions in either case. In the former case, solutions will probably lie in the area of greater participation and involvement. In the latter case, some variety of the Office Landscape approach may be most appropriate. Obviously there is no guarantee that the demand for greater efficiency to offset rising labour costs will prove compatible with the demand for more participation to counter alienation from decision-making. All decisions in this area must reconcile and harmonize conflicting demands, and while generally applicable principles can be established, decisions must be made on the basis of individual cases.

In general, it can be established that improvements in office design which promote efficiency either by increasing employee satisfaction or by streamlining functional relationships, will pay important dividends owing to the heavy predominance of labour costs. It has been estimated that during the thirty-year write-off period, plant and maintenance account respectively for 2% and 6% of total cost, while salaries make up the remaining 92%.³ This being the case, even minor increases in employee productivity will offset fairly major increases in the cost of office design.

Offices range along a continuum, all the way from a rigid, hierarchically organized space at one extreme, to a flexible series of task oriented facilities at the other. But wherever an office falls along this continuum, the same basic conflicts between social and economic needs, between isolation and integration, between spontaneity and order, between privacy and openness, between participation and efficient decision making, between security and universal accessibility, will be expressed in a different form. In what follows, we attempt to establish in general terms, the psychological demands the user makes on the office environment.

User Types

It is necessary at the outset to establish six basic categories of user. Each of these types will have somewhat different physical and psychological needs.

TYPE 1 Clerical

Workers in this category are expected to perform most of the menial office tasks. Their work may often be without personality or intrinsic interest and there may be a high degree of discontinuity between tasks. Tasks may also be highly repetitive and physically taxing.

TYPE 2 Private Secretarial

Workers, almost always women, in this category may have a great deal of autonomy and responsibility since they may control access and set work priorities for the executives to whom they are assigned. They may require extensive space and appointments appropriate to the degree of their responsibility.

TYPE 3 Machine Operator and General Secretarial

This category includes secretaries working out of a general stenographic pool receptionists, key punch operators, programmers, operators of accounting machines, etc. Absenteeism is highest in this category. Machine work is often highly repetitive and may be particularly taxing owing to the noise and heat generated by machines. Lack of variety may present a psychological problem.

TYPE 4 Professional

Work of this and the following categories is of the more Intellectual nature. Activities will include reading, thinking, analyzing and assembling information, preparing reports, etc. These activities will demand more privacy than is necessary in previous categories.

TYPE 5 Technical Professional

This category includes all professionals whose technical activities make special demands on their environment. For example, dentists, doctors, engineers, systems analysts, architects, etc. While their activities will otherwise resemble those in TYPE 4, special provision must be made for these technical activities.

TYPE 6 Executive

Despite a higher degree of responsibility, activities will not differ markedly from those in TYPE 4. Special demands may include status recognition and sufficient space to accommodate frequent confidential meetings, seminars, conferences, etc.

These six categories break naturally into two larger categories. In general, TYPES 1 through 3 can be said to be intrinsically motivated, that is, work is done not for the satisfaction it provides in itself, but for money, security, useful occupation or some other external good. TYPES 4 through 6 are more frequently intrinsically motivated, that is their work provides many of its own rewards through its intrinsic interest in the sense of accomplishment it provides.⁴

Introduction

The office user may spend up to half of his waking hours in the office environment for most of his adult life. This environment must therefore respond to the full range of the user's psychological needs. The social costs of its failure to do so will be enormous.

The question of cost must be examined in the broadest possible context. If conditions of immobility, isolation, regimentation, alienation and sensory deprivation are imposed on the user, the social costs in terms of the type of people users will be forced to become in order to adapt to this environment will far outweigh any short-run gains to the individual organization. Therefore, the environment should be planned and designed to give the fullest possible human scope to users in all categories.

This can only be accomplished by a holistic approach to design problems. The psychological environment results from the inter-action of the user with the place as a whole. If purely physical demands are put first, or specific building or furniture systems and sub-systems are designed independently of each other and the total effect desired, the resulting piecemeal approach to design will probably yield a disharmonious psychological environment which responds to human needs in only a fragmentary way.

In what follows, we have outlined the basic psychological user needs. These should be

considered first and then integrated with the economic constraints within the overall planning and design process.

Territory⁵

In recent years, we have been provided with a variety of sociological and ecological perspectives on the territorial behaviour of man. In general, we can say that all men tend to preserve and protect some form of personal territory. Having such a territory provides an indispensable sense of security. An unwarranted and/or uninvited encroachment on it may provoke a variety of conventional, aggressive, defensive reactions. Having such a territory must include control of what occurs within that space as well as the right to control access to it. Since office spaces will tend, through economic necessity, to be more or less standardized, as much provision as possible must be made for the personalization of space.

Personalization of space can be accomplished by display, i.e. by allowing the user to decorate the space as he sees fit. It is important to note in this regard, that any number of personally valued display items, be they photographs, mementoes, art objects or whatever, can act both as memory and motivation releasers. This consideration must be balanced against the apparent messiness with its attendant tax on the corporate image, which could result from widespread personal display. Neatness and order may satisfy management's desire to project a safe image, but they do not necessarily stimulate either productivity or user satisfaction.

The control of access to personal territory depends ultimately on the willingness of other users particularly superiors, to respect this right of control, but it can be greatly assisted by planning and design which foresees the whole variety of possible office interactions and therefore keeps work stations out of the way of traffic.

It should also be pointed out in regard to territory that there is an important reciprocal relationship between spacial distinctions and social distinctions. Sommer points out that, "A society compensates for blurred social distinctions by clear spatial distinctions."⁶ Changing social relationships within the office; the gradual undermining of traditional expressions of authority; changing styles in office design which leave everyone in a large common space; all tend to put a premium on a clear and imaginative articulation of territorial rights within the design process.

Community⁷

Having stressed the importance of territorial rights, we must now stress the equal and countervailing importance of design strategies which facilitate a spirit of community within the office. A harmonious psychological environment will depend first and foremost on these factors being kept in a dynamic equilibrium. Offices almost invariably lack sufficient communal space probably because no directly quantifiable economic value can be attached to it, but this is a very narrow view. Just as there must be personal spaces within the office, there must be public spaces which by definition belong to none. Here people should be able to meet and mix freely and converse across role and status boundaries which may have to be more rigidly observed within the work space proper.

Community requires a certain informality and is probably furthered by open plan offices which increase visibility and interaction and replace rigid geometric patterns by the non-geometric flow patterns of the communications matrix.

Privacy⁷

With the advent of the open plan office, privacy becomes an increasing problem.

While some suggest that privacy may function as a cover for the need for symbolic status⁸, there is also a legitimate need for privacy. Few general rules are possible in this area, since as Sommer points out privacy has a variable affect on different tasks. He quotes Triplett's finding that "Most people work faster when someone else was present. (However), later studies revealed that on certain tasks, particularly those calling for concentration and error-free performance, spectators and competitors often produced a decline in performance."⁹ The ideal solution would seem to be a basically open plan office which still provides private space for those working on tasks which require an enclosed environment. In order to avoid rigidity, and recognize the fact that most users will be required to form some combination of these two types of task, permanent divisions could be avoided and space allocated on an ad hoc job by job basis. This is a variant of the multi-work station approach suggested by Propst, which we will discuss below.

The user must be protected from distraction without feeling isolated and he should feel free to conduct his own activities without inhibition which may derive from his work station being overlooked from passers-by. Modesty, territoriality and the desire to occasionally be alone all demand a visually private space. The spirit of community coupled with the natural desire to know what is going on demands a relatively open space. The best solution seems to be some form of three sided enclosure. Acoustic privacy presents an additional problem particularly in offices where there is a great deal of machine noise. Good acoustic design will balance reflective and absorbent surfaces in such a way that the level of ambient noise protects the privacy of conversation without letting this noise rise to the level of distraction. Acoustic privacy in the office environment can be overdone. Office workers quickly learn selective hearing and a high tolerance of ambient noise and an acoustically dead environment with its attendant strain on social distance conversation, is too high a price to pay for quiet.

Lighting Quality

Lighting, wherever possible, should be adjustable for both position and intensity. Offices too frequently suffer the ill effects of uniform general lighting. Because general lighting must be set at the maximum required intensity it will be unnecessarily bright for many tasks, give the more sensitive headaches, and give the overall appearance of the office a boring uniformity.

Local task oriented lighting can solve many of these problems as well as producing the additional psychological benefits which come from an environment which is open to user modification. It breaks up the sweep of open spaces and adds to the user's ability to personalize his space and freely alter its mood as he requires.

Status

Status has traditionally been expressed in terms of private office size, type and cost of furniture and appointments, etc., in some cases, down to a level of surprisingly minute detail. It would seem that some form of symbolic status is necessary, both as an incentive and as a reward. But since status grades, it therefore degrades, and it would seem from this that the expression of status in terms of office furniture and furnishings, apportionment of space, etc. should be kept at the minimum feasible level. Office furniture has too often been made to bear a disproportionate share of status connotations ending with the monstrosity of the excessively large, and costly executive desk. Part of this problem is solved when status is made to attach more closely to function than to hierarchical position.

Monotony

Eight hours a day is a long time particularly for extrinsically motivated workers in categories 1 to 3. Where work is taxing and repetitive, special efforts must be made to compensate by making ample allowance for the user's needs in terms of territoriality, privacy, variety, sociability, etc.

Monotony is also a problem in overall office design. For example, in a small pri-

vate office, the ceiling attracts little attention. In a large open space its expanse is highly visible and usually quite monotonous to the eye unless special efforts are made to break it up.

The problem of monotony is partly solved by the establishment of multi-work situations. This would mean, for example, providing the sedentary worker with an alternative stand-up desk, thereby improving physical health, adding variety to work, and offering the user a place to display work to a visitor without the formality of having to seat him.¹⁰ Since monotony is one of the primary causes of user inefficiency, the provision of a variety of alternative work facilities within the work station would seem to be part of a reasonable solution. This would be in line with our earlier observation that even small increases in user efficiency would offset considerable increases in furniture costs.

Security

Most people feel safer when they have their back to the wall and their face to the action. Work station design must take account of this user need for a sense of security. Where possible, for example, access to the work station should not be from behind the user. Security of personal possessions should also be guaranteed by use of lockable or roll-top desks, lockers, and other types of personal storage unit.

Sensory Awareness¹¹

An environment that stimulates rather than inhibits sensory awareness is an important antidote to monotony. Textures and colours should be as various and as exciting as possible without becoming offensive to individual user tastes. A stimulating visual and tactile environment will encourage interest, alertness, and therefore, indirectly, work productivity. It should also be pointed out that the more actively the user participates in shaping the environment i.e. the more open the environment is to user modification, the more aware of it he will be. A static, unresponsive environment will eventually result in user passivity which will in due course affect work attitudes.

User comfort will depend in large part on careful attention to anthropometric and ergonomic considerations in the design of office furniture. Tables should be designed and positioned to accommodate the various types of conversation for which they may be required. Seating should be tailored to specific user needs, particular attention being paid to women's needs which are usually neglected by the furniture industry. Proper utilization of vertical space will ensure that office furniture is positioned at the elevation at which it can be most comfortably used, and so on. Comfort will also depend on the user feeling that he has sufficient space to accommodate his needs. This does not necessarily imply wide open spaces. For example, one woman interviewed by Hall¹² indicated that if her chair touched the wall when she leaned back with her feet on the desk, she considered the office too small, if it did not she considered it ample. Certainly cramping presents an extremely severe psychological problem. All sorts of adverse psychological effects derive from the basic experience of crowding and it can only be solved by a generous and imaginative apportionment of space in the design of the office environment.

Introduction

The psychological effect of the office describes the sum of its physical effects. Psychological user needs, as outlined above, reflect real physical needs. These needs are best served when the planning and design process works from the psychological whole to the physical parts. If physical needs are put first, or if these needs are considered in isolation from each other, the result will be a cluttered, disharmonious environment in which the parts do not make a coherent whole.

In what follows we outline briefly physical user needs, as they derive from and react on psychological needs. It should be pointed out at the outset that the physical requirements of the user, the purchaser, and the cleaning and maintenance staff may not always be compatible. For example, the purchaser's desire to maintain an image of cleanliness and order may conflict with the user's desire to personalize his space through display. We have dealt first with user requirements, which in the majority of cases will be identical with purchaser requirements, and then added a section on purchaser requirements where these may be different from or in conflict with user requirements.

Fire Safety¹³

Effective and efficient alarm and evacuation systems, as well as all possible precautionary measures against fire, are an important part of the physical security of

the user. Many buildings lose a great deal of their safety through careless construction. Unplanned adjustments in the electric system can cause once fire-proof surfaces to be perforated. Apertures left for plumbing if improperly sealed or left altogether unsealed, assist the spread of toxic gases caused by fire. Toxicity of all materials should be considered against their other properties, and where possible materials used should be self-extinguishing.

Modern high-rise office buildings have generally been considered to be fire-resistant. However, as a recent article in Engineering News Record indicates, "This may describe the structure, but it ignores the contents. Now the almost explosive qualities used in furnishing and decorating the modern office places a question mark over nomenclature. One authority on fire protection already has suggested modern buildings be classified as semi-combustible."¹⁴ Such evidence increases the force of the argument for the use of self-extinguishing materials.

High-rise office buildings present other problems. Multiple occupancy and variable space division may make routes of access and egress unclear and therefore call for extremely clear signage. Such buildings are extremely difficult to evacuate and should be provided with fire-free zones, open to the outside and completely sealed off from the rest of the building, to which occupants may move in case of fire, and where they can wait safely while the fire is extinguished and the building cleared of smoke and toxic gases. Open

plan offices, which present no barriers to the spread of fire and the diffusion of gases, present particular hazards and increase the need for easily accessible fire-free areas.

No building used by people is ever entirely fire-proof, but effective measures should localize the danger and bring it within manageable proportions.

Structural Safety¹³

Furniture and furnishings should be stable, obvious and easily manipulated. They should be designed to accommodate the maximum feasible use to which they can be put by the user. For example, surfaces, even where not designed for sitting, should be able to accommodate the weight of as many people as will fit on them. However this principle has its limitations, and, much of the need for indestructible items with their attendant bulk, can be avoided by designing items with interior flexibility.

Drawers can be designed to give way when sat upon, rather than breaking. Apparently indestructible items are often destroyed anyway because their appearance invites rough use. It is important that all furniture have the strength it appears to have so that the user is not deceived into abusing it.

Particular care should be taken in the design and positioning of potentially hazardous items. The user should be protected from slippery, sharp-edged, swinging or protuberant surfaces either by their being avoided all together or at least kept out of traffic routes where collisions might occur.

The question of health/hygiene is also related to the type and detailing of office surfaces. Where these surfaces are, porous uneven or hard to reach, they will be more difficult to clean and therefore present potential health problems. For this reason therefore, the office and its contents should be as straightforward and easy to keep clean as possible.

Acoustics¹⁵

Good acoustical design depends on the maintenance of a careful balance between absor-

bent and reflective surfaces in order to insure the intelligibility and confidentiality of speech within the office. If reflective surfaces predominate the sound environment will be too lively and will irritate by exaggerating extraneous noise. If absorbent surfaces predominate, the room will have a dead quality and will tend to take the life and energy out of desirable noises.

The establishment of this physically comfortable balance will depend on careful prior consideration being given to all potential noise sources both external and internal, as well as consideration of the acoustic properties of all components of the physical environment. It should be pointed out in this regard that the sound properties of furniture, as reflectors, absorbers, and generators of noise, are too frequently overlooked. External noise sources include noises from outside the building, like air and road traffic, as well as noise from adjacent parts of the building. The most important source of internal noise will probably be machine use but will also include background conversation, HVAC, telephone, etc.

The open plan office presents particular problems. In this environment the objective must be the maintenance of a level of ambient noise which is fairly uniform throughout the office, is well within the learned tolerance of the user, and protects the confidentiality of conversation within a relatively small area. This can be done through careful attention to the positioning of noise sources and the positioning of work stations and through the selective use of sound absorbent partitions, dividers, baffles, etc. Ideally a balance should be found which protects the confidentiality and intelligibility of conversation without the addition of "white" background noise which may have other insidious effects, as well as creating a vicious circle of noise level escalation. (see also SS 7 Acoustics and Appendix 2)

Lighting¹⁶

A balance must be sought between good general lighting and good task lighting. Wherever possible, all lighting should be movable, multi-purpose, and adjustable for intensity. Switching should be obvious and accessible from the place to be

illuminated.

As with other systems lighting must be planned to integrate with other features of office design. The quantity and quality of light provided from any given source must take into account the reflectivity of supporting and adjacent surfaces. In a carefully designed environment, the colours, finishes and textures throughout the office should influence the type and amount of light provided.

Office light intensity requirements will vary from approximately 20 foot candles at floor level for circulation, to 80 - 100 foot candles for writing and other desk work. Since only about 5% of the total office area will be occupied by work surfaces which require a high level of illumination, it is extremely wasteful to illuminate these surfaces with general lighting. The high level of general illumination (80-100 foot candles) frequently found in offices may also contribute to head-aches, fatigue and visual monotony.

A better mix would combine a relatively low level of general lighting with a variety of local task lighting. As well as creating an environment more open to user modification, this will provide far greater flexibility within the individual work stations and tend to create spatial divisions within the office work against the possible monotony and lack of privacy of the open-plan office.

Climate¹⁷

The physical comfort of the user will depend in part on office climate, which includes temperature, humidity, air movement and odour. Conflicts may occur between sedentary users and machine operators and others engaged in more taxing physical labour, the latter group desiring a somewhat lower temperature than the former. Individual control is probably not feasible, but new building systems which permit temperature variations within office zones may provide partial solutions. In the case of large machines, there may be sufficient heat generation to require a separate system altogether.

Care should be taken to maintain humidity at the optimum level. Excessively low humidity will aggravate bronchial and

asthmatic conditions, generate static electricity, and cause paper to deteriorate more rapidly. Excessively high humidity will assist fungus and bacterial growths and make paper sticky and hard to handle.

Control of air movement and odours will differ depending on whether there is natural or artificial ventilation. In the former case, windows should be easy to operate and designed to produce a good air-flow. In the latter, diffusers should be located away from foci of office or work station use, and the velocity of air movement should not be so high as to cause discomfort. Ideally, the movement of air should be imperceptible - neither heard nor felt.

Image

We have alluded above to the potential conflict between management's concern with image and the user's need for an environment which respects his need for territoriality, sociability, variety etc. The user's desire to so control and arrange his space that it reflects him in personal and possibly idiosyncratic ways may lend the office an appearance of clutter and inconsistency. Even though such an environment may well be more conducive to work, management may feel that it will tend to put off potential clients and adversely affect the attempt of advertising and public relations to project an image of stream-lined efficiency, homogeneity, and consistency.

This situation will probably produce sharp conflicts over the next few years but will gradually disappear as the industrial humanism school of management gains ground, and the type of image considered desirable begins to change. A move toward greater regimentation and depersonalization is the only way this very narrow idea of "corporate image" will withstand such changes, and such a move is unlikely to be in anyone's interests.

Cost

The main problem for the purchaser, and a potential source of conflict between user requirements and purchaser requirements, is weighing initial cost against long term cost. The saving on cheap furniture and furnishings, which will limit initial

capital outlay, may be out-weighed in the long term by maintenance, replacement and insurance costs. A partial solution may be in amortizing the cost of furniture and furnishings by including them in the mortgage. However, this is only possible where furniture and furnishings are considered to be part of the permanent physical plant; and this may conflict with both user and purchaser requirements for flexibility. The advantages inherent in the potential flexibility of movable furniture and furnishings must be measured against the disadvantages of immediate outlays of capital.

Insurance

An aspect of fire safety which should concern the purchaser rather than the user is the fire rating of furniture. That is to say, authorities are becoming increasingly aware of the potential hazards related to the inclusion of unrated furniture and furnishing items in the fire rated buildings. Their awareness may well lead to legislation requiring the fire rating of all furniture and furnishing items. Already, the use of some fire rated items, including carpet and interior, free-standing wall partitions is mandatory in some types of commercial building. Purchaser's may soon find that their stocks of unrated furniture and furnishings are either illegal and/or resulting in increases in their insurance rates.

Durability, Quality, Renewability

This will depend in a large part on the economic capability of the owner and the image he wants to project. Basically, there is a trade-off between the flexibility and short-term economies of cheap, renewable, or disposable furniture; and the more substantial image and long-term economies provided by durable quality furniture. The choice can only be made according to the operating conditions which the owner faces.

Flexibility

The user need consider only present needs, the purchaser must be more far-sighted and examine changing patterns of use with an eye to future needs. Changing management philosophy and the rapid pace of technological change make flexibility a critical criterion.

Technology makes a wide variety of demands on furniture. The purchaser must not only keep pace with developments by acquiring furniture appropriate to present technology, he must also acquire furniture which can be adapted to future needs.

There is also the problem of accumulated furniture, outmoded by technological change and improved design. Most offices have an enormous over-supply of unwieldy flat-top desks which inadequately serve all the purposes for which they may be required. Chairs frequently fall into the same category. Bulky storage furniture, including desks with filing drawers, outmoded by new electronic forms of information storage and retrieval, present another series of problems.

Much of this archaic inventory will gradually be replaced by flexible multi-use furniture, designed to serve a variety of specific functions, to accommodate the immediate and projected demands from new technology, and to provide a visual complement to changing styles in construction and design. The data sheets which follow enable the purchaser to evaluate present inventory. Having performed a thorough evaluation, it may then be possible to devise ways in which present furniture can be rehabilitated and fitted into new environments.

Finally, the data sheets which constitute the bulk of this document, are an attempt to establish in more specific terms, the nature of the inter-dependency between building, furniture and furnishing parts, and between these and the requirements of users and purchasers. Each data sheet is devoted to a particular item or family of items and the nature of the demands made on it by purchasers, users, and the other furniture, furnishing or building components with which it relates or 'interfaces'. Furniture and furnishing items have been singled out for particular attention. However, while building components related to lighting, plumbing, electric/electronic and structural systems and to other considerations such as acoustics, have been dealt with, their presence in this document should be seen more as a convenience than an authoritative source of information on these items. Thus, it was not our intention to provide the reader with highly detailed technical information. Rather, we sought to assist him to broaden his understanding and more readily articulate his requirements.

Furthermore, the data sheets emphasize the distinction which may be made between those parts of the built environment over which a user has direct control "the inner system", and those over which he has relatively little control, "the outer system". In the first category or system, we can locate such components as partitions, furniture, furnishings, some local light fixtures, the terminals of a ventilating system, etc. - these a user should be able to control and manipulate. These we have discussed in detail. In the second system are a building's structure, exterior cladding, its electric/electronic systems, fire retardant and safety systems, etc. - these a user need not, and perhaps, should not, define or manipulate, as they may require a level of technical expertise which the user may not have.

The view of office buildings we are proposing therefore, is that of a raw framework or "land" which consists of a structure, minimal lighting, cladding, HVAC, plumbing, electric/electronic supply, etc., which users then "scape" with furniture, furnishings, fixtures, etc., to meet their particular requirements.

1.

See Appendix 1. Trends in Organizational Management. A report prepared for Industrial Interiors Limited and Environment Systems International as background material for this study.

2.

Pile, John. "Burolandschaft - Theory" Canadian Architect, June 1969, p. 41

3.

Forrest, Gordon. The Office - Environmental Planning A report commissioned by Office of Design, Department of Industry, Trade and Commerce for the National Design Council. Ottawa: Department of Industry, Trade and Commerce, December 1970, p. 13

4.

Ibid, p. 109

5.

Hall, Edward T. The Hidden Dimension, Garden City, New York: Doubleday and Company, Inc., 1966.

Sommer, Robert. Personal Space, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1969

6.

Ibid., p. 23

7.

Chermayeff, Serge & Alexander, Christopher. Community and Privacy, Harmondsworth, Middlesex, England: Penguin Books Ltd., 1966.

8.

Propst, Robert The Office - A facility based on change, Herman Miller, Inc., 1968, p. 25

9.

Sommer, loc.cit., pp. 58 - 59.

10.

Propst, loc. cit., p. 55.

11.

Birren, Faber Colour in Interiors: Historical and Modern, New York: Whitney Library of Design, 1963

Birren, Faber Colour in Your World, (First edition) New York: Collier Books, 1962.

Halse, A.O. The Use of Colour in Interiors, New York: McGraw-Hill Book Company, 1968.

12.

Hall, loc.cit., pp. 50 - 51

13.

National Research Council. National Building Code of Canada 1970. Issued by the Associate Committee on the National Building Code. Ottawa: National Research Council, 1970.

14.

"Building systems and fires will bring changes in codes". Engineering News Record, January 21, 1971, pp. 38 - 39.

15.

Doelle, Leslie L. Acoustics in Architectural Design. An annotated bibliography in architectural acoustics. Ottawa: National Research Council, Division of Building Research, January 1965.

McCormick, E.J. Human Factors Engineering. New York: McGraw-Hill Book Company, 1964.

Murrell, K.F.H. Ergonomics, London: Chapman and Hall, 1965.

16.

Blackwell, H.R. and Blackwell, O.M. "The Effect of Illumination Quantity upon the Performance of Different Visual Tasks." Preprint of Paper No. 7, National Technical Conference, Illuminating Engineering Society, September, 1967.

Blackwell, H.R. "The Visual Performance Index (VPI) as a Criterion of Lighting Installations", The Ohio State University: Institute for Research in Vision. (mimeograph).

Lighting Handbook, Illuminating Engineering Society, Fourth Edition, 1966.

17.

Ashrae Handbook of Fundamentals 1967, American Society of Heating, Refrigeration and Airconditioning Engineers, 1967.

Murrell, loc. cit.

The data sheets which follow for the major furniture and furnishings items used in offices contain information which has been derived from an extensive study of the requirements of the prime user of these items.

Data Sheets - Content

These requirements are presented first as "Purchaser's Criteria", which includes those items of particular concern to office management of an establishment. Next, the "User's Criteria" section includes all the requirements of various groups of employee. Last, the "Sub-system Interfaces" group indicates the relationship and interdependence of the item being discussed to other items in the work station.

Each of these sections is first outlined in the summary, which lists all possible requirements or interface conditions which may apply to the product in question. Since an extremely detailed listing would be prohibitively long, this summary is somewhat general. The section which follows each summary, therefore, elaborates on those particular requirements which require more subtle interpretation. Although this elaboration is, in most cases, completely comprehensive, the summary is still included so that the user of this document may reference peculiar problem areas which may exist in his particular establishment.

Problem Identification

Most of the deficiencies found in products (and the whole office environment) may be directly attributed to certain limitations on the part of some or all of those parties involved in the problem solving (selection, design, sale or manufacture) process. Two of these handicaps are:

- a. an inability to articulate specific requirements. This results from a tendency to respond to a solution (product, idea, etc.) as a whole only; e.g. "I like it", "I don't like it", rather than articulating a specific aspect of the solution; e.g. "I like it generally, but does it have an adequate fire rating?".
- b. an inability to seek out, to be sensitive to and to accommodate the needs, ideas, etc., of the other parties who are either involved in the problem solving process, or are themselves, the ultimate users. This inclination tends to produce a solution based on one's own rather limited perception of a problem, e.g. "I like the appearance of this thing", rather than one which takes into account another viewpoint, e.g. "I like the appearance of this thing, but my maintenance staff will find it really difficult to clean".

Problem Solving

Whether formalized or not, the data sheet may help overcome both these major obstacles to the formulation of satisfactory solutions, through the following procedures:

a. Group Discussion

Probably the best method of producing useful solutions is one which includes all members (owners, builders, designers, suppliers, etc.) in a discussion of each product under consideration, referring to every requirement listed on the data sheets. With this "checklist" acting as a catalyst, this sort of group effort will greatly assist mutual understanding of a problem. For example, the architect and/or designer will emerge with a far more detailed knowledge of the purchaser's wishes, the manufacturer's facilities and ability to respond, and the needs of the office user.

The data sheets have purposely been weighted to favour the user, with information being obtained from a number of sources. Where sources of this data have been insufficient, we have put forward certain hypotheses in order to encourage exploratory discussion which may generate innovations.

b. Questionnaires/Performance Specifications

Where group discussion of a problem is not possible, the data sheets may serve as the basis for either a questionnaire or a performance specification. The questionnaire may simply be a complete (uncensored) list of all items contained on the data sheet, plus some method which will allow the respondent to score numerically each item for its subjective importance.

These questionnaires may then be distributed to all interested parties. The completed replies may then assist those responsible in making better informed decisions. An attempt to satisfy all the expressed wishes with one solution will invariably produce some item which does none of them well. It is essential that the information derived from this kind of activity be interpreted with a certain amount of sensitivity, keeping in mind

that the work station as a whole is the thing which must work.

Where it becomes desirable and practical to produce a performance specification for certain items, the specification writer must apply his own method of evaluation to each item covered on the data sheet. Once these items have been assigned their relative importance, the specification may then be written on an appropriate form. We feel that optimum results will occur where a group discussion of the problem precedes the writing of the specification. This will insure the production of a specification which more accurately describes the desired result.

Sample Problem

The major function of this document is then, to provide a comprehensive "check list" of all requirements for individual furniture and furnishings items. In order to illustrate how it may be used to facilitate the various activities of rehabilitation and evaluation of existing items, and in the purchase and design of new products, we have selected a typical seating unit (a swivel tilt armchair), and will proceed to analyze several alternate solutions which will arise from reference to the appropriate reference sheet. The first step in this procedure is the formulation of an accurate, specific list of requirements for easy reference. What follows is a list which represents what might be a typical interpretation of those items which are included on data sheet 1.1.a., Chairs.

Sub-system 1
Furniture
1.1.a. Seating

Condensed Requirement List

Purchaser/User Criteria

status differentiation
initial cost
maintenance cost
Insurability
quality
appearance/image
user efficiency
user comfort
easily moveable
strength
maintenance free mechanisms
adjustability
easy replacement of parts
removeable upholstery
comfort/support in many positions
wide range of vertical adjustment
rounded, resilient edges

Sub-system Interfaces

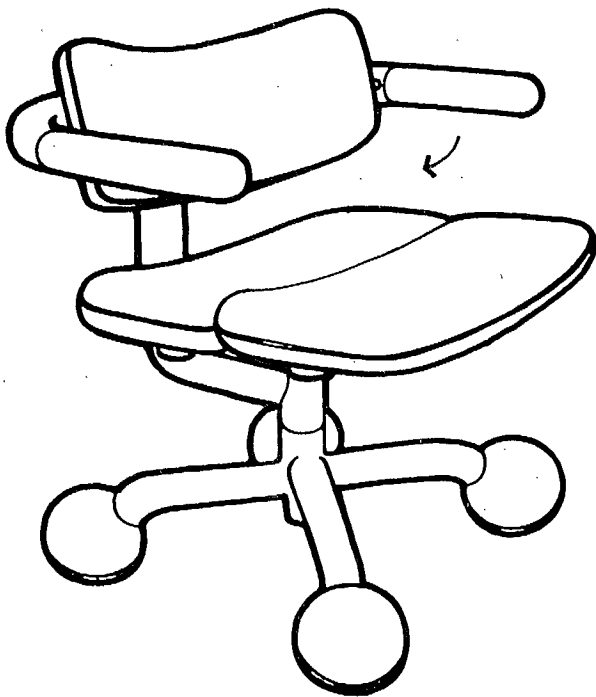
impact/abrasion resistance
clearance - arms to work surface
non-damaging to carpet
noiseless operation
labels
convertability
seat and back contour
safety release design detailing

Swivel-tilt Armchair
Conventional Design



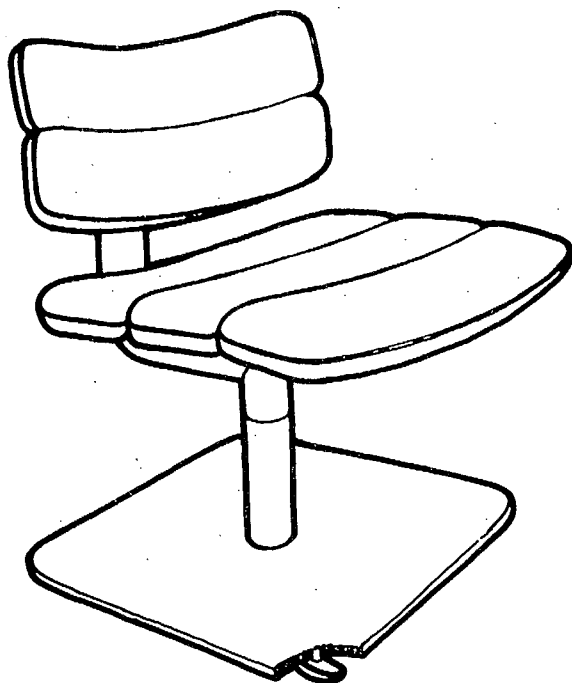
Appearance is utilitarian; use for purposes of status differentiation - difficult; initial cost - moderate, maintenance cost moderate; flammable - insurability effected; quality and strength of construction varies directly with price; male and female user efficiency and comfort badly compromised; casters too small for easy movement; not conveniently adjustable - range of adjustment, limited; upholstery not removeable, parts readily replaceable; doesn't recognize multi-position use; edges - square, sharp and hard; some parts are impact and abrasion resistant; inadequate clearance above chair arms for certain tasks; small casters cause excessive wear to carpet; noiseless operation; labels - non-informative; non-convertible; seat and back improperly contoured; structure and detailing unforgiving when over-loaded or otherwise abused.

Swivel-tilt Armchair
Alternative Design

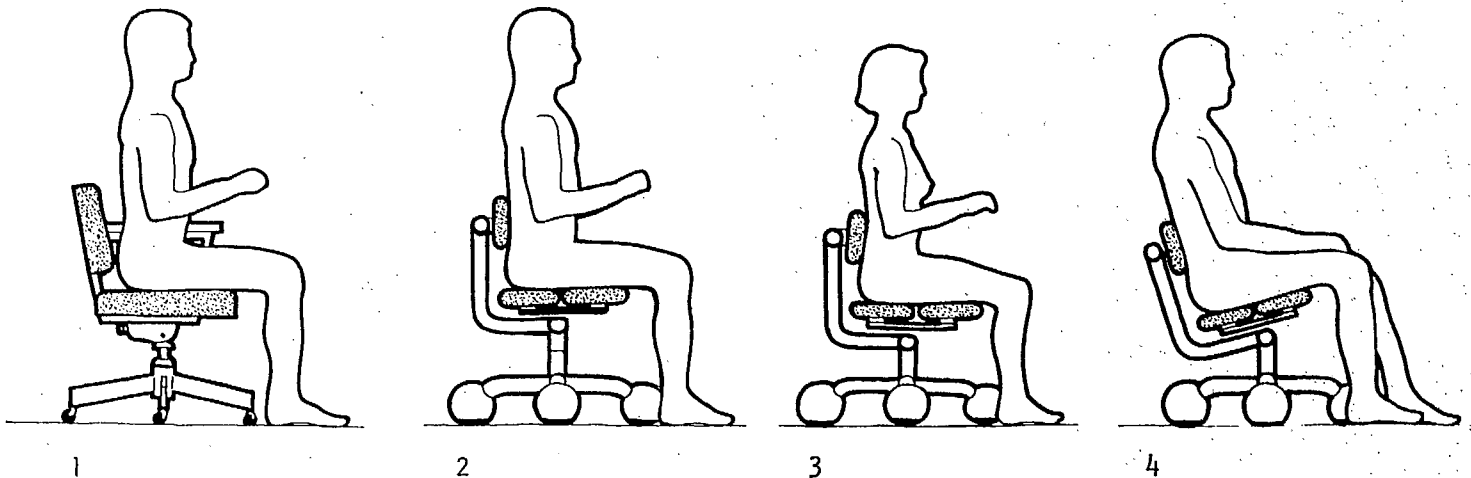


Appearance is functional - may be satisfactory, depending on selection of materials which also determine status differentiation ability. Initial cost - moderate; maintenance cost low. Materials may be flame proof. Quality and strength of construction varies directly with price. Male and female user efficiency and comfort accommodated. Large casters provide easy movement, and prevent wear to carpet. Convenient, wide range of adjustments provided. Upholstery removeable. Suits multi-position use. Rounded and resilient edges are impact and abrasion resistant. Chair arms disengage to facilitate use of chair for a variety of tasks. Noiseless operation. Labelling - informative. Seat and back properly contoured. Components - shock mounted to prevent damage.

Swivel-tilt Chair
Alternative Design



Simple attractive appearance. Choice of materials will aid status differentiation. Initial cost moderate; maintenance cost, low. Materials may be flame proof. Quality and strength of construction varies with price. Male and female user efficiency and comfort accommodated. Swivelling plastic skids provide easy movement, and prevent wear to carpet, although, unsuited for use on hard floor surfaces. Convenient, wide range of adjustments provided. Upholstery removable, upholstered parts readily replaceable. Comfortable, multi-position support provided by "bean-bag" styrofoam bead filled segments. Noiseless operation. Labelling - informative. Rounded and resilient edges are impact and abrasion resistant. Seat and back contoured and variable. Components, shock mounted to prevent damage.



In order to function effectively, it is essential that the work station be provided with comfortable seating. The comfort of a seating unit depends on the skillful handling of several factors, including the size, shape and variability of support surfaces. The physical dimensions of each support surface, and the relationship between these pieces must be devised to suit various statures, both male and female. These surfaces must be shaped to provide even support to fairly large areas of the body. Sections which are curved from side to side in fairly tight radii will conform generally to the body, with resilient material covering providing more specific shaping and support. In addition, it is essential that edges of these surfaces be well rounded and resilient.

To be comfortable, it is essential that the user constantly change body position while working. This movement is necessary to prevent fatigue caused by assuming a static position, no matter how comfortable this position may be initially. This movement is automatic, and generally done by the user despite the design of his chair. The user will, for this movement itself, and also to perform certain tasks, adopt a position as shown in figure 1. Reading and writing on a flat, horizontal surface dictates several body positions, none of which receive any back support from this type of chair. Similarly, this chair does not provide support to the lumbar region when the user adopts a relaxed position, but provides only point

support below the shoulder blades.

The importance of support to the lumbar area for long periods is probably best demonstrated by considering drafting on near-horizontal surfaces. Draftsmen are usually seated on stools or standing, leaning against the work surfaces. Because of this enforced position, and lack of lumbar support, this group has the largest incidence of back ailments, kidney disorders and the like. Similar, but less exaggerated problems result from poor back support in all work stations.

Figure 2 shows a chair which has a back properly dimensioned and positioned to fit the lower back. The chair back is also capable of assuming various angles and front-to-back locations. For most work station activities, this kind of support and adaptability is essential. Figure 4 shows how the same chair allows various user positions while still supporting the back properly. It should be noted that when this sort of "lounge" position is assumed, a great deal more weight is transferred to the lower spine, thus dictating even better support in this position.

Figure 3 shows what is probably the most difficult seating problem to solve effectively. Machine operating dictates a more or less fixed position for the operator, but in order to be comfortable, the operator must change position. This conflict has, in the past, been somewhat alleviated by training operators to

assume a static position, although high absentee rates, etc., in this group seem to indicate that this has not been a very satisfactory solution. A better solution, it seems, would be in the provision of comfortable, adjustable seating and easily variable machine position, in addition to the management technique of providing these operators a variety of tasks which demand different positions.

The chair provided for these operators should easily adjust in height, but equally essential is the ability to adjust the height of the machine. The operator must be able to place her feet flat on the floor, thus taking the weight of the legs. Frequently, high machine position allows only the toes to touch the floor, causing undue pressure and discomfort. The operator will still have to assume a fairly constant back to thigh relationship for extended periods, and therefore, must be able to change leg position frequently. The profile of the front edge of the seat should be thin and well rounded to permit this movement and not impair circulation or comfort, and the base should allow various locations for the feet.

In addition to allowing for change of location, angle and height of the support components, the unit shown above features resilient mounting to each of these parts, which allow the unit to flex somewhat with even slight body movement.

The following is a list of furniture, furnishings, hardware and related equipment, which may comprise an office interior. This list is by no means exhaustive, but is meant more as a guide to those interested in the physical contents of such environments. We have grouped these items into nine major categories or sub-systems to facilitate the analysis of the relationships or interfaces which exist between these components. The data sheets which follow are keyed to the numbering system established in this reference list.

Sub-system 1

Furniture

1.1. Seating

- 1.1.a. Chairs - side chairs
 - arm chairs
 - steno chairs
 - swivel tilt chairs
 - swivel tilt arm chairs
- 1.1.b. Stools
- 1.1.c. Stacking and folding chairs
- 1.1.d. Fixed seating and benches
- 1.1.e. Lounge seating - lounge chairs
 - lounge sofas

1.2. Horizontal Surfaces and Supports

- 1.2.a. Work and reference tables
- 1.2.b. Stepped tables and desks
- 1.2.c. Desks and run-offs
 - single pedestal desks
 - double pedestal desks
 - typing run-offs
 - reference run-offs
- 1.2.d. Roll top desks
- 1.2.e. Mobile tables - mobile work tables
 - mobile machine tables
- 1.2.f. Conference tables
- 1.2.g. Drafting tables
- 1.2.h. Lounge and dining tables
 - coffee tables
 - end tables
 - dining tables
- 1.2.i. Folding/stacking tables
- 1.2.j. Counters - low counter tops
 - high counter tops

1.3. Storage

- 1.3.a. Personal belongings
 - clothing
 - footwear
 - handbags/briefcases
 - hats
 - packages
- 1.3.b. Stationery and office supplies
 - tools
 - drawing equipment
 - stationery
 - office supplies
 - duplicating supplies
 - print-outs
 - tapes

- microfilm
- photographs
- art supplies
- 1.3.c. Filing
 - valuables
 - documents
 - books/catalogs/binders
 - folders
 - ledgers
 - dead files
 - active files
 - individual files
 - floating files
 - group files
 - mechanical files
 - drawing files
 - card file drawers
 - kardex
 - keypunch cards
- 1.3.d. Machines

- 1.4. Display
 - chalkboard
 - tackboard
 - pegboard
 - magnetic
 - bulletin board
 - projection
 - roll-up maps/charts
 - display case
 - sloped shelf
 - signage
 - copy

Sub-system 2

Furnishings

- 2.1. General
 - 2.1.a. Window coverings
 - curtains
 - drapery
 - blinds
 - 2.1.b. Floor coverings
 - carpets
- 2.2. Miscellaneous*
 - 2.2.a. Dressing
 - coat hooks
 - coat rods
 - coat hangers
 - coat trees

- coat racks
- mirrors
- boot racks
- umbrella stands
- hat racks
- 2.2.b. Accessories
 - waste bins
 - letter trays
 - ash trays
 - desk pads
 - personal reference indices
 - glass tops
 - chair mats
 - clocks
 - mirrors
 - cushions
 - pictures
 - hangings
 - sculpture
 - plants

2.3. Building*

- 2.3.a. Washroom hardware*
 - towel dispensers
 - towel rods
 - towel shelves
 - dryers
 - toilet partitions
 - TP holders
 - kleenex holders
 - sanitary napkin holders
 - sanitary napkin disposals
 - waste
 - coat hooks

Sub-system 3

Space Division

- 3.1. Partitions
 - fixed
 - fixed full height
 - relocatable full height
 - relocatable partial height
 - relocatable folding
 - freestanding
 - hanging

*No Data Sheets for these items

Sub-system 4

Electric/Electronic

4.1. Communications

- intercoms
- telephones
- teletypes
- computer terminals
- TV bw/colour/closed
- radios
- time
- fire alarms
- signage
- P.A. systems
- muzak

4.2. General

- vending machines
- wiring weight
- wiring location
- convenience outlets
- vending machines
- voltage levels
- telephone cables
- telex cables
- coaxial cables TV
- coaxial cables computer
- distribution systems

Sub-system 5

Lighting

5.1. Fixtures - Type and Location

- outdoor
- ceiling
- wall
- desk
- freestanding
- occasional
- display
- valance/indirect

5.2. Light Sources

- incandescent
- fluorescent
- natural

5.3. Switches - Type and Location

- rheostat
- 2 position
- 3 position
- touch
- switch
- low voltage

5.4. Task Lighting Levels

- corridors
- lobbies
- stairways
- lavatories
- cafeterias
- casual desk work
- reading rooms
- testing
- general assembly
- drafting
- counter display
- fine drafting
- prolonged seeing tasks
- severe office tasks
- color identification
- very severe seeing tasks

Sub-system 6

Plumbing

6.1. Fixtures

- lavatory basins
- water closets
- urinals
- food preparation sinks
- drinking fountains
- water coolers
- photo copy

6.2. Services

- hot/cold
- soil returns
- vents
- drinking water
- access

6.3. Hardware

- fire hose cabinets
- sprinkler systems

Sub-system 7

Acoustics

7.1. Reverberation Times

- floors
- ceilings
- walls
- windows
- window coverings
- furniture
- furnishings
- baffles
- doors

7.2. Frequency and Levels - Sources

- people
- machines
- plumbing
- impact
- outside
- TV and radios
- vibration

Sub-system 8

HVAC

8.1. Temperature

- population
- inside
- outside
- heat gain - machines
- heat gain - lights
- heat loss

8.2. Plant

- central
- unit
- CFM/sq. ft.
- CFM/person
- movement/FPM
- population
- air filter - effectiveness
- odors - control
- plant type
- air changes/hour
- room pressure
- humidifiers
- control/zoning
- control/switching

Sub-system 9

Structure

9.1. Glazed areas

- shades
- fixed
- openings
- hardware
- screens
- sliding doors

9.2. Walls, Ceilings, Floors, Hardware

- safety deposit vaults
- materials
- dimensions/shape/layout
- structural properties
- finishes
- flexibility
- thickness
- door hardware

Chairs

1.1.a

SUB-SYSTEM 1,
FURNITURE,
SEATING, 1.1.a.

SIDE CHAIR, ARM CHAIR, STENO
CHAIR, SWIVEL TILT CHAIR,
SWIVEL TILT ARMCHAIR

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility, comfort and safety standards of these chairs. Initial and long-term cost, maintenance, re-ordering and replacement are other purchaser's criteria. Fire ratings and non-toxicity are important economic considerations to the purchaser, as they relate to his insurability and insurance rates.

The durability and appearance of chairs after a period of sustained use are extremely important factors. All too often an item of furniture retains its original appearance for only a short time after purchase. These chairs should contribute to the efficiency of the user by being easy to move; all their surfaces should be cleanable and readily accessible for maintenance and renewal. Fabrics and finishes should be resistant to damage from abrasion, scratching, impact, and a variety of liquids including beverages, inks, etc.

The structural components should be designed to resist gradual deterioration by maintaining original shape, dimension and strength over a long period, particularly of joints. They should be structurally rigid and robust enough to support the full weight of as many adults as their horizontal surfaces, including arms and back, will support. Casters, tilt and swivel mechanisms should operate easily, quietly, safely and require no maintenance.

All adjustments for back position, seat and arm height, etc., should be readily, quickly and safely made by the user without tools.

If a chair becomes damaged, it is in the purchaser's interest that new parts be easily substituted for the damaged pieces without excessive disassembly of the unit. In order to facilitate the maintenance of both the frame and upholstery, the upholstery should be easily removable and replaceable by maintenance staff. Reversible upholstery components could extend the life of the unit.

USER'S CRITERIA - SUMMARY

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing storing
Related Equipment	typewriters calculators duplicators copiers recorders shredders binding equipment cutters postage meters terminals intercoms telephones projectors television sets telex equipment
Utility	maintenance convenience/adjustability movability comfort safety

USER'S CRITERIA

In that these chairs will receive more or less constant use during the work period, it is essential that they provide the user comfortable support in a variety of positions. Most chairs seem to be designed for a static user who only assumes one seating position. Users, however, do adopt many different postures while working, and chairs intended for use in the work station should recognize this fact.

The physical dimensions and shaping of body support surfaces should be anthropometrically correct to suit users of various statures of both sexes. Frequently, chairs used primarily by females are too deep to support them comfortably. This seems to occur because chairs are usually designed by men who tend to fit the units to themselves. Easily adjusted horizontal, vertical position of back and seat could overcome this problem.

Besides accommodating various seating postures, an ideal work station will provide the user a variety of locations at which to work displaced laterally and vertically from the conventional position.

To facilitate horizontal change of location, chairs must move easily, quietly and safely over both hard and carpeted floors. Relatively large and wide wheels, or smooth skids, combined with an easily swivelling upper chair section are required.

Conventional types of vertical adjustment are rather limited in height, and are usually quite slow and awkward to operate. A unit which is instantly adjustable from conventional low seat height to stool height, while the user is in a seated position, is required.

For user safety and comfort, all exposed surfaces of these chairs should be smooth, well rounded, possibly resilient, and where these surfaces directly contact the user's body, should be resistant to thermal conductivity. Fasteners, brackets and hardware should be free of sharp edges and corners.

SUB-SYSTEM 1,
FURNITURE,
SEATING, 1.1.a.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Horizontal Surfaces/
Supports

work tables
reference tables
stepped tables
stepped desks
single pedestal desks
double pedestal desks
typing run-offs
reference run-offs
roll top desks
mobile work tables
mobile machine tables
conference tables
drafting tables
dining tables
folding/stacking tables
low counter tops
high counter tops

Furniture/Storage

handbags/briefcases
tools
drawing equipment
stationery
office supplies
duplicating supplies
print-outs
tapes
microfilms
photographs
art supplies
machines
documents
books/catalogs/binders
folders
ledgers
dead files
active files
individual files
floating files
group files
mechanical files
drawing files
card file drawers
kardex
keypunch cards

Furniture/Display

chalkboard
tackboard
pegboard
magnetic
bulletin board
display case
sloped shelf
signage

Furnishings/General

carpets
waste bins
ash trays
chair mats

Space Division/Partitions

fixed full height
relocatable full height
relocatable partial height
relocatable folding
freestanding
hanging
fixed

Electric/Electronic/Communications

telephone
teletype
computer terminal
TV bw/colour/closed

Acoustics/Reverberation Times

furniture

Acoustics/Sound Sources

people noise

Structure/Building

materials
dimensions/shape/layout
structural properties
finishes
flexibility

SUB-SYSTEM INTERFACES

Side, arm, steno and swivel tilt chairs interface with most horizontal surfaces and their supports. They should, therefore, be resistant to impact, abrasion and scratching. Their exposed edges and corners should be well rounded and possibly resilient to help prevent damage to tables, desks, shelves and counters. When selecting arm chairs which are not adjustable for height, care must be taken that adequate clearance between arms and work surface undersides be provided.

Impact from chair parts and bases should not damage storage units, display surfaces and work station accessories such as waste bins. Their casters, skids and legs are moved constantly over floor surfaces and must not cause excessive wear to, nor cut or tear carpeting, or other flooring materials. It should be remembered that although a chair with fairly small feet, or casters may easily be moved by itself over carpeting, yet when it is occupied, their movement may become difficult, or cause excessive wear or damage to floor covering materials.

Chair mats are of limited use in this regard as they restrict user movement in the work station and make maintenance of carpet awkward. A better solution is the provision of large casters or skids as previously described.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

In that office furniture requirements may change quite rapidly, it would seem that chairs which have the ability to be easily converted from one use to suit another, would be useful. For example, a side chair which is suitably detailed could readily be converted to an armchair.

If chair seats are contoured in one direction, they should be concave from side to side, rather than from front to back, to provide greater comfort. Chair backs should also be curved in a fairly tight radius, from side to side to provide even support to the lumbar region of the back.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Stools

1.1.b

SUB-SYSTEM 1,
FURNITURE,
STOOLS, PERCHES, 1.1.b.

PURCHASER'S CRITERIA SUMMARY

User Groups	3 Machine Operator 4 Professional 5 Professional (Technical) 7 Communal Areas
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility, comfort and safety standards of these units. Initial and long-term cost, maintenance, re-ordering and replacement are other purchaser's criteria. Fire ratings and non-toxicity are important economic considerations to the purchaser, as they relate to his insurability and insurance rates.

The durability and appearance of stools and perches after a period of sustained use are extremely important factors. All too often an item of furniture retains its original appearance for only a short time after purchase. These units should contribute to the efficiency of the user by being easy to move; all their surfaces should be cleanable and readily accessible for maintenance and renewal. Fabrics and finishes should be resistant to damage from abrasion, scratching, impact, and a variety of liquids including beverages, inks, etc.

The structural components should be designed to resist gradual deterioration by maintaining original shape, dimension and strength over a long period, particularly at joints. They should be structurally rigid and robust enough to support the full weight of as many adults as their horizontal surfaces, including the back, will support. Casters should operate easily, quickly and safely and require no maintenance.

All adjustments for back position and seat height etc., should be readily, quickly and safely made by the user without tools.

If a stool becomes damaged, it is in the purchaser's interest that new parts be easily substituted for the damaged pieces without excessive disassembly of the unit. In order to facilitate the maintenance of both the frame and upholstery, the upholstery should be easily removable and replaceable by maintenance staff. Reversible components could extend the life of the unit.

USER'S CRITERIA - SUMMARY

User Activity	conversation meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating
Related Equipment	calculators duplicators copiers recorders shredders binding equipment cutters postage meters telephones telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Stools and perches will receive almost constant use during the work period. It is critical that they provide long-term comfort for such activities as reading, writing, drawing, layout, collating and a variety of machine operating tools. Their physical dimensions and body support surfaces should be anthropometrically designed to accommodate various statures of both sexes. This may require vertical, horizontal, swivel or tilt adjustment of either or both chair seat and back supports. The ability of the user to adjust the back tension, seat height of stools and perches, easily and without tools, is a prime consideration.

Users should be able to move chairs easily; which may indicate light weight units, skid supports, or casters attached to bases. Bases for stools and perches should be designed to provide user security and stability for a variety of major seating requirements.

Exposed chair surfaces which come into contact with the user, should be smooth, clean and snag-free. Sharp edges and corners are to be avoided. Fastening devices should be below or flush with the mounting surface.

Upholstery materials should be ventilated, durable, odour free and resistant to thermal conductivity.

Elevated surfaces are usually provided for tasks which require the user to assume a standing position at least some of the time. For this reason, it seems selection of stools is usually not given as much consideration as is the selection of chairs.

Stools and perches, like chairs, will receive more or less constant use during the work period. Where the user assumes a seated position for long periods, then a stool designed to comfortably support the user in a variety of postures should be provided. Where it is likely that the user will be standing most of the time, a perch may be used to provide occasional seating, as a perch essentially provides only partial support, most weight being taken by the user's legs.

The physical dimensions and shaping of body support surfaces of both types of unit should be anthropometrically correct to suit users of various statures of both sexes.

Stools and perches should move easily, quietly and safely over both hard and carpeted floors. Relatively large and wide wheels, or smooth skids, combined with an easily swivelling upper stool section, will aid this movement. Since there is a particularly high moment produced by the elevated position of the user, care must be taken that the base is adequately dimensioned to prevent overturning.

Vertical adjustment of the unit over a wide range is required to suit the user's stature and work surface location. Conventional types of vertical adjustment are rather limited in height, are usually quite slow and awkward to operate.

SUB-SYSTEM 1,
FURNITURE,
STOOLS, PERCHES, I.I.B.

Stools should be instantly adjustable in height while the user is in a seated position.

For user safety and comfort, all exposed surfaces of these stools and perches should be smooth, well rounded, resilient and resistant to thermal conductivity. All fasteners, brackets and hardware should be free of sharp edges and corners.

Foot rails or rests which form part of the seating unit or the base of related working surfaces are required for user comfort. These should be located at a position relative to the seat height which will provide the user comfortable support, and should allow a variety of positions for the feet.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Horizontal Surfaces/ Supports	work tables reference tables single pedestal desks double pedestal desks roll top desks mobile work tables mobile machine tables drafting tables folding/stacking tables high counter tops
Furniture/Storage	handbags/briefcases tools drawing equipment stationery office supplies duplicating supplies print-outs tapes microfilms photographs art supplies machines documents books/catalogs/binders folders ledgers dead files active files individual files floating files group files mechanical files drawing files card file drawers kardex keypunch cards
Furniture/Display	chalkboard tackboard pegboard magnetic bulletin board display case sloped shelf signage
Furnishings/General	carpets waste bins chair mats
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone teletype computer terminal TV bw/colour/closed
Electric/Electronic/General	distribution system
Acoustics/Reverberation Times	furniture
Acoustics/Sound Sources	people noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Stools and perches interface with most horizontal surfaces and supports. They should be resistant to impact, abrasion and scratching. Their exposed edges and corners should be well rounded and possibly resilient to prevent damage to tables, desks, shelves and counters.

Impact from stool parts and bases should not damage storage units, display surfaces and work station accessories such as waste bins; as well, this impact should not damage the stools. The casters, skids or legs will be moved constantly over floor surfaces and must not cause excessive wear to, nor cut or tear carpeting or other flooring materials. It should be remembered that although a stool or perch with fairly small feet or casters may be easily moved by itself over carpeting, yet when it is occupied, this movement may become difficult, and contribute to excessive wear or damage to floor covering materials.

Chair mats are frequently provided over carpeted surfaces to aid movement of units of this type, but are of limited use as they restrict user location at the work station, and make maintenance of the carpet difficult. A better solution is the provision of large counters or skids as previously described.

As upholstered items, these units may contribute to the reduction of noise levels by absorbing sound and reducing impact noise.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

If seats are contoured in one direction, they should be concave from side to side, rather than from front to back, to provide greater comfort. Chair backs should also be curved in a fairly tight radius, from side to side to provide even support to the lumbar region of the back.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but will ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Stacking & Folding Chairs

1.1.c

SUB-SYSTEM 1,
FURNITURE,
SEATING, 1.1.c.

STACKING CHAIRS
FOLDING CHAIRS

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

From the purchaser's point of view, stacking and folding chairs are usually selected for occasional short-term use, with efficient and compact storage when not in use, an important consideration. In addition, the overall efficiency of the units is related to their quality, utility, comfort and safety. Initial and long-term cost, maintenance and replacement are other purchaser's criteria. Fire ratings and non-toxicity are important economic considerations to the purchaser, as they relate to his insurability and insurance rates.

The durability and appearance of stacking and folding chairs after a period of sustained use are extremely important factors. These units are not only subjected to the normal kind of wear and tear which chairs usually receive, but are frequently handled by inexperienced, careless or hurried staff, and often stored in less than adequate areas. For these reasons, extra care must be taken in the selection of materials and finishes, and in the structural detailing of the unit. Racks used for storage and movement of units should be compact, easy to load, unload, move and maintain.

Frequent handling of the chairs by maintenance staff, with resultant contact to seat and back surfaces from chair legs and feet, will generate additional cleaning problems. All surfaces should be easily cleaned and readily accessible for cleaning. Fabrics and finishes should be resistant to damage from soiling, abrasion, scratching, impact and staining from a variety of substances, and be impermeable to liquids.

The structural components should be designed to resist gradual deterioration by maintaining original shape, dimension and strength over a long period, particularly at joints. Mechanisms required for folding or linking units should be obvious in their operation, should be easy and safe to use, and should require no maintenance.

If a chair becomes damaged, it is in the purchaser's interest that new parts be easily substituted for the damaged pieces without excessive disassembly of the unit.

In that this type of chair frequently ends up being used for long periods by a single user, the purchaser must balance the obvious requirements of cost and compact storage against long-term user comfort and efficiency.

USER'S CRITERIA - SUMMARY

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing storing
Related Equipment	calculators duplicators copiers recorders shredders binding equipment cutters postage meters terminals intercoms telephones projectors telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Since folding or stacking chairs are likely to be used as substitution for any of the units described in 1.1.a., they should satisfy the same kind of anthropometric considerations. However, adjustability of height and position of seats and backs to accommodate this need is likely to interfere with the compact storage of these units. Perhaps one solution to these conflicting requirements is the provision of flexible mountings to seats and backs, or in the use of a flexible material for the seats and backs themselves.

These chairs must be moved frequently over hard and carpeted floors, both for set-up after removal from storage, and by the user while seated. Units therefore, must be easily and quietly slid about, over carpet and tile. The need for frequent lifting of the units for storage also indicates a preference for light weight construction. It should be possible for one person to easily stack units to maximum height without undue strain. All fasteners, brackets and hardware should be free of sharp edges and corners for users' safety. All corners and edges should be well rounded and perhaps resilient to increase user's comfort and safety, and reduce the possibility of damage to other units.

Frames which nest together through the use of tapered sections, where the possibility of wedging and jamming exists, should be avoided. Care must be taken to ensure that even under the weight of a full stack of units, there is still adequate tolerance between nesting parts to prevent jamming.

In addition to resistance to soiling and damage from frequent handling, these units must also be resistant to perspiration, body oils, a variety of liquids, including inks, paints, hot and cold beverages, etc. For users' comfort, seat and back sections should offer comfortable support, be ventilated, odour-free and thermally non-conductive.

Racks which are used for storage of these units should be easy to move over all types of flooring materials. Casters should be of sufficient diameter and width to operate easily on carpet or tile, and be somewhat resilient to reduce noise on hard surfaces and at joints between flooring materials, door and elevator thresholds.

SUB-SYSTEM 1,
FURNITURE,
SEATING, I.I.C.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Horizontal Surfaces/ Support	work tables reference tables single pedestal desks double pedestal desks reference run-offs roll top desks mobile work tables conference tables dining tables folding/stacking tables low counter tops
Furniture/Storage	handbags/briefcases tools drawing equipment stationery office supplies duplicating supplies print-outs tapes microfilms photographs art supplies machines documents books/catalogs/binders folders ledgers dead files active files individual files floating files group files mechanical files drawing files card file drawers kardex keypunch cards
Furniture/Display	chalkboard tackboard pegboard magnetic bulletin board display case sloped shelf signage
Furnishings/General	carpets waste bins chair mats
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone teletype computer terminal TV bw/colour/closed
Electric/Electronic/General	distribution system
Lighting/Fixtures	type and location
Acoustics/Reverberation Times	floor wall furniture furnishings
Acoustics/Sound Sources	people noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Stacking and folding chairs interface with most horizontal surface units. They should, therefore, be designed to minimize damage to, and caused by, impact with these surfaces and their supports. Well rounded and perhaps resilient edges and corners will help minimize this damage.

These chairs will also interface with storage units, display units and work station accessories such as waste bins. They should neither damage nor be damaged by this contact.

Provision of large wheels on stacking or folding chairs does not seem to be feasible. Movement over, and potential damage to, carpet and other flooring materials still exists, so careful consideration must be given to feet and skids in this regard.

Wheels on racks used to store and move chairs should not damage or mark carpet, tile or other flooring materials, including thresholds.

Care must be taken when selecting these racks that when loaded, they fit easily through all required doorways (both height and width), and do not damage doors, frames or related hardware.

As upholstered items, these chairs may contribute to the reduction of noise levels by absorbing sound and reducing impact noise.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

If chair seats are contoured in one direction, they should be concave from side to side, rather than from front to back, to provide greater comfort. Chair backs should also be curved in a fairly tight radius, from side to side to provide even support to the lumbar region of the back.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Fixed Seating & Benches

1.1.d

PURCHASER'S CRITERIA - SUMMARY

User Groups	7 Communal Areas
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Benches and fixed seating units are generally provided for short-term seating in communal areas. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility, comfort and safety standards of these units. In that these units are likely to receive considerable use by visitors, their appearance and their effect on the image of the establishment becomes an important consideration to the purchaser. Initial and long-term cost, maintenance, re-ordering and replacement are other purchaser's criteria. Fire ratings and non-toxicity are important economic considerations to the purchaser, as they relate to his insurability and insurance rates.

The durability and appearance of benches and fixed seating after a period of sustained use are extremely important factors. Units should maintain their 'like new' appearance over a long period. Because of their static location, these units will tend to receive impact and abrasion at the same point repeatedly. Reversible or relocatable components will help minimize this wear and extend the useful life of the unit. All surfaces of benches and fixed seating units should be easily cleaned, and readily accessible for maintenance and renewal. Fabrics and finishes should be resistant to damage from abrasion, scratching, impact, fading and staining by a variety of liquids. Metal parts should resist rusting.

The structural components should be designed to resist gradual deterioration by maintaining original shape, dimension and strength over a long period, particularly at joints. They should be structurally rigid and robust enough to support the full weight of as many adults as their horizontal surfaces will support, and to resist racking caused by this kind of loading.

Benches must be stable while in use, but should be easily moved on hard or carpeted floors by maintenance staff for cleaning. Fixed units should be detailed so that cleaning of adjacent floor and wall surfaces is not hampered.

If these units become damaged, it is in the purchaser's interest that new parts be easily substituted for the damaged pieces without excessive disassembly of the unit. In order to facilitate the maintenance of both frame and upholstery, the upholstery should be easily removable and replaceable by the maintenance staff.

USER'S CRITERIA - SUMMARY

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Although benches and fixed seating are normally provided for short-term seating in waiting and reception areas, they also frequently serve as long-term seating for activities such as conferences, meetings, reading, writing and dining. Since most of these activities require relatively long-term comfortable support to users of different sizes in several positions, it is obvious that benches cannot adequately satisfy these needs.

Since these units will frequently be located in high traffic areas, it is essential that all edges and corners be well rounded and perhaps resilient, and that all surfaces, brackets, fasteners, etc., be smooth, clean and snag-free. Adjacent horizontal surfaces are required for most user activities related to benches and fixed seating. Since these units are frequently used in confined areas, there are some advantages to combining the surface and seating functions in one unit. Criteria for the horizontal surface may be found on Data Sheets 1.2.h. and 1.2.i.

SUB-SYSTEM 1,
FURNITURE,
SEATING, I.I.d.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating

work tables
reference tables
coffee tables
end tables
dining tables
folding tables
stacking tables
low counter tops
high counter tops

Furniture/Storage

office supplies
machines
active files
individual files
floating files
group files

Furniture/Display

chalkboard
tackboard
pegboard
magnetic
bulletin board
display case

Furnishings/Dressing/Grooming

coat racks
boot racks
umbrella stand

Furnishings/General

carpets
waste bins
sculpture
plants

Space Division/Partitions

fixed full height
relocatable full height
relocatable partial height
relocatable folding
freestanding
hanging
fixed

Electric/Electronic/General

distribution system

Acoustics/Reverberation Times

furniture

Acoustics/Sound Sources

people noise

Structure/Building

materials
dimensions/shape/layout
structural properties
finishes
flexibility

SUB-SYSTEM INTERFACES

Fixed seating units and benches will interface with a number of other furniture and furnishings items. They should, therefore, be designed so as to resist impact and abrasion damage caused by contact with furniture bases, waste bins and mobile units.

Legs or skids should be designed to prevent damage to tile or carpeted surfaces. The legs or skids must resist corrosion caused by exposure to water and salt, to prevent damage to themselves and resultant damage to the flooring material.

Units which are fixed in position to walls or floors should employ resilient mountings to reduce transmission of noise and prevent structural damage.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Lounge Seating

1.1.e

SUB-SYSTEM 1,
FURNITURE,
SEATING, i.e.

LOUNGE CHAIRS
LOUNGE SOFAS

PURCHASER'S CRITERIA - SUMMARY

User Groups	6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility, comfort and safety standards of these chairs. Initial and long-term cost, maintenance, re-ordering and replacement are other purchaser's criteria. Fire ratings and non-toxicity are important economic considerations to the purchaser, as they relate to his insurability and insurance rates.

The durability and appearance of lounge chairs after a period of sustained use are extremely important factors. All too often, an item of furniture retains its original appearance for only a short time after purchase.

Labour costs and hence maintenance costs are a particular concern of office management. For this reason, not only might the lounge furniture be easily relocatable, all of its surfaces must be readily accessible, impermeable to liquids, and resistant to many organic and inorganic substances. When selecting lounge furniture, purchasers should examine each item from the point of view of its ease of maintenance. This is necessary, as many lounge furniture items are so designed and detailed as to make periodic vacuuming or brushing, awkward, time consuming, and therefore, costly. The surfaces of lounge furniture should be easily renewable. Ease of maintenance, as well as use, are often further compromised by the bulk and weight of lounge furniture items. Bulky furniture items also reduce the amount of floor space available for effective user activity.

USER'S CRITERIA - SUMMARY

User Activity	conversation conference meetings reading studying thinking eating drinking
Related Equipment	telephones
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Lounge furniture will receive constant use by all user groups in Communal Areas and by executives in private offices, for sitting, lounging, resting and possibly sleeping. The body positions implicit in the above uses, are related to such activities as conference, reading, conversation, telephone use, TV viewing, entertaining, drinking, eating, etc. The lounge furniture must accommodate these activities comfortably and conveniently. Its physical dimensions, upholstery, points of body support, etc., should be anthropometrically designed. Lounge furniture should be easily relocatable by its users; lounge chairs might be mounted on a swivel base to provide additional flexibility. As well, it must be resistant to damage related to these activities. Thus its upholstered and other surfaces must be capable of resisting: perspiration, oils, dirt; make-up; shoe polish; water; food stains - grease, fruit, etc.; beverages. The ottoman, in particular, must be resistant to scuffing, shoe-polish, dirt, etc. These surfaces must also be resistant to: cigarette burns; fading; puncture, impact, scratch and abrasion damage. Lounge chairs and sofas should be structurally rigid and robust enough to support the full weight of as many adults as their area, including arms and back, will seat. In this regard, purchasers might note that, lounge furniture may tend to loosen up and sag after use, and is difficult to rehabilitate without stripping its upholstery completely. Frames and joints, regardless of material used, should be designed to resist loosening, racking and sagging. In order to facilitate the maintenance of both frame and upholstery, the upholstery should be easily removable and replaceable by maintenance staff. Reversible upholstery components may be supplied to extend the life of an item of lounge furniture.

For the protection of its users, lounge furniture should be designed without sharp edges and corners; all of its surfaces - exposed and hidden, should be smooth, clean and snag-free. All screws, bolts, nails, staples, etc., should be below or flush with the surface. Non-upholstered surfaces should be well-rounded and possibly resilient.

SUB-SYSTEM 1,
FURNITURE,
SEATING, i.e.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Horizontal Surfaces/ Support	coffee tables end tables folding tables stacking tables
Furniture/Storage	clothes footwear handbags/briefcases hats packages
Furniture/Display	chalkboard tackboard pegboard magnetic bulletin board display case signage
Furnishings/General	carpets ash trays cushions plants
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone
Electric/Electronic/General	wiring location convenience outlets distribution system
Lighting/Fixtures	type and location
Acoustics/Reverberation Times	furniture
Acoustics/Sound Sources	people noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Lounge chairs and sofas interface with coffee and end tables and should, therefore, be resistant to impact, abrasion and scratching. Their exposed edges and corners should be well rounded and resilient to prevent damage to tables, display and furnishings items.

Chair bases should be designed to move easily over and prevent damage to floor covering materials.

These units may be in frequent contact with a variety of wall surfacing materials, with the potential for damage to walls and furniture. It is important, therefore, that lounge furniture and wall materials be structurally sound and resistant to impact and abrasion damage. As upholstered items, these chairs may contribute to the reduction of noise levels by absorbing sound and reducing impact noise.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Work & Reference Tables

1.2.a

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Other) 6 Senior Executive 7 Communal
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Work and reference surfaces are required by all user groups. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to these surfaces and their supports are initial and long-term cost, as well as consideration to work station rearrangement, maintenance, and replacement of parts.

The long term performance of supports and surfaces is a major consideration for these items. Although most structural members used are usually adequate, their joining and levelling details frequently produce surfaces which rack and/or vibrate in use. Particular attention must be paid to detailing of joining of all structural supports to eliminate racking and vibration. The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to indelible inks, felt tip pens, burns, scratches and abrasions to retain a long-term 'like new' appearance.

In that office management theory is in a constant state of evolution, these surfaces and their supports must accommodate change. One means of achieving this is by their integration into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach (1) to office management.

Footnote (1) Appendix 1

USER'S CRITERIA - SUMMARY

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing
Related Equipment	typewriters calculators duplicators copiers recorders shredders binding equipment cutters postage meters terminals intercoms telephones projectors television sets telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Work and reference surfaces should be glare resistant and provide low contrast to paper to facilitate activities such as reading, studying and writing. Reflective and high contrast surfaces produce fatigue caused by constant shifting of focus.

Writing surfaces should be resilient to improve user efficiency and comfort, and to lessen resonance, and impact noise. They must be resistant to hot and cold foods, beverages, perspiration and body oils. Since present resilient surfaces are unlikely to adequately resist cigarette burns, special consideration should be given to the development of resilient material which will satisfactorily resist this kind of damage. Utility operations such as sorting, collating, mailing, etc., require considerable surface area but may impose negligible loads. Hinged, folding or add-on light weight surfaces of minimal structure could provide additional work area as necessary for this type of use.

Tables should be easily relocatable by their users. Feet or skids which move or slide easily on carpeted or hard floors, and low unit weight will facilitate this need. Tables should also be structurally robust enough to resist vibration and racking, and to support the full weight of as many adults as their top surface will accommodate.

Activities such as pasting, painting, modelling, etc., dictate a surface which is highly resistant to paints, solvents, adhesives, cutting, puncturing, abrasion and impact. Resilient surfaces desirable for major activities, are unlikely to withstand this kind of abuse; it is therefore recommended that temporary surface protection (cutting board) be provided. Reversible work surfaces could be another solution to this problem.

Different activities require a variety of postures including standing and sitting, therefore, the ability to adjust the height and slope of the horizontal surface would be desirable to the user. In order to decrease the possibility of personal injury and damage to user's clothing, the underside of surfaces, fasteners, brackets, etc., should be smooth, clean and snag-free.

Suitably shaped (rounded) edges and corners of work surfaces will increase user comfort and safety. In addition to improving appearance, ganging and concealing wiring will facilitate cleaning and maintenance. Mounting appropriate telephone or other equipment in a convenient location off the table top itself would either make more work surface available or enable some reduction in required surface area. For further discussion, see the ELECTRIC/ELECTRONIC data in the Sub-system interface text which follows.

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
1.2.a.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chair arm chair steno chair swivel tilt chair swivel tilt armchairs stools perches stacking chairs folding chairs fixed seating
Furniture/Storage	handbags/briefcases tools drawing equipment stationery office supplies duplicating supplies print-outs tapes microfilm photographs art supplies machines documents books/catalogs/binders folders ledgers dead files active files individual files floating files group files mechanical files drawing files card file drawers kardex keypunch cards
Furniture/Display	chalkboard tackboard pegboard magnetic projection sloped shelf copy signage
Furnishings/General	carpets waste bins letter trays ash trays desk pads personal reference indices glass tops chair mats
Electric/Electronic/General	wiring location convenience outlets telephone cables telex cables coaxial cables TV coaxial cables computer distribution system
Acoustics/Reverberation	floor furniture furnishings
Sound Sources	people noise machine noise
Structure	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Work and reference surfaces interface with most types of seating. Clearance between work surface undersides and seating units must be adequate to prevent damage and injury. Work and reference surface supports should be designed to resist damage from movable and mobile furniture. A foot rail should be provided as an integral part of either the table support, related seating unit, or both.

The hardware used to connect work and reference surfaces to storage units should accommodate potential height or slope adjustment. The characteristics of joining hardware should be: strength, stability and ease of adjustment by user. Standardization of joining hardware will enhance the flexibility and utility of an integrated system of office furniture. Additional detailing may be required to permit the interfaces of horizontal work and reference surfaces to conventional storage units.

Where display units connect to horizontal surfaces, the connecting hardware detail must be as discussed above. Horizontal surfaces with resilient edges and well-rounded corners are less likely to damage display units.

Careful detailing of horizontal surface support feet or skids will prevent damage to carpet, tile and other flooring materials. Horizontal work and reference surfaces or their supports must be resistant to damage by work station accessories such as waste bins, letter trays, desk pads, etc.

Work and reference surfaces interface with all types of space division. Co-ordination of work surfaces with walls, partitions and screens could reduce repetition of work surface supports. Where applicable, walls, partitions and screens should accommodate standardized joining hardware.

Work and reference surfaces interface with a variety of electric/electronic equipment; therefore, accommodation must be provided for their service cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, gangling and concealing these cords. A factor related to horizontal surface rearrangement is the ability of the electric/electronic distribution system to readily accommodate change.

Lighting fixtures and switches should not damage the horizontal surfaces to which they may be mounted. Increased flexibility and utility may be realized where standardized joining hardware is used for mounting lighting equipment. It is desirable to easily be able to control the quality, intensity and position of work station lighting.

Materials chosen for interior building finishes should limit potential damage to horizontal work surfaces which may come into contact with walls, columns, etc. The relationship of building size, shape and layout to work and reference surfaces demand that the building configuration and furniture systems be planned in unison.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

Storing, repairing, rehabilitating and rearranging of work and reference surfaces and their supports are prime considerations. A system of demountable furniture components would enhance these activities.

A task-oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components which vary in area and are adjustable for position, height and slope. It is possible that these or similar components may be used to modify conventional work tables to meet the requirements of specific tasks.

Most furniture items are occasionally subjected to loads they are not intended to withstand, and are, as a consequence, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Stepped Tables & Desk

1.2.b

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Stepped surfaces are frequently used by Clerical, Private Secretarial, Machine Operator, and some Professional groups. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to these surfaces and their supports are initial and long-term cost. As well, work station rearrangement, maintenance, and replacement of parts are of importance to the purchaser.

All surfaces and hardware should be readily accessible for cleaning. For the same reason, inside corners should be well rounded.

The long term performance of supports and surfaces is a major consideration for these items. Although most structural members used are usually adequate, their joining and levelling details frequently produce surfaces which rack and/or vibrate in use. Particular attention must be paid to detailing of joining of all structural supports to eliminate racking and vibration. The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to indelible inks, felt tip pens, burns, scratches and abrasions to retain a long-term 'like new' appearance.

In that office management theory is in a constant state of evolution, these surfaces and their supports must accommodate change. One means of achieving this is by their integration into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach (1) to office management.

Attempts on the part of management to employ these furniture items as status symbols may impair their utility and furthermore, may generate short and long-term cost penalties. Initially, unit cost may be increased, and long-term user efficiency impaired.

It may be preferable to express status differentials in some less costly fashion.

Footnote (1) Appendix 1

USER'S CRITERIA - SUMMARY

User Activity	conversation reading studying thinking writing eating drinking sorting storing
Related Equipment	typewriters calculators recorders terminals intercoms telephones television sets telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Stepped surfaces should be glare resistant and provide low contrast to paper to facilitate activities such as reading, studying and writing. Reflective and high contrast surfaces produce fatigue caused by constant shifting of focus.

Writing surfaces should be resilient to improve user efficiency and comfort, and to lessen resonance and impact noise. They must be resistant to hot and cold foods, beverages, perspiration and body oils. Since present resilient surfaces are unlikely to adequately resist cigarette burns, special consideration should be given to the development of resilient material which will satisfactorily resist this kind of damage.

Tables should be easily relocatable by their users. Feet or skids which move or slide easily on carpeted or hard floors, and low unit weight will facilitate this need. Stepped tables should also be structurally robust enough to resist vibration and racking associated with their use as supports for heavy business machines. Moreover, they should be capable of supporting the full weight of as many adults as their top surfaces will accommodate.

Different activities require a variety of postures including standing and sitting, therefore, the ability to adjust the height and slope of the horizontal surface would be desirable to the user. In order to decrease the possibility of personal injury and damage to user's clothing, the underside of surfaces, fasteners, brackets, etc., should be smooth, clean and snag-free.

Suitably shaped (rounded) edges and corners of work surfaces will increase user comfort and safety. In addition to improving appearance, gangling and concealing wiring will facilitate cleaning and maintenance. Mounting appropriate telephone or other equipment in a convenient location off the table top itself would either make more work surface available or enable some reduction in required surface area. For further discussion, see the ELECTRIC/ELECTRONIC data in the Sub-system Interface text which follows.

SUB-SYSTEM 1, FURNISHING
HORIZONTAL SURFACES AND SUPPORTS
1.2.b.

SUB-SYSTEM INTERFACE - SUMMARY

Furniture/Seating	steno chair swivel tilt chair
Furniture/Storage	handbags/briefcases tools stationery office supplies machines documents books/catalogs/binders folders ledgers active files individual files floating files card file drawers kardex keypunch cards
Furniture/Display	tackboard pegboard magnetic sloped shelf copy signage
Furnishings/General	carpets waste bins letter trays ash trays desk pads personal reference indices glass tops chair mats
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone teletype computer terminal TV bw/colour/closed
Electric/Electronic/General	wiring location convenience outlets telephone cables telex cables coaxial cables computer distribution system
Lighting/Fixtures	fixture type and location
Lighting/Switches	type and location
Acoustics/Reverberation Times	floor wall furniture furnishings
Acoustics/Sound Sources	people noise machine noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACE

Stepped surfaces interface with most types of seating. Clearance between work surface undersides and seating units must be adequate to prevent damage and to facilitate movement of users. Surface supports should be designed to resist damage from movable and mobile furniture.

Vertical units of all types, including storage units, partitions and screens, may support stepped surfaces. The connecting hardware used should allow vertical adjustment of the surfaces.

Joining hardware should be strong, stable and easily adjustable by the users. Standardization of joining hardware will enhance the flexibility and utility of an integrated system of office furniture.

Where display units connect to stepped surfaces, the connecting hardware detail must be as discussed above.

Careful detailing of feet and skids will prevent damage to carpet, tile and other flooring materials. Surfaces and supports must be resistant to damage by work station accessories such as waste bins, letter trays, desk pads, etc.

The primary function of stepped tables and desks is the accommodation of electric/electronic equipment; therefore, accommodation must be provided for their service cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, ganging and concealing these service cords. A factor related to horizontal surface rearrangement is the ability of the electric/electronic distribution system to readily accommodate change.

Lighting fixtures and switches should not damage the horizontal surfaces to which they may be mounted. Increased flexibility and utility may be realized where standardized joining hardware is used for mounting lighting equipment. It is desirable to be easily able to control the quality, intensity and position of work station lighting.

Materials chosen for interior building finishes should limit potential damage to horizontal work surfaces which may come into contact with walls, columns, etc. The relationship of building size, shape and layout to work and reference surfaces demand that the building configuration and furniture systems be planned in unison.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in reordering, replacement or maintenance of products.

Storing, repairing, rehabilitating and rearranging of work and reference surfaces and their supports are prime considerations. A system of demountable furniture components would enhance these activities.

A task-oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components which vary in area and are adjustable for position, height and slope. It is possible that these or similar components may be used to modify conventional stepped tables and desks to meet the requirements of specific tasks.

Most furniture items are occasionally subjected to loads they are not intended to withstand, and are, as a consequence, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. Preferably, the reassembly of these pieces should not require tools.

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
1.2.c.

SINGLE PEDESTAL DESK
DOUBLE PEDESTAL DESK
TYPING RUN-OFF
REFERENCE RUN-OFF

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Other) 6 Senior Executive
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Although single and double pedestal desks and run-offs are frequently used by all user groups, they vary considerably in size, finish and type. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to these surfaces and their supports are initial and long-term cost. As well, ease of work station rearrangement, maintenance and replacement of parts are important purchaser's considerations.

The long-term performance of supports and surfaces is a major consideration for these items. Although most structural members used are usually adequate, their joining and levelling details frequently produce surfaces which rack and/or vibrate in use. Particular attention must be paid to detailing of joining of all structural supports to eliminate racking and vibration. The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to indelible inks, felt tip pens, burns, scratches and abrasions to retain a long-term 'like new' appearance.

In that office management theory is in a constant state of evolution, these surfaces and their supports must accommodate change. One means of achieving this is by their integration into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach to office management.

Attempts on the part of management to employ these furniture items as status symbols may impair their utility and furthermore, may generate short and long-term cost penalties. Initially, unit cost may be increased, and long-term user efficiency impaired. It may be preferable to express status differentials in some less costly fashion.

USER'S CRITERIA - SUMMARY

User Activity	conversation reading studying thinking writing eating drinking filing cataloging sorting collating mailing storing
Related Equipment	typewriters calculators recorders terminals intercoms telephone miniaturized television sets
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Single and double pedestal desk surfaces should be glare reducing and should provide low contrast to paper to facilitate activities such as reading, studying and writing. Reflective and high contrast surfaces produce fatigue caused by constant shifting of focus.

Writing surfaces should be resilient to improve user efficiency and comfort, and to lessen resonance and impact noise. They must be resistant to hot and cold foods, beverages, perspiration and body oils. Since present resilient surfaces are unlikely to adequately resist cigarette burns, special consideration should be given to the development of resilient material which will satisfactorily resist this kind of damage.

Single and double pedestal desks should be easily relocatable by their users. Feet or skids which move or slide easily on carpeted or hard floors, and low unit weight will facilitate this need. Desks and their run-offs should resist vibration and racking, and be structurally robust enough to support the full weight of as many adults as their top surfaces will accommodate.

As different activities require a variety of postures, including standing and sitting, it is desirable, therefore, that horizontal surfaces be adjustable for slope and height. In order to decrease the possibility of personal injury and damage to user's clothing, all exposed surfaces, fasteners, brackets, etc., should be smooth, clean and snag-free. Suitably rounded edges and corners of the work surfaces will increase user comfort and safety.

In addition to improving appearance, ganging and concealing wiring will facilitate cleaning and maintenance. Mounting appropriate telephone or other equipment in a convenient location off the table top itself would either make more work surface available or enable some reduction in required surface area.

Utility operations such as sorting, collating, mailing, etc., require considerable surface area but impose negligible loads. Hinged, folding or add-on light weight surfaces of minimal structure could provide additional work area as necessary for this type of use.

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
1.2.c.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chair arm chair steno chair swivel tilt chair swivel tilt armchair stools perches
Furniture/Storage	handbags/briefcases tools stationery office supplies print-outs tapes microfilm photographs machines documents books/catalogs/blinders folders ledgers active files individual files floating files card file drawer kardex keypunch cards
Furniture/Display	tackboard pegboard magnetic sloped shelf copy signage
Furnishings/General	carpets waste bins letter trays ash trays desk pads personal reference indices glass tops chair mats
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone TV bw/colour/closed intercom signage
Electric/Electronic/General	wiring location convenience outlets telephone cables telex cables coaxial cables TV coaxial cables computer distribution system
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Acoustics/Reverberation Times	floor wall furniture furnishings
Sound Sources	people noise machine noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Single and double pedestal desk surfaces interface with most types of seating. Clearance between work surface undersides and seating units must be adequate to prevent damage and injury. Single and double pedestal desk surface supports should be designed to resist damage from movable and mobile furniture. A foot rail should be provided as an integral part of either the table support, related seating unit, or both.

The hardware used to connect desk and run-off surfaces to storage units should accommodate potential height or slope adjustment. The characteristics of joining hardware should be: strength, stability and ease of adjustment by user. Standardization of joining hardware will enhance the flexibility and utility of an integrated system of office furniture. Additional detailing may be required to permit the interfaces of horizontal work and reference surfaces to conventional storage units.

Where display units connect to horizontal surfaces, the connecting hardware detail must be as discussed above. Horizontal surfaces with resilient edges and well-rounded corners are less likely to damage display units.

Careful detailing of horizontal surface support feet or skids will prevent damage to carpet, tile and other flooring materials. Horizontal work and reference surfaces or their supports must be resistant to damage by work station accessories such as waste bins, letter trays, desk pads, etc.

Work and reference surfaces interface with all types of space division. Co-ordination of work surfaces with walls, partitions and screens could reduce repetition of work surface supports. Where applicable, walls, partitions and screens should accommodate standardized joining hardware.

Work and reference surfaces interface with a variety of electric/electronic equipment; therefore, accommodation must be provided for their service cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, ganging and concealing these cords. A factor related to horizontal surface rearrangement is the ability of the electric/electronic distribution system to readily accommodate change.

Lighting fixtures and switches should not damage the horizontal surfaces to which they may be mounted. Increased flexibility and utility may be realized where standardized joining hardware is used for mounting lighting equipment. It is desirable to be able to easily control the quality, intensity and position of work station lighting.

Materials chosen for interior building finishes should limit potential damage to horizontal work surfaces which may come into contact with walls, columns, etc. The relationship of building size, shape and layout to work and reference surfaces demand that the building configuration and furniture systems be planned in unison.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

Storing, repairing, rehabilitating and rearranging of work and reference surfaces and their supports are prime considerations. A system of demountable furniture components would enhance these activities.

A task oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components which vary in area and are adjustable for position, height and slope. It is possible that these or similar components may be used to modify conventional work tables to meet the requirements of specific tasks.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are consequently damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Roll Top Desks

1.2.d

PURCHASER'S CRITERIA - SUMMARY

User Groups	2 Private Secretarial 4 Professional 5 Professional (Technical) 6 Senior Executive
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Roll top desks may be used by the following user groups: Clerical, Private Secretarial, Professional and Senior Executive Staff. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to roll top desks are initial and long-term cost. As well, work station rearrangement, maintenance, and replacement of parts, together with continuous trouble-free operation of the moving parts are important considerations.

The long-term performance of desk supports and surfaces is a major consideration for this item. Although most structural members conventionally used are adequate, their joining and levelling details frequently produce desks which rack and/or vibrate in use. Particular attention must be paid to detailing of joining of all structural details to eliminate racking and vibration. The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to indelible inks, felt tip pens, burns, scratches and abrasions to retain a long-term 'like new' appearance.

In that office management theory is in a constant state of evolution, roll top desk surfaces and supports must accommodate change. One means of achieving this is by integrating these components into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach¹ to office management.

The use of security or protective covers over work in progress may improve efficiency of all user categories. The use of such devices precludes the exercise of retrieving, assembling and filing away each day of working materials and papers. This would also ensure that work in progress is not disturbed by maintenance staff or other employees.

USER'S CRITERIA - SUMMARY

User Activity	conversation reading thinking studying writing eating drinking filing cataloging sorting collating
Related Equipment	calculators recorders intercoms telephones
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Roll top desk surfaces should be glare reducing and should provide low contrast to paper to facilitate activities such as reading, studying and writing. Reflective and high contrast surfaces produce fatigue caused by constant shifting of focus. Writing surfaces should be resilient to improve user efficiency and comfort and to lessen resonance and impact noise, and must be resistant to hot and cold foods, beverages, perspiration and body oils. Since present resilient surfaces are unlikely to adequately resist cigarette burns, special consideration should be given to the development of resilient material that will resist this kind of damage. Resilient surfaces could also provide the necessary friction to hold machines in place while in use.

Roll top desks should be easily relocatable by their users. Feet or skids which move or slide easily on carpeted or hard floors, and low unit weight will facilitate this need. These desks should be structurally robust enough to resist racking and vibration and should be capable of supporting the full weight of as many adults as their top surface will accommodate.

Different activities require a variety of postures including standing and sitting, therefore, the ability to adjust the height of the horizontal surface would be desirable to the user. In order to decrease the possibility of personal injury and damage to user's clothing, the underside of surfaces, fasteners, brackets, etc., should be smooth, clean and snag-free. Suitably rounded edges and corners of work surfaces will increase user comfort and safety. In addition to improving appearance, ganging and concealing wiring will facilitate cleaning and maintenance. Mounting appropriate telephone or other equipment in a convenient location off the table top itself would either make more work surface available or enable some reduction in required surface area. For further discussion, see the electric/electronic data in the sub-system interface text which follows.

Utility operations could be facilitated through the use of hinged, folding or add-on light weight surfaces of minimal structure which could provide additional work area as necessary.

Footnote (1) Appendix 1

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
ROLL TOP DESK, 1.2.d.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chair arm chair steno chair swivel tilt chair swivel tile armchair stools perches
Furniture/Storage	handbags/briefcases tools stationery office supplies print-outs tapes microfilm photographs art supplies documents books/catalogs/binders folders ledgers active files individual files floating files card file drawers kardex keypunch cards
Furniture/Display	tackboard pegboard magnetic sloped shelf copy signage
Furnishings/General	carpets waste bins letter trays ash trays desk pads personal reference indices glass tops chair mats cushions
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone computer terminal TV bw/colour/closed signage intercom
Electric/Electronic/General	wiring location convenience outlets telephone cables telex cables coaxial cables TV coaxial cables computer distribution system
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Acoustics/Reverberation Times	furniture
Acoustics/Sound Sources	people noise machine noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Roll top desks interface with most types of seating. Clearance between work surface undersides and seating units must be adequate to prevent damage and injury. Desk surface supports should be designed to resist damage from movable and mobile furniture. A foot rail should be provided as an integral part of either the table support, related seating unit, or both.

The hardware used to connect roll top desks to storage units, legs, skids, should accommodate potential height or slope adjustment. The characteristics of joining hardware are: strength, stability and ease of adjustment by user. Standardization of joining hardware will enhance the flexibility, utility and appearance of an integrated system of office furniture. Additional detailing may be required to permit the interfaces of roll top desk units to conventional storage units.

Where display units connect to roll top desks to form integrated units, the standard joining hardware detail should be utilized. Desk unit surfaces with resilient edges and well-rounded corners offer less damage potential to display units.

Careful detailing of roll top desk supports will prevent damage to carpet, tile and other flooring materials. Desk unit surfaces or their supports should not be damaged by work station accessories such as waste bins, letter trays, desk pads, etc.

Roll top desks interface with all types of space division. Co-ordination of desk units with walls, partitions and screens could reduce repetition of work surface supports. Where applicable, walls, partitions and screens should accommodate standardized joining hardware.

Roll top desks interface with a variety of electric/electronic equipment; therefore, accommodation must be provided for their service cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, ganging and concealing these service cords. A factor related to work station rearrangement is the ability of the electric/electronic distribution system to readily accommodate change.

Lighting fixtures and switches which mount to desk units should be non-damaging. Some expedience and economies may be realized where standardized joining detail is used for mounting lighting equipment. The facility to easily adjust intensity and relocate the source of work station lighting is desirable.

Materials chosen for interior building finishes should limit potential damage to desks which may come into contact with walls, columns, etc. The relationship of building size, shape and layout to work stations demand that the building configuration and furniture systems be planned in unison.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

Storing, repairing, rehabilitating and rearranging of work and reference surfaces and their supports are prime considerations. A system of demountable furniture components would enhance these activities.

A task-oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components which vary in area and are adjustable for position, height and slope. It is possible that these or similar components may be used to modify conventional work tables to meet the requirements of specific tasks.

Most furniture items are occasionally subjected to loads they are not intended to withstand, and are, as a consequence, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.



SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
1.2.e.

MOBILE WORK TABLE
MOBILE MACHINE TABLE

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical)
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

The term "mobile machine table" refers to a general furniture item which may be provided to support a wide variety of office machines, and does not describe a unit which is integral with a single machine. Mobile work and machine tables are frequently used by Clerical, Private Secretarial, Machine Operator and Professional user groups. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to these table surfaces and their supports are their initial and long term cost. As well, maintenance and replacement of parts are major purchaser's criteria.

The long-term performance of supports and surfaces is a major consideration for these items. Although most structural members used are usually adequate, their joining and levelling details frequently produce surfaces which rack and/or vibrate in use. Particular attention must be paid to detailing of joining of all structural supports to eliminate racking and vibration. The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to indelible inks, felt tip pens, burns, scratches and abrasions to retain a long-term 'like new' appearance.

In that office management theory is in a constant state of evolution, these surfaces and their supports must accommodate change. One means of achieving this is by their integration into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach to office management.

Although mobile tables of all types are a response to the purchaser's requirement for short-term flexibility, they must also ensure long-term performance related to the equipment they support and the surfaces over which they operate.

Footnote (1) Appendix 1

USER'S CRITERIA - SUMMARY

User Activity	reading studying thinking writing eating drinking drawing pasting painting layout modelling filling cataloging sorting collating mailing storing machine operating
Related Equipment	typewriters calculators duplicators copiers recorders shredders binding equipment cutters postage meters terminals intercom telephones projectors television sets telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

The surfaces of mobile work and machine tables should be glare reducing and should provide low contrast to paper to facilitate activities such as reading, studying and writing. Reflective and high contrast surfaces produce fatigue caused by constant shifting of focus. Resilient surfaces will lessen resonance and impact noise, and could also provide the necessary friction to hold machines in place while in use, and while being moved about. They must be resistant to heat generated by the machines they support, perspiration and body oils. Since resilient surfaces are unlikely to adequately resist excessive heat, cigarette burns and permanent indentation, special consideration should be given to the development of resilient material which will withstand these conditions.

Mobile work and machine tables should be designed to facilitate ease of movement by user. Casters are a major consideration for work and machine table mobility. They should be of sufficient diameter to roll easily on carpet, the tread should be sufficiently wide to reduce point loading, the profile should be well rounded to avoid cutting carpet (particularly at the seams), the wheels should be resilient to operate easily and quietly over joints between different types of flooring material and elevator and door thresholds.

Completely positive locking of the unit while the machine is in operation is necessary to prevent all movement and vibration. Locks or wheels may not be adequate for this purpose (as casters still allow considerable movement even when locked). Material used for caster treads should not mark hard or carpeted flooring. They should also be structurally robust enough to eliminate vibration and racking and to support heavy office machines. To prevent injury to users, and damage to equipment, the mobile tables must be stable when being used and when stationary. Different activities and the operation of different types of machines make adjustable height tables desirable to the user. In order to decrease the possibility of personal injury and damage to user's clothing, the underside of surfaces, fasteners, brackets, etc., should be smooth, clean and snag-free. Suitably rounded and resilient edges and corners of the top surface will increase user comfort and safety. Operating hardware associated with this unit must be designed for easy operation and user safety.

In addition to improving appearance, ganging and concealing wiring will facilitate cleaning and maintenance.

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
1.2.e.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chair arm chair steno chair swivel tilt chair stools
Furniture/Storage	handbags/briefcases tools stationery office supplies machines documents books/catalogs/binders folders ledgers active files individual files floating files card file drawers kardex keypunch cards
Furniture/Display	tackboard pegboard magnetic sloped shelf copy signage
Furnishings/General	carpets waste bins letter trays ash trays desk pads personal reference indices glass tops chair mats
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone teletype computer terminal TV bw/colour/closed
Electric/Electronic/General	wiring location convenience outlets telephone cables telex cables coaxial cables TV coaxial cables computer distribution system
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Acoustics/Reverberation Times	furniture
Acoustics/Sound Sources	people noise machine noise
Structure/Building	door hardware materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Mobile work and machine table surfaces interface with most types of seating. Clearance between work surface undersides and seating units must be adequate to prevent damage and injury. Mobile table surface supports should be designed to resist damage from movable and mobile furniture. A foot rail should be provided as an integral part of either the table support, related seating unit, or both.

The hardware used to connect these table surfaces to support units should accommodate potential height or slope adjustment. The characteristics of joining hardware should be: strength, stability and ease of adjustment by user. Standardization of joining hardware will enhance the flexibility and utility of an integrated system of office furniture. Additional hardware may be required to permit the interface of these surfaces with conventional storage units for added stability.

Where display units connect to horizontal surfaces, the connecting hardware detail must be as discussed above. Horizontal surfaces with resilient edges and well-rounded corners are less likely to damage display units.

Wheels and casters should be carefully detailed to move easily on and between all types of flooring materials. These table surfaces and their supports must be resistant to damage by machines and work station accessories such as waste bins, letter trays, etc.

Mobile machine and work tables may occasionally interface with all types of space division. Tables, walls, partitions and screens should be detailed and finished to prevent damage, resulting from this interface. Compatible detailing of hardware may allow these tables to obtain additional stability from the vertical surfaces. These units interface with a variety of electric/electronic equipment; therefore, accommodation must be provided for service cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, ganging, and concealing these cords.

Lighting fixtures and switches should not damage the horizontal surfaces to which they may be mounted. Increased flexibility and utility may be realized where standardized joining hardware is used for mounting lighting equipment. It is desirable to be able to easily control the quality, intensity and position of work station lighting.

Doors, door jambs, columns, walls and hardware all should be designed to resist damage from impact and abrasion from these mobile units.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

Storing, repairing, rehabilitating and rearranging of work and reference surfaces and their supports are prime considerations. A system of demountable furniture components would enhance these activities.

A task oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components which vary in area, which may be mobile, and are adjustable for height and slope. It is possible that these or similar components may be used to modify conventional work tables to meet the requirements of specific tasks.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are consequently damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACE AND SUPPORTS
CONFERENCE TABLE, 1.2.f.

PURCHASER'S CRITERIA - SUMMARY

User Groups	2 Private Secretarial 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost Insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Conference tables frequently receive use by Private Secretarial, Professional, Professional (Technical), Senior Executive Staff, and users in private and communal conference areas. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to these tables and their supports are initial and long-term cost. As well, purchasers may give consideration to the ease with which these items are maintained and their parts replaced.

Furthermore, the long-term performance of the supports and surfaces of this item is a major consideration. Although most support members used are structurally adequate, their joining and leveling details frequently produce surfaces which rack and/or vibrate in use. Therefore, when consideration is given to support devices utilizing legs, pedestals, hinges, or storage, display and space division units, this problem must be resolved. The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to indelible inks, felt tip pens, scratches and abrasions to retain a long-term 'like new' appearance.

Image is a major criterion in the selection and purchase of conference room furniture and furnishings. Thus, a conference table may be selected for its unique appearance - structure, material of manufacture, design, etc., where image is of prime importance, this item might, of necessity, be custom fabricated.

Since the number of people who will use a conference table at a given time may vary greatly in number, the ability to increase or decrease the surface area of this item is an important consideration. Care must be taken in the design or selection of this unit to ensure that door openings, elevators, stairways and corridors are large enough to allow passage. A series of modular add-on units could be one solution to these problems.

USER'S CRITERIA - SUMMARY

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking storing
Related Equipment	recorders terminals intercoms telephones projectors television sets telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Since reflective and high contrast surfaces produce fatigue caused by constant shifting of focus, it is important that the top of a conference table should be glare reducing and should provide low contrast to paper to facilitate activities such as reading, studying and writing. Resilient surfaces with curved edge profiles, will provide an improved surface on which to write and will increase user comfort. In addition, resilient toppings will lessen impact noise and damage, and will contribute to the room's overall acoustic quality. Conference table tops must be resistant to hot and cold foods, beverages, ink, and perspiration and body oils, and to damage due to abrasion, impact and pressure.

The supports of such tables should be rigid to reduce possibility of spillage and to provide a more suitable working surface. They should also be structurally robust enough to support the full weight of as many adults as their top surface will accommodate.

The configuration of conference tables should permit visual and acoustic communication among a large number of users.

In order to decrease the possibility of personal injury and damage to user's clothing, the underside of surfaces, fasteners, brackets, etc., should be smooth, clean and snag-free.

In addition to improving appearance, ganging and concealing wiring related to electric/electronic equipment will facilitate cleaning and maintenance of the table. Mounting appropriate telephone or other equipment in a convenient location off the table top itself would either make more work surface available or enable some reduction in required surface area.

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACE AND SUPPORT
CONFERENCE TABLE, 1.2.f.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chairs arm chairs swivel tilt chairs swivel tilt armchairs lounge chairs lounge sofas
Furniture/Storage	tools stationery office supplies tapes microfilm photographs art supplies machines documents books/catalogs/binders folders
Furniture/Display	chalkboard tackboard pegboard magnetic bulletin board projectors roll-up maps/charts display case sloped shelf signage
Furnishings/General	carpets waste bins ash trays desk pads personal reference indices glass tops chair mats
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone teletype computer terminal television radio time fire alarm signage PA system muzak intercom
Electric/Electronic/General	wiring location convenience outlet telephone cables telex cables coaxial cables TV coaxial cables computer distribution system
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Acoustics/Reverberation	furniture
Acoustics/Sound Sources	people noise machine noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Conference tables interface with most types of seating. Clearance between work surface undersides and seating units must be adequate to prevent damage and to facilitate easy movement by users. Table supports should be designed in such a way that damage by movable and mobile furniture be kept to a minimum. Where conferences occur in lounge areas, physical and aesthetic compatibility of the table and lounge furniture may be a consideration.

Conference tables may connect to or support integrated storage units. The joining hardware should be strong and stable, and allow for the potential interface with free standing storage units.

Where display units connect to conference tables to form integrated units, the connecting hardware should be as discussed above. Table tops with resilient edges and well rounded corners offer less damage potential to interfaced display units.

Careful detailing of conference table supports will prevent damage to carpet, tile and other flooring materials. Tables must be resistant to damage by accessories such as waste bins, letter trays, desk pads, chair pads, etc.

Conference tables interface with a variety of electric/electronic equipment; therefore, accommodation must be provided for their service cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, ganging and concealing these service cords. A factor related to table use and rearrangement is the ability of the electric/electronic distribution system to readily accommodate change.

Lighting fixtures and switches should not damage the horizontal surfaces on which they may be mounted. Some expedience and economies may be realized where standardized joining detail is used for mounting lighting equipment. This would also facilitate the use of interchangeable lighting fixtures, designed to light various tasks.

Conference tables may interface with a number of building materials used in walls, columns, etc. Care should be taken therefore, in designing conference room furniture and in selecting materials so as to reduce their potential for material damage.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful in re-ordering, replacement or maintenance of products.

Storing, repairing, rehabilitating and rearranging of tables and their supports are prime considerations. A system of demountable furniture components would enhance these activities.

Most furniture items will occasionally be subject to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Drafting Tables

1.2.g

PURCHASER'S CRITERIA - SUMMARY

User Groups	5 Professional (Technical)
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Drafting tables are required by both professional and non-professional users, including engineers, architects, draftsmen, commercial artists and others with large graphic material. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of this item. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to drafting tables are initial and long term cost, as well as consideration to work station rearrangement, maintenance, and replacement of parts.

The long term performance of supports and surfaces is a major purchaser's consideration for this item. The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to indelible inks, felt tip pens, solvents, scratches and abrasions to retain a long-term 'like new' appearance. In addition, pointed objects like compasses, dividers and map pins should not permanently damage the surface. Constant use will necessitate periodic replacement of the drawing surface. This should be a simple, straightforward task requiring no special tools or skills.

In that office management theory is in a constant state of evolution, drafting tables must accommodate change. One means of achieving this is by integrating drafting table surfaces and supports into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach¹ to office management.

Footnote (1) Appendix 1

USER'S CRITERIA - SUMMARY

User Activity	conversation conference meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling
Related Equipment	drawing equipment parallel rules drafting machines
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

User efficiency and comfort are largely dependent on the anthropometric consideration given drawing boards. It is essential, for any kind of work, that the user's eye be at a constant distance of approximately 14" from the drawing surface, and his line of vision be perpendicular to the specific area of the drawing on which his activity is focused. Usually, in order to maintain this essential relationship, the user must position himself uncomfortably at a slightly sloped surface, causing excessive strain to the lower back. This problem may largely be solved through the use of an adjustable drawing surface and balanced drafting equipment, which may be located at a near vertical position when required. It is implicit that all of these adjustments may be easily and safely carried out by the user. High quality lighting which is adjustable for position and intensity by the user will be required to complement the adjustability of the working surface. The surface for drawing tables should be glare reducing and should provide low contrast to paper, as reflective and high contrast surfaces produce fatigue caused by constant shifting of focus.

Efficient use of this table usually will require that ancillary items including reference surfaces, display and storage units be located adjacent to the table. In addition, storage for small instruments in the form of a pencil tray along the lower edge of the drawing surface is required.

A foot rail which forms part of the surface support should be provided particularly where the user will stand while drawing. The drawing surface must be particularly stable and free from vibration, a requirement of fine and accurate drawing. A slightly resilient surface which is required to accept pointed instruments, will enhance drawing. This surface plus resilient mountings will reduce vibration caused by drawing and related drawing equipment. The mechanism used to lock the drawing surface in position should be capable of withstanding normal loads. Heavier loads and impact should cause gradual rather than sudden release of this device.

Many activities related to drawing, such as painting, pasting, assembly, modelling, etc., will damage most surfaces suitable for drawing. Additional surfaces or removable protective covering for the drawing surface should be provided for these functions. Since some work in process is likely to remain in position on the surface for a long time, a temporary protective covering may be required. If this cover were also transparent and impermeable to felt pens, inks, etc., it could be useful for protection while tracing.

In order to decrease the possibility of injury to the user or damage to his clothing, the operating hardware and all brackets, fasteners and undersides of surfaces should be smooth, clean and snag-free. In addition, corners and edges should be well rounded and resilient.

In addition to improving appearance, ganging and concealing wiring for desk lights, electric erasers, and pencil sharpeners will facilitate cleaning and maintenance.

SUB-SYSTEM 1,
FURNITURE,
DRAFTING TABLES, 1.2.g.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chair arm chair swivel tilt chair swivel tilt armchair stools perches stacking chairs
Furniture/Storage	handbags/briefcases tools drawing equipment office supplies print-outs art supplies documents books/catalogs/binders folders active files individual files floating files drawing files card file drawers
Furniture/Display	tackboard pegboard magnetic sloped shelf copy signage
Furnishings/General	carpets waste bins letter trays ash trays desk pads personal reference indices glass tops chair mats
Space Division/Partitions	Fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/General	wiring location convenience outlets distribution system
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Lighting/Light Levels	drafting counter display fine drafting
Acoustics/Reverberation Times	furniture furnishings
Acoustics/Sound Sources	people noise machine noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Drafting tables interface with most types of seating. Both seating, height and table height and slope should be adjustable. Drafting surface supports should be designed to resist damage by movable and mobile furniture. Stools, perches and tables should incorporate foot rails.

The hardware used to connect drafting surfaces to supports e.g. - legs, storage units, partitions, should accommodate height and slope adjustment. Joining hardware should be strong, stable and easy for the user to adjust. Standardization of joining hardware will enhance the flexibility, utility and appearance of an integrated system of office furniture. Additional hardware may be required to permit the interface of work surfaces to conventional storage units.

Display and storage units located adjacent to drafting tables may, through the use of similar hardware, add stability. Work surfaces with resilient edges and well-rounded corners offer less damage potential to display units.

Careful detailing of drafting table supports will prevent damage to carpet, tile and other flooring materials. Levelling devices must be provided so that the drawing surface can be stabilized on uneven floors.

The use of drafting tables fixed in a near-vertical position, possibly supported by walls or screens, could satisfy the requirements of some users and at the same time save considerable floor space.

Drafting tables interface with a variety of electric/electronic equipment; therefore, accommodation must be provided for their service cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, ganging and concealing these cords. It is likely that the use of electronic equipment related to drafting will increase greatly, so the provision for an increasing number of coaxial cables will become important.

Lighting fixtures and switches which mount to drafting table surfaces should be non-damaging.

Materials chosen for interior building finishes should limit potential damage to drafting tables which may come into contact with walls, columns, etc. The relationship of building size, shape and layout to drafting tables demand that the building configuration and furniture systems be planned in unison.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

Storing, repairing, rehabilitating and rearranging of work and reference surfaces and their supports are prime considerations. A system of demountable furniture components would enhance these activities.

A task oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components and related storage units, which vary in area and are adjustable for position, height and slope. As well, it is possible that these or similar components may be used to modify conventional work tables to meet the requirements of specific tasks.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Lounge & Dining Table

1.2.h

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS,
1.2.h.

COFFEE TABLE
DINING TABLE
END TABLE

PURCHASER'S CRITERIA - SUMMARY

User Groups	6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Dining, end and coffee tables are frequently used by Clerical, Private Secretarial, Machine Operator, Professional, Professional (Other), Senior Executive Staff, in Communal Areas and by executives in private offices. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to these tables are their initial and long-term cost, as well as consideration to work station rearrangement, maintenance and parts replacement.

The long-term performance of supports and surfaces is a major consideration for these items. Thus, while most structural members used are adequate, their joining and levelling details frequently produce tables which rack and/or vibrate in use. Therefore, when consideration is given to various support devices, e.g. legs, skids, pedestals, as well as storage, display or space division units, this problem must be resolved. The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to damage caused by hot and cold beverages, scratches and abrasions, to retain a long-term 'like new' appearance.

In that office management theory is in a constant state of evolution, these surfaces and their supports must accommodate change. One means of achieving this is by integrating them into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach¹ to office management.

Footnote (1) Appendix 1

USER'S CRITERIA - SUMMARY

User's Criteria	conversation conference seminars meetings reading studying thinking writing eating drinking
Related Equipment	projectors telephones
Utility	maintenance convenience rearrangement mobility safety

USER'S CRITERIA

The surfaces for coffee, end and dining tables should be glare reducing and should provide low contrast to paper to facilitate activities such as reading and studying. Reflective and high contrast surfaces produce fatigue caused by constant shifting of focus. Resilient surfaces with appropriate edge profiles, will provide increased user comfort and safety. They will lessen impact noise and damage, and will contribute to the room's overall acoustic quality. Resilient surfaces could also provide the necessary friction to hold machines in place while in use. They must be resistant to hot and cold foods, beverages, water, perspiration and body oils. Since currently available resilient surfaces are unlikely to adequately resist cigarette burns, special consideration should be given to their development.

Coffee, end and dining table supports should be designed to facilitate ease of rearrangement by user. Supports should be rigid to reduce the possibility of spillage, which is especially important for dining tables. They should also be structurally robust enough to support the full weight of as many adults as their top surface will accommodate.

Different activities require a variety of postures including high and low seating, therefore, the ability to adjust the height of the horizontal surface would be desirable to the user. In order to decrease the possibility of personal injury and damage to user's clothing, the underside of surfaces, fasteners, brackets, etc., should be smooth, clean and snag-free. Dining tables should be capable of seating a number of users comfortably, without table legs inhibiting their placement at the table. Drop-leaf or fold-up tables should comfortably seat at least two persons and should be expandable to accommodate more users. From a functional point of view, a rectilinear shape is to be preferred for this item.

Operations such as studying documents and drawings, require considerable surface area but impose negligible loads. Hinged, folding or add-on light weight surfaces of minimal structure could provide additional work area as necessary for this type of use. These considerations may be pertinent to senior executives whose use of lounge areas for meetings could be accommodated.

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS,
1.2.h.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chairs arm chairs stacking chairs folding chairs benches lounge chairs lounge sofas
Furniture/Storage	handbags/briefcases
Furniture/Display	tackboard pegboard magnetic bulletin board
Furnishings/General	carpets ash trays glass tops sculpture plants
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone signage
Electric/Electronic/General	wiring location convenience outlets telephone cables distribution system
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Acoustics/Reverberation Times	furniture
Acoustics/Sound Sources	people noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Coffee, end and dining tables interface with most types of seating. Clearance between work surface undersides and seating units must be adequate to prevent damage and to facilitate easy movement by users. Table surface supports should be designed in such a way that damage by movable and mobile furniture be kept to a minimum. The mean relationship between fixed bench seating and horizontal surfaces must accommodate variations in body size and traffic flow. Horizontal surfaces and lounge seating interfaces dictate that special attention be given to the height, relationship and appearance compatibility between these items.

The hardware used to connect table surfaces to supports should accommodate height or slope adjustment. The characteristics of joining hardware should be: strength, stability and ease of adjustment by the user. Standardization of joining hardware will enhance the flexibility, utility and appearance of an integrated system of office furniture.

Display units may connect to coffee, end and dining tables to form integrated units.

Careful detailing of table supports is necessary to prevent damage to carpet, tile and other flooring materials.

Coffee, end and dining tables may interface with all types of space division. Co-ordination of table surfaces with walls, partitions and screens could reduce repetition of supports. Where applicable, walls, partitions and screens should accommodate standardized joining hardware.

Lighting fixtures and switches which rest on, or mount to table surfaces, should be non-damaging to those surfaces. Some expedience and economies may be realized where standardized joining detail is used for mounting lighting equipment.

Materials chosen for interior building finishes should limit the potential for damage to tables which may come into contact with walls, columns, etc. The relationship of building size, shape and layout to coffee, end and dining tables demand that the building configuration and furniture systems be planned in unison.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

Storing, repairing, rehabilitating and rearranging of work and reference surfaces and their supports are prime considerations. A system of demountable furniture components would enhance these activities.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Folding/Stacking Tables

1.2.i



SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
FOLDING/STACKING TABLES, 1.2.1.

PURCHASER'S CRITERIA - SUMMARY

User Groups	7 Communal Areas	Related Equipment	duplicators copiers recorders shredders binding equipment cutters postage meters telephones projectors
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility	Utility	maintenance convenience rearrangement movability safety
Standards	fire safety fire ratings toxicity general safety manufacturing		

PURCHASER'S CRITERIA

Folding/stacking tables are used by all user groups. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to folding tables are initial and long-term cost. As well, a purchaser may give consideration to the ease and means of storing, rearrangement, maintenance and parts replacement of these tables.

The long-term performance of supports and surfaces is a major consideration for these items. Although most structural members used in folding/stacking tables are adequate, their joining/folding and levelling details frequently produce tables which rack and/or vibrate in use. Therefore, when consideration is given to various support devices, e.g. legs, skids, hinges, this problem must be resolved. The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to indelible inks, felt tip pens, scratches and abrasions to retain a long-term 'like new' appearance. Table edges must be detailed to withstand abuse from storing, rearrangement and various user activities.

In that office management theory is in a constant state of evolution, these tables must accommodate change. One means of achieving this is by integrating them into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach to office management.

Footnote (1) Appendix 1

USER'S CRITERIA - SUMMARY

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing
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USER'S CRITERIA

As reflective and high contrast surfaces produce fatigue caused by constant shifting of focus, folding/stacking table surfaces should be glare reducing and should provide low contrast to paper to facilitate activities such as reading, studying and writing. Resilient surfaces with curved edge profiles, will provide an improved surface on which to write, and should also decrease the possibility of damage caused by storing and rearranging. Such surface finishes will lessen impact noise and damage, and will contribute to a room's overall acoustic quality. The working surfaces of these tables must be resistant to hot and cold foods, beverages, inks, burns, perspiration and body oils, and to abrasion, puncture, impact and pressure damage. Resilient surfaces could also provide the necessary friction to hold machines in place while in use.

Activities such as pasting, painting, modelling, etc., require a working surface which is highly resistant to paints, solvents, adhesives, cutting, puncturing, abrasion and impact. Resilient surfaces desirable for major activities, may be unlikely to withstand this kind of use; it is therefore recommended that temporary surface protection be provided. On the other hand, reversible work surfaces could be one solution to this problem.

Folding table supports should be designed to facilitate with ease and safety, their operation by a user. When in position, the supports should be rigid to reduce the possibility of spillage and to provide a more suitable vibration-free working surface. These surfaces and their supports should also be structurally robust enough to support the full weight of as many adults as their top surface will accommodate. In order to decrease the possibility of personal injury and damage to user's clothing, the underside of surfaces, fasteners, brackets, hinges, should be smooth, clean and snag-free. Brackets and hinges should be straightforward, simple and safe to use.

Utility operations such as sorting, collating, mailing, etc., require considerable surface area but impose negligible loads. Hinged, folding or add-on light weight surfaces of minimal structure could provide additional work area as necessary for this type of use. Finally, as different activities require a variety of postures including standing and sitting, the ability to adjust the height of these tables may be desirable.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chair arm chair steno chair swivel tilt chair swivel tilt armchair stools perches stacking chairs folding chairs benches
Furnishings/General	carpets waste bins ash trays personal reference indices chair mats

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
FOLDING/STACKING TABLES, 1.2.1.

Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Electric/Electronic/Communications	telephone signage intercom
Electric/Electronic/General	wiring location convenience outlets telephone cables distribution system
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Acoustics/Reverberation Times	furniture
Acoustics/Sound Sources	people noise machine noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Folding and stacking tables interface with most types of seating. Clearance between work surface undersides and seating units must be adequate to prevent damage and injury. The supports should be designed to resist damage from movable and mobile furniture. A foot rail should be provided as an integral part of either the table support, related seating unit, or both.

The hardware used to connect table top surfaces to lock and hinge supports may accommodate height or slope adjustment. The characteristics of joining hardware should be: strength, stability and ease of adjustment by user. Standardization of the joining hardware used in this and other items will enhance the flexibility and utility of an integrated system of office furniture. Additional detailing may permit the interface of horizontal work and reference surfaces to storage units.

Where display units are connected to folding and stacking table surfaces, the connecting hardware detail must be as discussed above. The edges and corners of such horizontal surfaces should be resilient and well-rounded to reduce damage to display units. Folding and stacking tables may interface with all types of space division. Co-ordination of work surfaces with walls, partitions and screens could reduce repetition of work surface supports. Where applicable, walls, partitions and screens should accommodate standardized joining hardware.

Careful detailing of horizontal surface support feet or skids will prevent damage to carpet, tile and other flooring materials. Horizontal work and reference surfaces or their supports must be resistant to damage by work station accessories such as waste bins, letter trays, desk pads, etc.

These tables may also interface with a variety of electric/electronic equipment; therefore, temporary accommodation must be provided for their service cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, ganging and concealing these cords.

Lighting fixtures and switches should not damage the horizontal surfaces to which they may be mounted. Increased flexibility and utility may be realized where standardized joining hardware is used for mounting lighting equipment. It is desirable to be easily able to control the quality, intensity and position of work station lighting.

Materials chosen for interior building finishes should neither damage nor receive damage from horizontal work surfaces with which they may come into contact.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

The means of storing, repairing, rehabilitating and rearranging of folding and stacking tables and their supports are prime considerations. Thus, for example, storage racks for such tables should be simple and safe to load and unload, non-damaging to tables and users, and mobile.

A task oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components which vary in area and are adjustable for position, height and slope. It is possible that folding and stacking tables or similar components may be used to modify conventional work stations to meet the requirements of specific tasks.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are consequently damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
1.2.J.

LOW COUNTER TOPS
HIGH COUNTER TOPS

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Low and high counters may be frequently used by all user groups. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to these counters are their initial and long-term cost, the latter factor related to maintenance and rearrangement of units.

The user's criteria described below dictate that surface finishes must be impermeable to liquids, organic and inorganic substances, and be particularly resistant to indelible inks, felt tip pens, burns, scratches and abrasions to retain a long term 'like new' appearance.

Counters and their related storage units are usually only partially prefabricated or built on site, generally fastened in position permanently to walls and floors. In that office management theory is in a constant state of evolution¹ and that resultant environmental changes take place frequently, this method of providing work surfaces and storage may be unsatisfactory. Instead, relocatable counter units which form part of an integrated system of office furniture should be considered.

Footnote (1) Appendix 1

USER'S CRITERIA - SUMMARY

User Activity	reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing storing
Related Equipment	typewriters calculators duplicators copiers recorders shredders binding equipment cutters postage meters terminal intercoms telephones projectors television sets telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

High and low counter top surfaces should be glare reducing and should provide low contrast to paper to facilitate activities such as reading, studying and writing, as reflective and high contrast surfaces produce fatigue caused by constant shifting of focus. Many of the activities which take place on counter tops would be improved if the surface were resilient. This surface would enhance writing, tend to keep machines in position, and reduce impact and machine noise and resonance.

Suitably rounded corners and edges will increase user comfort and safety. Counters must be particularly rigid, and should also be structurally robust enough to support the full weight of as many adults as their top surface will accommodate.

In addition to resisting hot and cold foods, beverages, perspiration and body oils, heat generated by machines and cigarette burns, special activities such as pasting, painting, modelling, etc., dictate a surface which is also highly resistant to paints, solvents, adhesives, cutting, puncturing, abrasion and impact. Resilient surfaces desirable for major activities, are unlikely to withstand this kind of abuse; it is therefore recommended that temporary surface protection be provided for these activities.

Again, changing needs indicate that a counter surface which is readily (although not instantly) adjustable for height would be desirable. In order to decrease the possibility of personal injury and damage to user's clothing, the underside of surfaces, fasteners, brackets, etc., should be smooth, clean and snag-free.

Utility operations such as sorting, collating, mailing, etc., require considerable surface area but impose negligible loads. Hinged, folding or add-on light weight surfaces of minimal structure could provide additional work area as necessary for this type of use.

SUB-SYSTEM 1, FURNITURE
HORIZONTAL SURFACES AND SUPPORTS
1.2.j.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chairs arm chairs swivel tilt chairs swivel tilt armchairs stools folding chairs stacking chairs	Plumbing/Services	services hot/cold soil pipes vent pipes drinking water access
Furniture/Storage	handbags/briefcases tools drawing equipment stationery office supplies duplicating supplies print-outs tapes microfilms photographs art supplies valuables machines documents books/catalogs/binders folders ledgers dead files active files individual files floating files group files mechanical files drawing files card file drawers kardex keypunch cards	Acoustics/Reverberation Times	floor furniture
		Acoustics/Sound Sources	people noise machine noise
		Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility
SUB-SYSTEM INTERFACES			
Low and high counter tops interface with most types of seating. Clearance between work surface undersides and seating units must be adequate to prevent damage and injury. Surface supports should be designed to resist damage from movable and mobile furniture and maintenance equipment. For high counters particularly, a foot rail should be provided as an integral part of either the counter support, related seating unit, or both.			
The hardware used to connect counter surfaces to vertical surfaces and storage units may accommodate height and slope adjustment. The characteristics of joining hardware should be strength, stability and ease of adjustment by user. Standardization of joining hardware will enhance the flexibility and utility of an integrated system of office furniture. Additional hardware may be required to permit the interfaces of counter surfaces to conventional storage units.			
Furniture/Display	chalkboard tackboard pegboard magnetic roll-up maps/charts sloped shelf copy signage	Where display units connect to counter surfaces, the connecting hardware must be as discussed above. Counters interface with a variety of electric/electronic equipment; therefore, accommodation must be provided for service cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, ganging and concealing these cords. Frequently, where counter surfaces abut other vertical surfaces, hard to clean junctures are formed, therefore, careful attention must be paid to this detail. Counter surfaces and their supports must be resistant to damage by work station accessories such as waste bins, letter trays, desk pads, etc.	
Furnishings/General	carpets waste bins ash trays glass tops chair mats	As these surfaces interface with all types of space division, where applicable, walls, partitions and screens should accommodate standardized joining hardware.	
Furnishings/Building	towel dispenser towel rods towel shelf dryer toilet part. kleenex holder sanitary napkin holder sanitary napkin disposal waste coat hooks	High and low counter tops may interface with sinks and plumbing service including hot and cold water supply, and possibly chilled water, vents soil return and access. Supply and return piping should be readily accessible for maintenance purposes. The sink, taps, faucets, etc., should be integrated with the counter top to prevent splashing, leaking, and to facilitate maintenance. This area is likely to be exposed to damp conditions over long periods, so materials should be selected to resist this condition.	
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed	COMMENTS	
Electric/Electronic/Communications	telephone teletype computer terminal signage	A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.	
Electric/Electronic/General	wiring location convenience outlets telephone cables telex cables distribution system	Storing, repairing, rehabilitating and rearranging of work and reference surfaces and their supports are prime considerations. A system of demountable furniture components would enhance these activities.	
Lighting/Fixtures	type and location	A task oriented work station comprised of a number of integrated components may include high or low counter units. Thus, a work station may consist of a number of small surface components which vary in area and are adjustable for position, height and slope.	
Lighting/Switches	type and location	Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are consequently damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.	
Lighting/Light Levels	counter display		
Plumbing/Plumbing Fixtures	lavatory basin food prep. sinks photo copy		

Personal Belongings

1.3.a

SUB-SYSTEM 1, FURNITURE
STORAGE
PERSONAL BELONGINGS, 1.3.a.

CLOTHES
FOOTWEAR
HANDBAGS/BRIEFCASES
HATS
PACKAGES
UMBRELLAS

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	initial cost insurability maintenance renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

The provision of units to store personal belongings for office workers and visitors is mandatory. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to these storage units are initial and long-term cost, maintenance and parts replacement.

A modular system of storage units would be advantageous to provide flexibility in capacity. Components which could be readily replaced or repaired if damaged, are desirable. All surfaces should be rust-proof, impermeable to liquids, and resistant to scratching, abrasion and impact. Exposed and inside corners and edges should be smooth and well rounded, for safety and ease of maintenance.

If doors are used, the purchaser must consider the potential for interference to traffic from hinged types, and the accessibility of stored contents behind sliding doors.

Screws, hinges and other fixing devices should preferably be flush with, or below all surfaces. If they do protrude, then exposed areas must be smooth and well rounded, again for safety and ease of cleaning.

Storage units for coats, rubbers, umbrellas and other outer wear should contain drip trays to catch and contain moisture, slush, mud, etc., and be easily removable for cleaning, maintenance or replacement. Hangers of wood or plastic will not rust, are less likely to tangle than wire hangers, while generally providing better support for user's clothing. Hangers should be easily removable from storage units. Adequate hangers, hooks, shelf space, boot and overshoe capacity must be allowed to accommodate the belongings of users at peak periods, i.e. during winter months or rainy periods.

In that office management theory is in a constant state of evolution, storage units must accommodate change. One means of achieving this is by integrating them into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach to office management.

USER'S CRITERIA - SUMMARY

User Activity	storing dressing undressing grooming
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Storage units may be private or communal. Sufficient shelf space must be provided to accommodate parcels, hats, gloves, briefcases, etc., for the total number of users. Ready access to stored articles is mandatory. As well, some secured storage may be provided.

Hooks, hangers, shelves, other hardware, and all exposed or interior surfaces should be smooth, clean and snag-free, to prevent clothing damage and personal injury. For this same reason, all corners and edges should be well rounded and perhaps resilient. Resilient surfaces could also lessen the potential for injury and contribute to reduction of noise levels, thus adding to user's comfort.

Shelves should adjust easily in height, and the potential to add additional shelves or storage as required would be useful. The user should be able to make these rearrangements without special tools or skills. Hooks and hangers should be readily accessible and designed to support the user's clothing without damage. Drip trays should be positioned in such a way that all moisture from stored clothing and foot-wear is caught and contained, thus avoiding potential personal injury from slippery or wet floors.

Seating adjacent to, or forming an integral part of the storage unit may be provided for the convenience of the user.

SUB-SYSTEM 1, FURNITURE
STORAGE
PERSONAL BELONGINGS, 1.3.a.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chairs benches
Furniture/Horizontal Surfaces/ Supports	work tables reference tables low counter tops high counter tops
Furniture/Storage	clothes footwear handbags/briefcases hats packages
Furniture/Display	chalkboard tackboard pegboard magnetic bulletin board projection roll-up maps/charts sloped shelf signage
Furnishings/Dressing/Grooming	coat hooks coat rods coat hangers coat tree coat racks mirrors boot racks umbrella stand hat rack
Furnishings/General	carpets mirror
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Acoustics/Reverberation Times	furniture
Acoustics/Sound Sources	people noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACES

Conventional freestanding personal storage units are not likely to interface well with most types of seating, tables or desks. However, if a modular system of furniture components were developed, including this type of storage, these necessary interfaces could be satisfied. It would be essential for storage units to be complementary in appearance to the other furniture components, and have the necessary scratch, abrasion and impact resistance needed to prevent damage to chairs, tables, desks, etc. If fastening devices are required to attach horizontal surfaces, display units, or other furniture to storage units, then a standardized form of connecting hardware should be used throughout the system.

Storage units must not damage floors, carpets or tiles, and should be relocatable on these surfaces. Drip trays must be large enough to accommodate the water, snow, sand, mud, etc., deposited by the stored articles so that damage to the floor will be avoided. They should also be readily accessible for emptying, cleaning, repair or replacement.

It is conceivable that one or more of the vertical surfaces of the storage unit might be used for display. Items such as hangers, boot racks, umbrella stands and mirrors, may be an integral part of storage units, or may simply interface with them. Always, where these interfaces occur, care must be taken that the objects will not damage, or be damaged by, the interfacing object.

Personal storage units could possibly serve a dual purpose, acting as relocatable space dividers. On the other hand, some partitions could be modified to create storage. In either instance, duplication of vertical surfaces might be avoided. Again, standardized joining hardware should be used where applicable.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

A task oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components and related storage units which vary in area and are adjustable for position, height and slope. As well, it is possible that these or similar components may be used to modify conventional work tables to meet the requirements of specific tasks.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Stationery & Office Supplies

1.3.b

SUB-SYSTEM 1, FURNITURE
STORAGE
STATIONERY & OFFICE SUPPLIES, 1.3.b.

TOOLS, DRAWING EQUIPMENT, TAPES,
STATIONERY, OFFICE SUPPLIES,
DUPLICATING SUPPLIES, PRINT-OUTS,
MICROFILM, PHOTOGRAPHS,
ART SUPPLIES.

PURCHASER'S CRITERIA - SUMMARY

User Groups

- 1 Clerical
- 2 Private Secretarial
- 3 Machine Operator
- 4 Professional
- 5 Professional (Technical)
- 6 Senior Executive
- 7 Communal Areas

Cost/Quality/Utility

- initial cost
- insurability
- maintenance
- economic efficiency
- renewability
- construction
- finish
- appearance
- durability
- user efficiency
- flexibility

Standards

- fire safety
- fire ratings
- toxicity
- general safety
- manufacturing

PURCHASER'S CRITERIA

The provision of units to store tools, stationery, office supplies and related items at individual work stations and in communal areas is mandatory. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates.

Other purchaser's criteria related to these storage units are their initial and long-term costs. A purchaser may also be concerned with the ease of relocation and maintenance of these units.

A fully integrated modular system of storage units would provide flexibility in capacity and relocation. Components which could be readily replaced or repaired if damaged are desirable. All surfaces should be rust-proof, impermeable to liquids and resistant to scratching, abrasion and impact. Exposed corners and edges should be smooth and well rounded. If doors are used, they should not interfere with traffic flow. Sliding doors are usually preferable to hinged types, provided they do not interfere with access to stored items.

Screws, hinges and other fixing devices should be flush with, or below, all surfaces or smooth, with no sharp edges. The ability of the user to quickly identify and retrieve stored articles has a significant bearing on the purchaser's operating cost, particularly in communal storage areas; therefore, storage bins, drawers and shelves must be designed to accommodate this requirement.

In that office management theory is in a constant state of evolution, storage units must accommodate change. One means of achieving this is by integrating them into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach to office management.

USER'S CRITERIA - SUMMARY

User Activity

- reading
- studying
- thinking
- writing
- drawing
- pasting
- painting
- layout
- modelling
- filing
- cataloging
- sorting
- collating
- mailing
- storing

Related Equipment

- typewriters
- calculators
- duplicators
- copiers
- recorders
- shredders
- binding equipment
- cutters
- postage meters
- terminals
- intercoms
- telephones
- projectors
- television sets
- telex equipment

Utility

- maintenance
- convenience
- rearrangement
- movability
- safety

USER'S CRITERIA

Storage units including horizontal shelves, drawers and bins may be required for the storage of stationery and office supplies in private and communal areas.

Ready access and identification of stored objects is mandatory. Horizontal shelves, drawers and bins must be dimensioned and possibly adjustable to accommodate a variety of items such as stationery, pens, pencils, rulers, microfilm and tapes. Storage units should incorporate a potential for modification in their combined storage capacity.

A user should be able to make these adjustments, additions or deletions, easily and safely, without special tools or skills. Provision for secured storage must not be ignored, as many user activities may dictate this requirement.

All exposed or interior surfaces, handles or pulls, should be smooth, clean and snag-free, to prevent clothing damage and personal injury. For this same reason, all corners and edges should be well rounded and perhaps resilient. Resilient surfaces could also lessen potential injury through accident and contribute to reduction of noise levels, thus adding to user's comfort. All hardware, including hinges, pulls and stops, should be smooth, simple and safe to operate. All drawers should be provided with stops and should be mounted on runners, which will resist catastrophic collapse due to over-loading.

SUB-SYSTEM 1, FURNITURE
STORAGE,
STATIONERY & OFFICE SUPPLIES, 1.3.b.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chairs arm chairs steno chairs swivel tilt chairs swivel tilt armchairs stools perches stacking chairs folding chairs
Furniture/Horizontal Surfaces/ Supports	work tables reference tables stepped tables stepped desks single pedestal desks double pedestal desks typing run-offs reference run-offs roll top desks mobile work tables mobile machine tables conference tables drafting tables folding/stacking tables low counter tops high counter tops
Furniture/Storage	handbags/briefcases clothes footwear hats packages
Furniture/Display	chalkboard tackboard pegboard magnetic bulletin board projection roll-up maps/charts sloped shelf copy signage
Furnishings/General	carpets waste bins letter trays ash trays desk pads personal reference indices glass tops chair mats clocks pictures hangings sculpture plants
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Acoustics/Reverberation Times	furniture
Acoustics/Sound Sources	people noise machine noise
Structure/Building	materials dimensions/shape/layout structural properties flexibility

SUB-SYSTEM INTERFACES

Conventional freestanding storage units for stationery and office supplies would not be likely to interface well with most types of seating, tables, desks or other storage units. However, if a modular system of furniture components were developed, including this type of storage, these necessary interfaces could be satisfied. It would be essential for storage units to be complementary in appearance to the other furniture components, and have the necessary scratch, abrasion and impact resistance needed to prevent damage to chairs, tables, desks, etc. If fastening devices are required to attach horizontal surfaces, display units or other furniture to storage units; then the connecting hardware should be standard throughout the system.

Storage units must not damage floors, carpets or tiles, and should be easily relocatable on these surfaces. It is conceivable that one or more of the storage units' vertical surfaces might be used for display, or a display unit may be attached to it. Items such as stationery shelves, pencil trays, drawing equipment, etc., may be an integral part of storage units, or may simply interface with them. Always, where these interfaces occur, care must be taken that the objects will not damage, or be damaged by, the interfacing object.

Storage units could possibly serve a dual purpose, acting as relocatable space dividers. On the other hand, some partitions could be modified to create storage. In either instance, duplication of vertical surfaces might be avoided. Again, standardized joining hardware should be used where applicable.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

A task oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components and related storage units, which vary in area and are adjustable for position, height and slope. As well, it is possible that these or similar components may be used to modify conventional work tables to meet the requirements of specific tasks.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are consequently damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Filing

1.3.c

SUB-SYSTEM 1, FURNITURE
STORAGE
FILING, 1.3.c.

VALUABLES, DOCUMENTS, BDDKS/
CATALDGS/BINDERS, FOLDERS, LEDGERS
DEAD FILES, ACTIVE FILES, INDIVIDUAL
FILES, FLOATING FILES, GROUP FILES,
MECHANICAL FILES, DRAWING FILES,
CARD FILE DRAWERS, KARDEX FILES,
KEYPUNCH CARD FILES.

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost Insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

The provision of units for storage of information so that it can be found quickly when required is an important office function. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of the storage items which perform this role.

Fire ratings, fire safety, security and non-toxicity are important economic considerations to the purchaser, as they relate to his insurability and insurance rates. Initial and long-term cost, ease of maintenance and parts' replacement are other purchaser's criteria.

Because traditionally information has been recorded on everything from small cards to large books and documents, a modular system of file storage units would be advantageous to provide flexibility in capacity.

All surfaces should be rustproof, impermeable to liquids, and resistant to scratching, abrasion and impact. Exposed corners and edges should be smooth and well rounded. If doors are used they should not interfere with traffic flow. Sliding doors are usually preferable to hinged types, provided they do not interfere with access to stored items. Screws, hinges and other fixing devices should preferably be flush with, or below all surfaces; if they do protrude, then exposed areas must be smooth and well rounded.

Because most offices contain quite a large amount of filing storage, the purchaser must be concerned about the contribution to noise levels which may be caused by file storage units. Resilient surfaces along with quiet opening and closing devices would add to good overall acoustics and user efficiency.

Storage items may be classed as inactive or active, and the purchaser's requirements could vary greatly between the units needed to store these two material classifications. For instance, the mobility, robustness and ease of operation required for units in active use may be superfluous for inactive file storage; and of course, these characteristics could add significantly to the purchaser's cost.

Generally, the purchaser will require some secured file storage for expensive items, important documents, confidential records, etc., which must be protected against vandalism, theft, improper scrutiny, fire, water, explosion, smoke and the like.

In that office management theory is in a constant state of evolution, storage units must accommodate change. One means of achieving this is by integrating them into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach to office management.

USER'S CRITERIA - SUMMARY

User Activity	reading studying thinking writing filing cataloging sorting collating mailing storing
Related Equipment	typewriters calculators duplicators copiers recorders shredders binding equipment cutters postage meters terminals intercoms telephones projectors television sets telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

File storage units may be private or communal and may contain 'active' or 'inactive' records. Whatever the use, it is imperative that the units permit ready access and identification of stored objects to the user. They should also assist the user in working comfortably while storing, retrieving or examining information. This means that the user should be easily able to see, reach and handle stored records, from a variety of postures. File storage units which are mobile, or easily movable, could aid in these activities, particularly when the stored articles are 'active'.

Horizontal shelves, drawers, bins, etc., must accommodate a variety of objects such as cards, stationery, documents, catalogs, books, binders, folders, and ledgers. The ability to add, decrease or modify storage capacity is an essential consideration, and the user should be able to make these adjustments easily without special tools or skills. Storage units should support the variety of items they are meant to contain in such a way that the stored items are not damaged and remain clearly visible to the user.

All exposed or interior surfaces, handles or pulls should be smooth, clean and snag-free, to prevent clothing damage and personal injury. For the same reasons, all corners and edges should be well rounded and perhaps resilient. Resilient surfaces could also lessen potential injury while contributing to reduction of noise levels, thus adding to user comfort. Mechanical devices such as drawer glides and casters, should operate easily and quietly to reduce user fatigue and increase his efficiency.

SUB-SYSTEM 1, FURNITURE
STORAGE,
FILING, 1.3.c.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chairs arm chairs steno chairs swivel tilt chairs swivel tilt armchairs stools perches stacking chairs folding chairs
Furniture/Horizontal Surfaces/ Supports	work tables reference tables stepped tables stepped desks single pedestal desks double pedestal desks typing run-offs reference run-offs roll top desks mobile work tables mobile machine tables conference tables drafting tables folding/stacking tables low counter tops high counter tops
Furniture/Storage	valuables documents books/catalogs/binders folders ledgers dead files active files individual files floating group files mechanical files drawing files card file drawers keypunch cards
Furniture	chalkboard tackboard pegboard magnetic bulletin board projection roll-up maps/charts sloped shelf copy signage
Furnishings/General	carpets waste bins letter trays ash trays desk pads personal reference indices glass tops chair mats
Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Lighting/Fixtures	type and location
Lighting/Switches	type and location
Acoustics/Reverberation Times	furniture
Acoustics/Sound Sources	people noise machine noise
Structure/Building	materials dimensions/shape/layout structural properties finishes flexibility

SUB-SYSTEM INTERFACE

File storage is required by all office user groups. It is mandatory that 'active' file storage units interface well with all types of seating, horizontal work and reference surfaces, and other storage units. Files should be readily accessible from a seated, perched, standing or other comfortable position. They may be under, over, adjacent to or butt against other storage units or horizontal and vertical surfaces. Therefore, it is essential that file storage units be complementary to other furniture, and have the necessary scratch, abrasion and impact resistance needed to prevent damage from, or to, other office furniture. Storage units must not damage floors, carpets or tiles, and should be easily relocatable on these surfaces. A modular system of furniture components which included file storage units, would be most likely to satisfy these necessary interfaces.

It is conceivable that one or more of the file storage unit's vertical surfaces might be used for display, or a display unit may be attached to it. Items such as file hangers, dividers, signage, locks, etc., may be an integral part of storage units, or may simply interface with them. Interface may also occur with waste bins, letter trays, ash trays, chair mats, etc., always, where these items will not damage, or be damaged by, the interfacing object.

File storage units could possibly serve a dual purpose, acting as relocatable space dividers. On the other hand, some partitions could be modified to create storage. In either instance, duplication of vertical surfaces might be avoided. Again, standardized joining hardware should be used where applicable.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

A task oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components and related storage units, which vary in area and are adjustable for position, height and slope. As well, it is possible that these or similar components may be used to modify conventional work tables to meet the requirements of specific tasks.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are, consequently, damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Machines

1.3.d

SUB-SYSTEM 1, FURNITURE
STORAGE
MACHINE STORAGE, 1.3.d.

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

The problem of storing machines used by office personnel demands some special consideration by the purchaser. Two distinct types of machine storage are normally required. These include those storage units which house and secure the equipment when it is not in use, as well as those storage units which are a permanent and integral part of the equipment, and which may or may not form a part of the machine where it is in operation. For example, consoles in which key punch and large accounting machines are positioned, fall into this latter category. From his point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of these items. Fire ratings, fire safety, security and non-toxicity are important economic considerations to the purchaser, as they relate to his insurability and insurance rates. Initial and long-term cost, ease of maintenance and parts replacement are other purchaser's criteria.

Some reasons a purchaser must give special consideration to the storage of office machines follow. Machines as small as pocket-sized recorders, or as large as computers, must be accommodated. Some suppliers house their machines in self-contained storage units, other suppliers do not. And while one supplier may identify his machines with a certain colour range, another supplier may use an incompatible colour range to identify his product. Most office machines and equipment are noise producers, so the purchaser must ensure that the integrated storage unit provides acoustic control. Many machines are used by more than one person, so they must be mobile or easily movable.

Despite these inconsistencies, the purchaser must seek to maintain a co-ordinated total office environment.

A modular system of storage components which could readily adapt in size and shape, and which provides the necessary acoustic, abrasion, impact, and scratch resistant features, could well be the answer. All exposed and inside corners and edges should be smooth and well rounded, and along with surfaces, could possibly be resilient, adding to acoustic control and thus, maintenance and user efficiency. Resilient surfaces might also assist in stabilizing the machine on the surface while in use, without mechanical fixing.

In that office management theory is in a constant state of evolution, storage units must accommodate change. One means of achieving this is by integrating them into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach¹ to office management.

Footnote (1) Appendix 1

USER'S CRITERIA - SUMMARY

User Activity	reading studying thinking writing filing cataloging sorting collating mailing storing
Related Equipment	typewriters calculators/computers duplicators copiers recorders shredders binding equipment cutters postage meters terminals intercoms telephones projectors television sets telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Machine storage units should be designed to permit user comfort from a variety of work postures while he is performing the various necessary activities associated with the machine. Storage units which are mobile, or easily movable, could allow the user to perform associated tasks such as reading or writing, more efficiently. The ability to add, decrease, or modify storage capacity would provide greater task flexibility. Adjacent work, reference and display surfaces may be horizontal, sloped or vertical; and their design should permit position change and area increase or decrease as required. A similar degree of flexibility might be built into the storage unit itself. This would facilitate the use of different equipment by a variety of users from a number of positions. The user should be able to make these adjustments easily and safely without special tools or skills.

All exposed or interior surfaces, handles or pulls should be smooth, clean and snag-free, to prevent clothing damage and personal injury. For the same reasons, all corners and edges should be well rounded and perhaps resilient. Resilient surfaces could also lessen potential injury while contributing to reduction of noise levels, thus adding to user comfort. Mechanical devices such as drawer guides and casters, should operate easily and quietly to reduce user fatigue and increase his efficiency.

SUB-SYSTEM 1, FURNITURE
STORAGE
MACHINE STORAGE, 1.3.d.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chairs	coaxial cables TV
	arm chairs	coaxial cables computer
	steno chairs	distribution system
Lighting/Fixtures	swivel tilt chairs	type and location
	swivel tilt armchairs	
	stools	
Lighting/Switches	perches	type and location
	stacking chairs	
	folding chairs	
Light Levels	work tables	casual desk work
	reference tables	reading room
	stepped tables	testing
Furniture/Horizontal Surfaces/ Supports	stepped desks	general assembly
	single pedestal desks	drafting
	double pedestal desks	counter display
Acoustics/Sound Sources	typing run-offs	fine drafting
	reference run-offs	prolonged seeing tasks
	roll top desks	
Structure/Building	mobile work tables	people noise
	mobile machine tables	machine noise
	conference tables	
Furniture/Storage	drafting tables	materials
	folding/stacking tables	dimensions/shape/layout
	low counter tops	structural properties
Furnishings/General	high counter tops	finishes
	handbags/briefcases	flexibility
	tools	thickness

Furniture/Storage	drawing equipment
	stationery
	office supplies
Furniture/Display	duplicating supplies
	print-outs
	tapes
Furnishings/General	microfilms
	photographs
	art supplies
Space Division/Partitions	valuables
	card file drawers
	kardex
Electric/Electronic/Communications	keypunch cards
	chalkboard
	tackboard
Electric/Electronic/General	pegboard
	magnetic
	bulletin board
Furniture/Seating	projection
	roll-up maps/charts
	sloped shelf
Lighting/Fixtures	copy
	signage
	carpets
Lighting/Switches	waste bins
	letter trays
	ash trays
Light Levels	desk pads
	personal reference indices
	glass tops
Structure/Building	chair mats
	fixed full height
	relocatable full height
Furniture/Storage	relocatable partial height
	relocatable folding
	freestanding
Furniture/Display	hanging
	fixed
	telephone
Furnishings/General	teletype
	computer terminal
	TV bw/colour/closed
Space Division/Partitions	radio
	time
	fire alarm
Electric/Electronic/Communications	signage
	PA system
	muzak
Electric/Electronic/General	intercom
	wiring weight
	wiring location
Furniture/Seating	convenience outlets
	vending machines
	voltage levels
Lighting/Fixtures	telephone cables
	telex cables

SUB-SYSTEM INTERFACES

Because machine storage is required by all user groups, it is necessary that it interfaces well with all types of seating. Horizontal work and reference surfaces could be an integral part of the machine storage units, or adjacent to where the machines are used; interface with display surfaces for copy or reference materials could similarly be accommodated. Machine storage units may be under, over, in or against horizontal, sloped or vertical surfaces, or other storage units. Therefore, machine storage must be complementary to other furniture, and have the necessary scratch, abrasion and impact resistance needed to prevent damage from, or to, other office furniture. They must not damage floors, carpets or tiles and should be easily relocatable on these surfaces.

Items such as work, reference or display surfaces may simply interface with them. Interface may also occur with waste bins, ash trays, chair mats, etc. Always, where these interfaces occur, care must be taken that the items will not damage, or be damaged by, the interfacing object.

Machine storage units could possibly serve a dual purpose, acting as relocatable space dividers. On the other hand, some partitions could be modified to create storage. In either instance, duplication of vertical surfaces might be avoided. Again, standardized joining hardware should be used where applicable.

Machine storage may interface with a variety of electric/electronic equipment; therefore, accommodation must be provided for connecting service for all types of office machines and their cords. Cord trays, ducts, hangers, clips, power poles, etc., should be considered for mounting, ganging and concealing these cords. A factor relating to machine storage flexibility is the ability of the electric/electronic system to readily accommodate change. Lighting fixtures and switches which may mount to machine storage units should not damage them.

COMMENTS

A tagging system which would label each furniture item with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour and finish type, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

A task oriented work station comprised of a number of integrated components may be preferable to the conventional single, large surface usually provided. For example, a work station may consist of a number of small surface components and related storage units, which vary in area and are adjustable for position, height and slope. As well, it is possible that these or similar components may be used to modify conventional work tables to meet the requirements of specific tasks.

Most furniture items will occasionally be subjected to loads they are not intended to withstand, and are consequently damaged. Frequently, an attempt to avoid this kind of damage results in a piece which is over-designed for normal use, but ultimately will be damaged by even greater loads. A better solution may be to detail units so that even fairly moderate loads or impact will cause parts to separate without breaking. The reassembly of these pieces preferably should not require tools.

Display Units

1.4.a

PURCHASER'S CRITERIA - SUMMARY

User Group	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost Insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing
Furniture Display	chalkboard tackboard pegboard magnetic bulletin board projection roll-up maps/charts display case sloped shelf copy signage

PURCHASER'S CRITERIA

One or more of the various display surfaces listed above are likely to be required by all user groups. From the purchaser's point of view, employee satisfaction and efficiency are related to the quality, utility and safety standards of the items listed above. Fire ratings, fire safety and non-toxicity are important economic considerations to the purchaser as they relate to his insurability and insurance rates. Initial and long-term cost, ease of maintenance and parts' replacement are other factors influencing the purchaser.

Chalkboard surfaces should resist damage from chalk and other marking devices, and be easily cleanable by the user, without "ghosting". Tackboards, pegboards, magnetic display boards, bulletin boards, etc., should resist permanent damage from pins, tacks and other fasteners used to mount various items of display.

Cases are quite a specific type of unit, and their design depends greatly on the end use, however, the criteria stated herein should be applied by the purchaser.

Economic and space saving advantages to the purchaser would be obtained if a display surface could serve a dual function, e.g. a magnetic display could also serve as a projection surface; or one side could be pegboard and the other pin-up; or a pin-up surface could be removable and replaced with a pegboard.

The surfaces, edges and bases of all display units should be light, impact and abrasion resistant, impermeable to liquids, organic and inorganic substances. In the interests of efficiency, mechanical devices which may form part of the display unit, must be easy to operate by the user without special tools or skills.

In that office management theory is in a constant state of evolution, storage units must accommodate change. One means of achieving this is by integrating them into a system of office furniture, the flexibility and adaptability of which would be compatible with the present Task Approach to office management.

USER'S CRITERIA - SUMMARY

User Activity	conversation conference seminars meetings reading studying thinking writing drawing pasting painting layout modelling display
Related Equipment	typewriters calculators duplicators copiers recorders shredders binding equipment cutters postage meters terminals intercoms telephones projectors television sets telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Display units of one kind or another are required by all user groups, and may be private or communal. Display surfaces should be glare resistant and provide low contrast to paper to facilitate user activities such as reading, studying or writing. However, where the user writes or draws directly on the display surface, there should be relatively high contrast between the display surface and the written or drawn material; for example, light coloured chalks would be best on dark coloured blackboards.

Tackboards must be soft enough to permit easy insertion and removal of tacks or pins, while being dense enough to support the displayed materials. Pegboards and associated hardware should be strong enough to support display shelves and as many objects as may be displayed without danger of structural failure which might cause injury to the user or damage to displayed objects or other furniture. Similarly, with magnetic display boards, the magnets must exert sufficient force to safely hold in place the displayed material. Bulletin boards generally require frequent change and letters, numbers, etc., should be easy to re-arrange, but should not permit accidental or undesirable dislodging or displacement. Projection screens, roll-up chart and map units should permit easy set-up and storing by the user. They should be sufficiently opaque to stop undesirable light filtration. Sloped shelf and copy display units should be easily adjustable in height, and the capability to fix these units to adjacent horizontal or vertical surfaces would eliminate duplication of supports.

The design of graphics which form part of the information system should be consistent in and around the total office space. The scale and placement of these graphics must permit the user comfortable visual access to the displayed information.

All exposed surfaces, hardware, etc., should be smooth, clean and snag-free to decrease the possibility of personal injury or damage to user's clothing. Corners and edges should also be well rounded and smooth.

Display units should be mobile, or easily movable by the user, so that work stations, and the total work area has more flexibility, thus adding to user comfort and overall efficiency. Surfaces like chalkboards, must provide the necessary stability to permit the user to write, draw, pin to, etc.

SUB-SYSTEM 1,
FURNITURE
DISPLAY, 1.4.a.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	<ul style="list-style-type: none"> side chairs arm chairs steno chairs swivel tilt chairs swivel tilt armchairs stools perches stacking chairs folding chairs fixed seating benches lounge chairs lounge sofas 	<ul style="list-style-type: none"> time fire alarm signage PA system muzak Intercom
Furniture/Horizontal Surfaces/ Supports	<ul style="list-style-type: none"> work tables reference tables stepped tables stepped desks single pedestal desks double pedestal desks typing run-offs reference run-offs roll top desks mobile work tables mobile machine tables conference tables drafting tables low counter tops high counter tops 	<ul style="list-style-type: none"> Electric/Electronic/General wiring weight wiring location convenience outlets vending machines voltage levels telephone cables telex cables coaxial cables TV coaxial cables computer distribution system
Furniture/Storage	<ul style="list-style-type: none"> clothes footwear handbags/briefcases hats packages tools drawing equipment stationery office supplies duplicating supplies print-outs tapes microfilm photographs art supplies valuables machines documents books/catalogs/binders folders ledgers dead files active files individual files floating files group files mechanical files drawing files card file drawers kardex keypunch cards. 	<ul style="list-style-type: none"> Lighting/Fixtures type and location ceiling wall desk freestanding occasional display Lighting/Light Source incandescent fluorescent natural Lighting/Switches type and location Acoustics/Reverberation Times furnishings baffles Acoustics/Sound Sources people noise machine noise Structure/Building materials dimensions/shape/layout structural properties finishes flexibility thickness
Furnishings/General	<ul style="list-style-type: none"> carpets waste bins letter trays ash trays desk pads personal reference indices glass tops chair mats clocks mirror pictures hangings 	
Space Division/Partitions	<ul style="list-style-type: none"> fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed 	
Electric/Electronic/Communications	<ul style="list-style-type: none"> telephone teletype computer terminal TV bw/colour/closed radio 	

SUB-SYSTEM INTERFACES

Displays may interface with all types of seating, horizontal surfaces, storage, other display units, partitions and structural building materials. They may be fixed to, butted against or hung from any of these other sub-systems. Therefore, their design detail should complement these other sub-systems and should provide the scratch, abrasion and impact resistance necessary to prevent damage from or to these sub-system components. Whether display units are free standing or an integrated part of another sub-system or modular furniture components, they must not damage floors, carpets, tiles, wall surfaces, ceilings, or general furnishing accessories.

Display items such as directory boards or projection screens may require interface with the electric/electronic sub-system to permit sound and sight production at their surfaces. Where this need occurs, provision for electrical service such as coaxial cable, telephone wiring, illumination wiring, etc., must be made.

Lighting fixtures may be an integral part of a display unit, part of another sub-system or an independent object. If the interface between display units and lighting is to be successful, particular care should be given as to the location of the light source, type and intensity of illumination, type and location of switches.

Window Coverings

2.1.a

SUB-SYSTEM 2,
FURNISHINGS
WINDOW COVERINGS, 2.1.a.

CURTAINS
DRAPES
BLINDS
HARDWARE

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Window coverings are a mandatory requirement from the purchaser's point of view, to aid in light and sound control within the office, and to enhance the overall interior decor, thus adding to the efficiency and general well being of all user groups. On the other hand, the increasing use of reflective and fitted glazing in office structures tends to render redundant some of the utilitarian aspects of window coverings. Increasingly, therefore, aesthetic or decorative value may be given prime consideration by management as they contribute to the overall image. Window coverings may be curtains, drapery, blinds or be a combination of any two or all three items.

Initial and long term cost are prime considerations to the purchaser. In addition, these factors plus the degree of inflammability and non-toxicity, influence the purchaser's decision when buying window coverings as they affect his insurability and insurance rates. Other purchaser's criteria are the quality, durability, ease of maintenance and long-term appearance of window coverings. Window coverings which are guaranteed to retain their original appearance after a period of continuous use and maintenance would be a real advantage to the purchaser, since all too often these items retain their new appearance for only a short while after purchase.

Another contributing factor to the rapid deterioration of window coverings is the hardware used to open, close or otherwise adjust the window coverings. Too often these hardware items are not readily accessible, or easily operable, which may cause the user to damage the operating hardware or to pull on the drapery material itself, causing extra and unnecessary wear and tear to these materials.

Because labour costs are a major concern to the purchaser, window coverings and associated hardware should be readily accessible for in-place cleaning and maintenance, and easily demountable for outside servicing.

The purchaser's cost to maintain window coverings could be further minimized if they were impermeable to liquids and resistant to damage from staining, fading or abrasion.

Although Venetian blinds cannot be considered interchangeable with drapery as their acoustic and decorative characteristics are quite different, they may be useful for light control and privacy. While they may be resistant to damage, cost of maintenance becomes a consideration. Roller blinds which are integrated fully into a window sash, may initially be more expensive than conventional blinds, but are less likely to be damaged, may be easier to operate, and, depending on detailing, may have improved appearance.

USER'S CRITERIA - SUMMARY

User Activity	visual and acoustic control associated with: conversation conference seminars meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing
Related Equipment	terminals intercoms projectors television sets
Utility	maintenance convenience removability safety

USER'S CRITERIA

Window coverings may aid a number of user activities, including reading, writing, viewing and conversation. It is important, therefore, that window coverings should provide the user with control of exterior light and contribute to his visual privacy. Even where these factors are not prime considerations, window coverings may greatly reduce exterior sound and contribute to a reduction of noise within the office.

In addition to working smoothly and quietly, all hardware must be straight forward to operate.

Hardware should be smooth and free from sharp corners or edges which may damage the drapery fabric itself or the user's clothing, and cause injury.

SUB-SYSTEM 2,
FURNISHINGS
WINDOW COVERINGS, 2.1.a.

SUB-SYSTEM INTERFACES - SUMMARY

Space Division/Partitions	fixed fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging
Lighting/Fixtures	type and location valance/indirect
Task Lighting Levels	corridors lobbies stairways lavatories cafeterias casual desk work reading rooms testing general assembly drafting counter display fine drafting prolonged seeing tasks severe office tasks colour identification very severe seeing tasks
Acoustics/Reverberation Times	windows window coverings furnishings
Frequency and Levels/Sources	people machines impact outside
HVAC/Temperature	heat gain heat loss
Structure/Glazed Areas	shades fixed openings hardware screen sliding door
Walls, Ceilings, Floors, Hardware	structural properties finishes

SUB-SYSTEM INTERFACES

Window coverings interface with partitions and walls in that they are connected to and supported by these sub-systems and are in frequent contact with all wall surfacing materials or finishes. Window covering hardware should be installed in a manner appropriate to the type of partition or wall material to which they are fitted. Window coverings should be resistant to damage from abrasion when in contact with plaster, wood, block, tile or any other wall finish or surface. In addition, curtains and drapery should be resistant to soiling from window hardware, to aluminum, grease and dirt which may infiltrate poorly fitting windows.

Because window coverings interface with valance lighting, particular attention should be paid to the problems of maintaining both lighting and window coverings within the valance. Heat generated by lighting should not adversely affect curtains, drapes or blinds, therefore care must be taken that there is no direct interface between these items. Moreover, arrangements must be made to dissipate the heat from light sources as quickly as possible. Finally, the interface between window coverings, valance and lighting should be so detailed that the user can have complete control over exterior light sources.

Window coverings in offices contribute to the reduction of noise by absorbing sound generated inside the office, and by insulating the area against externally produced noise. The weight of the window covering, and the detailing of its interface with a window, wall, ceiling, etc., should be such as to facilitate this effect.

Window coverings also interface with SS 8 (HVAC), in that they may interface directly with convectors, and in that they may contribute to a reduction in the heat loss or heat gain within the office. Window coverings should not interfere with the flow of air from convectors. However, in anticipating the possibility that window coverings may come in contact with HVAC hardware, selection should be made of fabrics which are heat, stain, abrasion and pull resistant.

Floor Coverings

2.1.b

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Wall-to-wall carpeting or large area carpets are optional in certain traditional office schemes, but mandatory in open office planning as an acoustical aid. From the purchaser's point of view, user satisfaction is critical and is related to the utility, comfort and appearance of these items, their safety in use and their compatibility with the office decor. Their non-toxicity and degree of inflammability are critical to the user as well as the purchaser, in that they influence the purchaser's insurability and insurance rates.

Other purchaser's criteria related to carpets are their quality and initial cost - factors which must be balanced against the anticipated life of the carpet. The quality of the item, its durability and appearance after a period of continuous use and maintenance are also important factors. All too often, even the most costly carpet retains its original appearance only a short while. This is due in part, to the fact that carpets in offices are subjected to particularly heavy traffic and conditions of use, as described below. Thus, from the purchaser's vantage point, it might be desirable to have access to carpets which are guaranteed to retain their original quality and appearance after a period of use and repeated maintenance. Of course, the long-term appearance of a carpet is also related to the ease and regularity with which it is maintained.

Labour costs and hence maintenance costs are a particular concern of the purchaser. For this reason, wall-to-wall carpets have an advantage over area carpets - which may be hazardous to users and which imply care of two types of floor coverings. As well, hard or resilient flooring is costly to maintain. Carpet designed or selected for use in offices should resist damage due to staining, fading, puncture, abrasion, etc. Carpet fabric, weave design and colour selection could help mask staining which may occur. Fade resistance is a quality which may extend the life of a carpet in that the purchaser may interchange worn sections of carpet with segments which have received little use.

USER'S CRITERIA - SUMMARY

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking walking drawing pasting painting layout modelling filing cataloging sorting collating mailing storing
Related Equipment	typewriters calculators duplicators copiers recorders shredders binding equipment cutters postage meters terminals Intercoms telephones projectors television sets telex equipment
Utility	maintenance convenience rearrangement movability safety

USER'S CRITERIA

Wall-to-wall carpeting, and/or small area carpeting are utilized in most offices. These types of floor coverings contribute to the comfort and efficiency of all user groups. Carpeting must be lint and allergy free; sanitized and anti-static; and non-irritating to skin. The adhesive, backing and carpeting fibre itself should be odour free, immediately following installation. All carpets, particularly small area carpets, should be provided with non-skid backing. Snag-free, perhaps cut pile as opposed to loop type carpets, are to be prepared to prevent damage by catching on footwear, casters, body extremities, etc. If a loop pile carpet is utilized, care should be taken to ensure that if snagging results, it is with the loss of one loop at a time, only.

Carpets receive particularly heavy use in offices and should, therefore, be resistant to damage resulting from: organic and inorganic substances; writing instruments; cigarette burns; shoe polish; grease, dirt and rust stains; and to abrasion, puncture, and the effects of furniture and people movement. As carpets may be frequently subjected to moisture, they should dry quickly, resist mildew and shrinkage, curling or swelling.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating	side chairs arm chairs steno chairs swivel tilt chairs swivel tilt armchairs stools stacking chairs folding chairs fixed seating benches lounge chairs lounge sofas	Space Division/Partitions	fixed full height relocatable full height relocatable partial height relocatable folding freestanding hanging fixed
Furniture/Horizontal Surfaces/ Supports	work tables reference tables stepped tables stepped desks single pedestal desks double pedestal desks typing run-offs reference run-offs typing run-offs reference run-offs roll top desks mobile work tables mobile machine tables conference tables drafting tables dining tables coffee tables folding tables stacking tables low counter tops high counter tops	Electric/Electronic/Communications	intercoms telephones teletypes computer terminals TV bw/colour/closed radios fire alarms signage PA system muzak
Furniture/Storage	clothing footwear handbags/briefcases hats packages stationery office supplies tools drawing equipment duplicating supplies print-outs tapes microfilm photographs art supplies valuables documents books/catalogs/binders folders ledgers dead files active files individual files floating files group files mechanical files drawing files card file drawers kardex keypunch cards machines	Electric/Electronic/General	vending machines convenience outlets telephone cables telex cables coaxial cables TV coaxial cables computer distribution systems
Furniture/Display	chalkboard tackboard pegboard magnetic bulletin board projection roll-up maps/charts display case sloped shelf signage copy	Lighting/Fixtures	type and location
Furnishings/Dressing	coat trees coat racks boot racks umbrella stands hat racks	Plumbing/Fixtures	drinking fountains water coolers photo copy
Furnishings/General	waste bins ash trays chair mats cushions sculpture plants	Acoustics/Reverberation Times	furnishings
		Acoustics/Sound Sources	people noise machine noise plumbing noise impact noise outside noise TV and radios vibration
		HVAC/Temperature	heat gain - machines heat gain - lights heat loss
		Structure/Glazed Areas	sliding doors
		Structure/Walls/Ceilings, Floors/Hardware	safety deposit vaults materials dimensions/shape/layout finishes flexibility door hardware

SUB-SYSTEM INTERFACES

Wall-to-wall carpets and area carpets interface with items in several Sub-systems. In SS 1 (FURNITURE) and SS 4 (ELECTRIC/ELECTRONIC), interfaces occur with tables, desks, files, seating and horizontal surfaces, TV sets and possibly, with a computer terminal. Carpets should, as a result, be capable of recovering quickly from indentation caused by heavy point loads. On the other hand, the supports of these items should be designed to minimize the effect of point loading and to facilitate their movement without damage to carpet.

Carpets contribute to the reduction of noise in offices by reducing impact noises and by absorbing noise. Good quality carpet and underlay will enhance this quality of carpeting and will reduce the transmission of sound through floor slabs into adjacent areas.

Carpets may increase user comfort in a number of ways. Insofar as temperature is concerned, carpets and good quality underlay reduce heat loss, through floor slabs, and provide users with a comfortable alternative to cold tile or other resilient flooring. In this regard, consideration should be given to the potential of indoor/outdoor carpets in washrooms as an alternative to tile flooring.

Carpets interface with all items in SS 9 (STRUCTURE), in that they are in direct contact with a variety of floor and wall surfacing materials. Carpets should be resistant to soiling from aluminum, sash, grease, dirt and possibly, weathering due to poorly fitting sash. Consideration of the interface between wall and carpet, may suggest the utility of the carpeted base as a means of reducing the costs of maintaining other types of base - i.e. - of the necessity to wipe down rubber or vinyl bases with the potential for damage to adjacent carpets.

COMMENTS

A tagging system which would label all carpeting material with its manufacturer's name, its date of manufacture, fabric colour and finish type, could prove useful to purchasers in the reordering, replacements and/or maintenance of products.

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost Insurability Maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

For the owners of large office complexes, built over a period of several years, the ability to use partitions of several manufacturing origins in the same space would be a major advantage (a similar major need exists with school, college and university authorities). Almost no partitions of diverse manufacturing origin will mutually interface. This market-place diversity in reality is of benefit to no one. The manufacturers of metal and gypsum partition systems would benefit their customers considerably if a series of standard methods of head, base, and wall junction details were agreed upon in the partition manufacturing industry.

Full height partitions should be able to support hung shelves and cupboards.

Partitions are required in the following types:

- fixed full height
- fixed partial height
- relocatable full height
- relocatable partial height
- relocatable folding
- freestanding
- hanging
- where the particular selection of partition type for a specific user group will be determined by the requirements of the project under consideration.

PURCHASER'S CRITERIA

Partitions are used in association with all user groups. With a trend towards open office layout, or office landscaping, partitions tend to be used where acoustical or visual privacy is needed. As a consequence, partition systems in an installed situation should have good acoustical performance.

The first cost of a partition tends to relate reasonably directly with its quality, resistance to wear and tear, and consequently its maintenance cost. This cost benefit assessment being limited to the range of competitively priced commercial partition systems. Resistance to wear and tear, and reasonable maintenance costs is not an automatic feature of expensive, custom designed and manufactured partition systems.

Partitions should be easily relocatable, if possible, without the need to use skilled mechanics, where building services are not involved. The relocating of partitions should not necessitate the repair and refinishing of adjoining surfaces.

Quality should be such as to avoid a rapid deterioration of a partition's surfaces and finishes to a worn and shabby appearance. Partition finishes must be able to withstand fairly strong impacts from pointed and hard objects without permanently denting or marking.

A surface which was soft, yet tough and resilient, would, in many instances, be more resistant to wear and tear than one which was very hard.

Partition systems should offer the ability to remove intermediate panels (known as a non-progressive system), without the necessity of taking down a whole wall of panels, in order to remove a single panel.

Partition systems should be as near as possible, featureless, and visually jointless. There is no particular merit in constant awareness of the joints between panels.

Many inexpensive partition systems which use metal extrusions or formed studs with gypsum board infill, produce a room environment for users which is seriously wearing. These partition types usually have black or coloured plastic cover strips, (usually called "feature" strips for sales purposes) which draw attention to the joints. The combined effect of these strips, with comparable suspension channels to lay-in ceilings, create an atmosphere of jazzy visual chaos. The best partitions from a user's performance viewpoint are those which have flat, smooth, plane surfaces, with the simplest possible base and head details, and as near invisible, hair-line butt joints between panels, without cover or filler strips. Room decoration is the business of the user, not the partition designer or manufacturer.

Partition surfaces must be capable of holding papers and other materials secured by standard commercial adhesive tapes without stripping off the partition finishes when they are removed. To expect that only magnets will be used on steel partitions is unrealistic. In many instances where heavy materials are to be secured, temporarily, to a partition or screen, pin-up board is still the best system. It is difficult to secure cardboard items to a partition with tape without damaging either the item or partition, while most magnets lack adequate power to stop heavy objects from sliding down, a wall.

USER'S CRITERIA - SUMMARY

User	conversation conference seminars meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing storing
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Related Equipment Equipment related to different partition types

	FIXED		RELOC- ATABLE		FREE- STANDING	
	FH	PH	FH	PH	FH	PH
Thermostats	X		X			
Humidistats	X		X			
Lighting Switches	X	X	X	X		
Convenience Outlets	X	X	X	X	X	X
Pin-up Boards	X	X	X	X	X	X
Writing Surfaces	X	X	X	X	X	X
Electrified Displays	X	X	X	X	X	X
Programme Control Boards	X	X	X	X	X	X
Intercoms	X	X	X	X	X	X
Telephones	X	X	X	X	X	X
Projectors	X	X	X	X		
Television Sets	X	X	X	X		
Wall hung Electronic Equipment	X	X	X	X	X	X
Shelving	X	X	X	X	X	X
Cabinets	X	X	X	X	X	X

Utility	maintenance convenience rearrangement movability safety acoustic isolation
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*FH - FULL HEIGHT
PH - PARTIAL HEIGHT

SUB-SYSTEM 3,
SPACE DIVISION,
PARTITIONS

USER'S CRITERIA

All user activities can take place in spaces which use one or more of the partition types listed under purchaser's criteria.

A basic user requirement of all types of partition is spatial division, which will normally involve visual division. Depending on the specific user circumstances, acoustic privacy may also be required.

All partition types should be stable against accidental impacts, and also be easily and inexpensively relocated to facilitate the rearrangement of user space.

User equipment which relates to partitions has been summarized above.

The surface finishes of all partitions should be resistant to damage from normal impacts, wear and tear. Surfaces should be of plain colours or tones, without strong decorative patterns. The provision of decoration should be left to the user's discretion. Colours should generally have a high reflectance factor, to reduce the possibility of harsh visual contrasts. Again, strong colours and patterns, or the use of dark finishes such as wood grain finishes should only be used in specifically designed situations, where care is taken to design the whole space and its services.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Seating

side chairs
arm chairs
steno chairs
swivel tilt chairs
swivel tilt armchairs
stools
stacking chairs
folding chairs
fixed seating
fixed benches
lounge chairs
lounge sofas

Furniture/Horizontal Surfaces/
Supports

work tables
reference tables
stepped tables
stepped desks
single pedestal desks
double pedestal desks
typing run-offs
reference run-offs
roll top desks
mobile work tables
mobile machine tables
conference tables
drafting tables
coffee tables
end tables
dining tables
folding tables
stacking tables
low counter tops
high counter tops

Furniture/Storage

storage units for:
personal belongings
stationery supplies
office supplies
filing
machines

Furniture/Display

chalkboard
writing surface
tackboard
pegboard
magnetic
bulletin board
projection
roll-up maps/charts
display case
sloped shelf
signage
copy

Furnishings/General

carpets
coat hooks
coat rods
coat hangers
coat racks
mirrors
boot racks

Building/Washroom Hardware

umbrella stands
hat racks
clocks
mirrors
pictures
hangings
sculpture
plants

towel dispensers
towel rods
towel shelves
dryers
toilet partitions
TP holders
kleenex holders
sanitary napkin holders
sanitary napkin disposals
waste
coat hooks

Space Division/Partitions

fixed full height
relocatable full height
relocatable partial height
relocatable folding
freestanding
hanging
fixed

Electric/Electronic/Communications

intercoms
telephones
teletype
computer terminals
TV bw/colour/closed
radios
time
fire alarms
signage
P.A. systems
muzak

Electric/Electronic/General

vending machines
wiring weight
wiring location
convenience outlets
voltage levels
telephone cables
telex cables
coaxial cables TV
coaxial cables computer
distribution system

Lighting/Fixtures

wall
occasional
display
valance/indirect

Lighting/Light Sources

incandescent
fluorescent
natural

Lighting/Switches

rheostat
2 position
3 position
touch
switch
low voltage

Plumbing/Fixtures

lavatory basins
water closets
urinals
food preparation sinks
drinking fountains
water coolers
photo copy

Plumbing/Services

hot/cold
soil returns
vents
drinking water
access

Plumbing/Hardware

fire hose cabinets
sprinkler systems

Acoustics/Reverberation Times

floors
ceilings
windows
window coverings
furniture
furnishings
baffles
doors

SUB-SYSTEM 3,
SPACE DIVISION,
PARTITIONS

Acoustics/Frequency and Levels/
Sources.

people noise
machine noise
plumbing
impact noise
outside noise
TV and radios
vibration

HVAC/Temperature

population
inside
outside
heat gain - machines
heat gain - lights
heat loss

HVAC/Plant

central enclosure
unitary enclosure
control/zoning
control/switching

Structure/Building

safety deposit vaults
materials
dimensions/shape/layout
structural properties
finishes
flexibility
thickness
door hardware

Wiring may occur inside partitions, or be accommodated in surface mounted or flush recessed standard wiring channels. The use of standard wiring channels tends to facilitate access to relocatable wiring systems. Such relocatable wiring systems are a necessity if partitions are to be truly relocatable.

Sub-system 5 Lighting/Fixtures/Sources and Switches, impose interface requirements on partitions, concerned primarily with the accommodation of switches, and surface reflectance characteristics, as part of a room's overall luminous environmental quality.

Interface with Sub-system 6 - PLUMBING, is concerned with the support of wall mounted fixtures, most of which will transfer their own weight plus that of an adult to their wall fixings. Partitions must also be able to accommodate plumbing pipes and fire hose cabinets, or be suited to the formation of appropriate ducts for these purposes.

The acoustic requirements of partitions relate to two general situations. The first concerns all partitions used in "office landscape" layouts. The acoustic environment is critical in these situations, where every attempt should be made to localize noise at its source. As a consequence, all partitions used in office landscape layouts should have the maximum sound absorption characteristics, without limiting other functions.

the second general application concerns those situations where normally enclosed rooms are required. In these instances, interface with ceilings is critical, as are the acoustic isolation properties of the partitions used.

SUB-SYSTEM INTERFACES

Interface between all partition types and "Furniture/Seating", "Furniture/Horizontal Surfaces/Supports", is primarily concerned with impact and wear and tear between partition surfaces and furniture items.

"Furniture Storage" interface requirements concern means of fixing storage units and shelving to partition surfaces. This requirement affects the strength and stability of the partition system, and the problem of repairing the partition surface when storage units are relocated.

"Furniture Display" interface requirements like the fixing of storage units to partitions, present a problem of support and repair. It is probable that writing surfaces and tackboards would be produced as an integral part of partition finishes. Where this is the case, it is important to ensure flush hair-line joints between adjoining partition panels to provide writing and tack surfaces over several adjoining partition panels. For certain types of bulletin or display boards, the partitions may be required to carry considerable weight, and furnish extensive wiring to these boards.

The interface with furnishings concerns carpet, and miscellaneous manufactured items. The interface with carpet involves the provision of a partition base detail which will cover the joint between carpet and partition face, allowing adequate provision for relative shrinkage movements. In the majority of installations, partitions will be installed on top of a continuous carpet floor finish, making necessary careful co-ordination between partition and carpet manufacturers if carpet is not to be left permanently damaged when partition relocations take place. To reduce damage to a minimum, fixed partitions should require a minimum of floor anchoring devices to stabilize them. In addition, commensurate with safety, fire and stability requirements, partitions should be as light as possible to reduce carpet crushing to a minimum. For freestanding screens and light relocatable partitions, support details in the form of feet, or small area post ends should be avoided, as again, these tend to cause serious carpet damage, through permanent crushing or puncture.

Partition bases should be designed to withstand and protect partitions from damage by floor cleaning machines.

Miscellaneous manufactured furnishings fall mainly in the category of requiring support from partitions through the use of mechanical fastenings or hangers. It would be of considerable convenience if all manufacturers of partitions provided some form of hanging rail or ledge as a standard detail for partition heads. Such a detail would facilitate the use of partition surfaces by many users reticent to drill holes in partitions for the temporary anchoring of heavy objects.

The fixing requirements for "Building/Washroom Hardware" are similar to those for miscellaneous manufactured furnishings.

Interface requirements between partitions, concern problems of joining and a matching of detailing. These requirements have been described under "Purchaser's Criteria".

Interface with Sub-system 4 ELECTRIC/ELECTRONIC, both Communications and General, concerns a need to support equipment secured to the face of partitions, and the accommodation of wiring and switches serving such equipment.

Interface between the HVAC Sub-system 8, and partitions is concerned primarily with the fixing of thermostats, humidistats and other HVAC controls and their associated wiring or pneumatic lines, within a partition thickness. In a limited number of instances, partitions will be used to enclose HVAC equipment, when the noise control and access could be important factors. Partitions could also be used to form duct shafts, and would probably be required to accommodate thermal insulation.

Interface with Sub-system 9 STRUCTURE/BUILDING, concerns accommodation to the dimensions and fixings requirements of other materials and equipment used in the construction of a specific building. These requirements can be generalized for common interfaces which tend to occur in all buildings, such as with exterior walls and floors, and would be customized for specific situations on all projects.

COMMENTS

A tagging system which would label, in a standard, inconspicuous location, (for instance, behind a removable base) each partition system with the manufacturer's name, product number, date of manufacture, fabric colour, paint colour, finish type, fire rating and load capacity reference, could prove useful to purchasers in re-ordering, replacement or maintenance of products.

A standard convention among partition manufacturers standardizing head, base and jointing details, is a necessity from the purchaser's viewpoint. This is particularly necessary in very large office buildings where numerous partition changes are a common event. Of particular importance in this proposed convention on joints, are those concerned with floor (carpet) and ceiling interfaces, and electric/electronic wiring and switch interfaces. It is strongly recommended that the manufacturers of partitions, lighting-ceiling systems and electric/electronic wiring devices and methods should develop as a matter of urgency, interfacing techniques and product lines which make relocatability and interchangeability an early fact, rather than an oft quoted ideal. It is also suggested that to encourage such co-operative developments that governments and other large office space users and developers require as a pre-condition of product purchase, the interface compatibility outlined above between partitions, lighting-ceiling systems and electric/electronic systems. Such a requirement would be in the long-term interest of purchasers in simplifying and speeding-up spatial rearrangements, while cutting the costs of such work, in both the short and long-term.

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical
	2 Private Secretarial
	3 Machine Operator
	4 Professional
	5 Professional (Other)
	6 Senior Executive
	7 Communal Areas

Cost/Quality/Utility	initial cost
	insurability
	maintenance
	economic efficiency
	renewability
	construction
	finish
	appearance
	durability
	user efficiency
	flexibility

Standards	electrical safety
	fire safety
	toxicity
	general safety
	manufacturing

PURCHASER'S CRITERIA

The ELECTRIC/ELECTRONIC sub-system will have an increasingly important role to play in the function of all types of office as time passes. An increasing number of office work functions are being mechanised and automated, resulting in a drastic increase in the degree of electrification used.

This trend is associated particularly with the use of computers and computer terminals, recording machines, and a variety of typing, printing and calculating machines. There is already a degree of electrified mechanization associated with all the user groups listed above.

In choosing an electric/electronic system for an office building, the purchaser will be concerned with its initial maintenance and operating cost, its quality and safety.

With a growing trend towards unpredictable change in office layouts, the need for ease of relocatability of office electric/electronic systems is a mandatory requirement. Such changes should be possible with a minimum involvement of specialist labour to keep costs and delays to a minimum. In addition, changes should permit re-use of electric/electronic sub-system parts displaced.

Those elements of the electric/electronic sub-system which are exposed to view and public operation, should be of simple design. Parts should be foolproof against misuse, with rounded surfaces to prevent injury, and of non-allergic and non-toxic, fire resistant, material. Equipment intended for user control should express its mode of operation clearly through its design.

Electric/Electronic sub-system components should be CSA (Canadian Standards Association) labelled, and will be required to meet the requirements of Provincial electrical safety codes. Before purchasing any relocatable electrical wiring or component system, the purchaser should ensure that the products are approved for use.

Elements of relocatable electric/electronic systems should be fully interchangeable, using the minimum number of products. It should be possible to replace parts of sub-systems without the necessity of discarding whole multiple-function elements.

With a growing use of "office-landscaping" and similar office planning techniques, there is a growing tendency for office furniture and equipment to be moved more often, to achieve optimum working arrangements. Electric/electronic systems, including telephone systems which derive their electrified services from the floor, tend to be overly restrictive. All under-floor wiring systems necessitate puncturing of the floor structure surface and the floor finish (carpet). Every time a service is moved, it necessitates repair of the floor structure finish, as well as the finish. If the punctured surface is structural or part of a fire graded assembly, multiple punctures over a number of years can seriously deteriorate the efficiency of the floor. Underfloor systems usually involve the use of upstanding convenience outlets, which are both, a tripping hazard to the users, and also a nuisance to floor maintenance staff. The provision of all electric/electronic services from the ceiling, except those associated with computers, can overcome all the problems listed above. Such an arrangement assumes proper interface between the electric/electronic system and the ceiling system. Where such an interface exists, the electric/electronic service "columns" used can be moved without cutting, patching or costly electrical and other work. The floor to ceiling service columns, a necessity in this approach can be criticised on aesthetic grounds, or

as a planning restriction. However, it will be found that in "office-landscape" planning arrangements and in conventional layouts using surface applied "electric/electronic pillars", that the service columns will seldom restrict use, or be even noticeable.

The electric/electronic sub-system will be required to provide the following communications and general functions:

Communications
Intercoms
telephones
teletypes
computer terminals
TV bw/colour/closed
radios
time
fire alarms
signage
P.A. system
muzak

General
vending machines
wiring weight
wiring location
convenience outlets
vending machines
voltage levels
telephone cables
telex cables
coaxial cables TV
coaxial cables computer
distribution systems

USER'S CRITERIA - SUMMARY

User Activity	conversation
	conference
	seminars
	meetings
	reading
	studying
	thinking
	writing
	eating
	drinking
	drawing
	pasting
	painting
	layout
	modelling
	filing
	cataloging
	sorting
Related Equipment	collating
	mailing
	storing
	typewriters
	calculators
	duplicators
	copiers
	recorders
	shredders
	binding equipment
	cutters
	postage meters
	terminals
	intercoms
	telephones
	projectors
	television sets
	telex equipment
	smoke detection
	computers
	computer terminals
	video recorders
	display boards
	fire alarms
	P.A. systems
	radios
	teletypes
	clocks
	signage
	muzak
	vending machines
	surveillance systems
	security systems

SUB-SYSTEM 4,
ELECTRIC/ELECTRONIC

Utility

maintenance
convenience
rearrangement
movability
safety

USER'S CRITERIA

As noted under Purchaser's Criteria, all office activities require electrical services either directly or indirectly (as in the case of lighting). Many functions require convenience outlets, while others need direct wiring service. The actual density of service provided on any specific project should be determined through a project-oriented "user requirements study". Provision should be made in all office buildings for substantial increases in the future amount of electrical services needed. Provision best takes the form of spare transformer and primary switch gear, and secondary distribution board service room space, and provision in floor/ceiling plenums of space for the addition of future services. Through the use of ceiling plenums, and "cordset" wiring techniques, the provision of empty power ducts in floors can be avoided.

Electric/electronic services must be easily moved to facilitate user work habit, and functional changes.

All equipment should be easily and safely usable, and withstand heavy wear and tear.

The above summary illustrates the range of equipment which the electric/electronic sub-system should be able to service in office buildings.

SUB-SYSTEM INTERFACES - SUMMARY

Furniture/Horizontal Surfaces/
Supports

work tables
reference tables
stepped tables
stepped desks
single pedestal desks
double pedestal desks
typing run-offs
reference run-offs
roll top desks
mobile work tables
mobile machine tables
drafting tables
low counter tops
high counter tops

Furniture/Display

display boards
signage
bulletin boards

Furnishings/Accessories

clocks
sculpture

Building/Washroom

dryers

Space Division/Partitions

fixed full height
relocatable full height
relocatable partial height
relocatable folding
freestanding
hanging
fixed

Lighting/Fixtures

outdoor
ceiling
wall
desk
freestanding
occasional
display
valance/indirect

Lighting/Sources

incandescent
fluorescent
natural

Lighting/Switches

rheostat
2 position
3 position
touch
switch
low voltage

Lighting/Task-Lighting Levels

corridors
lobbies
stairways
lavatories
cafeterias
casual desk work
reading rooms
testing
general assembly
drafting
counter display
fine drafting
prolonged seeing tasks
severe office tasks
colour identification
very severe seeing tasks

Plumbing/Fixtures

water coolers
photo copy

Acoustics/Frequency & Levels

machines
TV and radios
vibration

HVAC/PLANT

central
unitary
humidifiers
control/switching

Structure/Walls/Ceilings/Floors

floor thickness
wall thickness

SUB-SYSTEM INTERFACES

The interface between the electric/electronic sub-system and furniture is primarily concerned with bringing electrical service to equipment resting on horizontal work surfaces. In "office landscape" plans where electrical service is brought from the ceiling, the ability to connect horizontal working surfaces together electrically is an advantage. In some instances, three to four convenience outlets per working surface may be required.

Display boards and bulletin boards, can be simple, illuminated surfaces, to complex, computer operated boards of the type used in Stock Exchanges. In both instances, access to wiring and operating parts for servicing is vital.

The interface requirements with partitions are concerned primarily with the passage of wiring and the accommodation of switches. Wiring passages should be of sufficient size to pass male and female plugged cordsets, about 1½ inches in diameter, to facilitate the use of relocatable wiring systems.

The electric/electronic interface with the Lighting sub-system will be concerned with the provision of power and switching controls. It is strongly recommended that all wiring be of the relocatable cordset type to permit full rearrangement of the lighting system at minimum cost.

HVAC electric/electronic requirements are concerned with the universal provision of power for motor and other equipment operations, to the use of electricity as a fuel.

The principal interface consideration between the electric/electronic and structure sub-systems concerns the provision of adequate space in floor plenums, vertical service shafts, switch and transformer rooms to accommodate future extensions of service. The space should be readily accessible and clear of major obstructions, which would cause serious detours. Space in plenums should provide a means of suspending neatly, cordset wiring, as well as metal raceways and ducts.

Special provision is required for computer rooms in the form of a specially designed proprietary elevated floor. This floor which is raised above the structural floor slab by about 1' 0" is foreseen by computer manufacturing companies as a long-term future need. Unless computers are redesigned for top air and wiring service. Due to the inconvenience and hazards caused by raising computer floors above regular floor levels, it is proposed that special provision be made in large rental buildings for this function. It is proposed that about 25% of the total area of each floor be prepared for computer installation. As computers require controlled climate conditions and no natural light, it is proposed that area within the building core, with its structural floor dropped 1' 0", be provided, to give flush-finished floors. By this means, any tenant may have its computer services on its own working floor, with the possibility of connecting together several "floors" of computers by private vertical circulation. The same dropped floor provision can provide a means of dealing with the rearrangement of washrooms from floor to floor.

SUB-SYSTEM 4,
ELECTRIC/ELECTRONIC

COMMENTS

There is a need to develop ultra-thin wiring systems which could be laid on top of concrete floor surfaces, and below floor finishes. These systems should be tough enough to resist accidental fracture or shorting from normal floor impacts, and puncturing stresses. Similar wiring systems might be applied to wall surfaces. The ultra-thin wiring systems should interface through appropriate attachments to the normally wired relocatable cordset systems.

A totally relocatable wiring system, probably based on the use of cordsets, is a mandatory requirement to permit the full use of spatial flexibility in "office landscape" settings. This relocatable wiring system which can be similar in concept to that developed and used in the Metropolitan Toronto School Board's S.E.F. Building System, should have a full range of service terminal items, floor to ceiling columnettes, and wall mounted pilasters.



PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost Insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

All user groups require a luminous environment of high quality to permit as near ideal seeing conditions as practical. Certain tasks involving demanding visual accuracy such as drafting, or operating complex machines, without routine operation patterns, will require the provision of above average luminous conditions.

In discussing the lighting sub-system, mention is made here of the luminous environment. It is mandatory to consider the combined effect of wall partition, furniture, floor, as well as ceiling colours, tones, textures, in combination with the location and type of lighting in developing an appropriate luminous environment for any specific task.

"In offices today, a relatively high level of illumination of excellent quality is required to serve the needs of a wide variety of seeing tasks.

The lighting system may have to provide a uniform degree of illumination, since it is not possible to predict the location of office tasks. On the other hand, the illumination may not need to be uniform over the entire area, but care should be taken that the complete visual environment is lighted to attain luminance ratios within defined limits. Adequate diffusion is necessary to prevent shadows at or near the task that will reduce task luminance and which may be annoying or confusing.

The lighting sources should provide some control over brightness and reflected glare. Poor planning can result in discomfort, glare and loss of visual performance because of substantial loss in contrast of the task. This loss of contrast occurs when the reflected glare from the task and background makes the printing more difficult to read. The lighting system should provide values of visual comfort probability and contrast rendition factors to meet the current recommendations as set out by the Illuminating Engineering Society".*

While it may be possible to develop an overall "ideal" lighting solution, it is important to provide users with a means of enjoying temporary relief from such "optimum" conditions with either personally controlled local task lighting, or areas of the building which provide a contrast in character to the principal form of lighting.

In order to be acceptable, lighting systems must have reasonable first cost, as well as reasonable maintenance and operating cost. The latter considerations can be greatly influenced by the product design and installation.

Related to this consideration of quality, is the flexibility and renewability of a lighting system. All lighting systems should lend themselves to easy, rapid and inexpensive relocation of elements to suit changes in spatial function and layout. In this regard, it is important that fluorescent lighting systems which relate to a building module, such as 5' 0" X 5' 0", be capable of rotation through 90°, and be available in the $\frac{1}{2}$ module form.

Product lines should also offer the option to lower the lighting plane below that of the general ceiling plane.

It is strongly recommended that individual lighting units be of the simplest possible form and detailing, designed to give a lighting source, which, while restful, has character. Related to form is the quality of fixtures. Construction should be robust in order that units retain their appearance after a number of years of use, and maintenance.

All fixtures should be CSA (Canadian Standards Association) labelled, and appropriately constructed to suit the fire grading of the assembly in which they are to be incorporated.

The following summarizes the fixture types and locations which may be required, the types of light sources and switches available, and the tasks and functions which will require specific lighting consideration:

Fixtures - Type and Location

- outdoor
- ceiling
- wall
- desk
- freestanding
- occasional
- display
- valance/indirect

Light Sources

- incandescent
- fluorescent
- natural

Switches - Type and Location

- rheostat
- 2 position
- 3 position
- touch
- switch
- low voltage

Task Lighting Levels

- corridors
- lobbies
- stairways
- lavatories
- cafeterias
- casual desk work
- reading rooms
- testing
- general assembly
- drafting
- counter display
- fine drafting
- prolonged seeing tasks
- severe office tasks
- colour identification
- very severe seeing tasks

SUB-SYSTEM 5,
LIGHTING

USER'S AND HARDWARE CRITERIA

The user activities which require lighting and the equipment related to those activities are summarized below. It will be noted that whereas there may be a need to have a high level of general illumination available as a prime option, that secondary lighting options to suit the "mood" of some tasks could do much to take out the drudgery elements from many office tasks.

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing storing
Related Equipment	typewriters calculators duplicators copiers recorders shredders binding equipment cutters postage meters terminals intercoms telephones projectors television sets telex equipment teletype equipment

Further considerations of the User are concerned with:

Utility	maintenance convenience rearrangement movability safety
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From the user's viewpoint, there is a clear need for individual control of general lighting, which has been dealt with in greater detail in "Comments" below.

Similarly, secondary lighting systems intended to define and "customize" specific "user territories" in open office planning arrangements are required. Such secondary lighting systems should offer a wide variety of lighting types and design styles, to enable each user to obtain a personal luminous environment to suit as far as is reasonable, his lighting needs and aesthetic tastes.

All secondary lighting system components should be relocatable by the user and not require the services of electricians to rearrange furniture and space division elements. This requirement, applies to both, the lighting fixtures and their wiring back to the secondary distribution panels. Such user manipulated elements should include all wiring systems within the permanently built space, including all of those applied to surfaces within that space. For this purpose, there would appear to exist a need for the development of CSA labelled, and Electrical Authority approved user assembled wiring systems, as appliances, rather than construction services. There is also little doubt that the combined effects of the high hourly cost of specialized building labour, the conservatism and tardiness of building services standards setting committees, and of licensing and code enforcement authorities, combined with the generally poor management skills of contractors normally handling office alteration and renovation projects, are the prime reason for restraining major improvements in existing work environments.

The high cost, inefficiency and disruption caused by the traditional building industry in these matters, indicates a need for developing comprehensive secondary building systems, as "appliances" which could be wholly installed and changed by lay users. These secondary building systems should include:

furniture
equipment
partitions
electric/electronic wiring and terminal features
air-conditioning ducting and terminal features
lighting fixtures and wiring
plumbing services and terminal fixtures
all interior wall, floor and ceiling finishes

Secondary lighting systems should be readily attachable to a wide range of horizontal and vertical surfaces by a series of common attachment devices, of diverse manufacturing origin which do not require the use of tools to operate.

COMMENTS

There is a need to improve the quality of general lighting, rather than just the quantity, as has been the practice in the past. Considerations such as glare, extreme contrast, reflectance, although often discussed in lighting engineering circles as important matters which require attention in office lighting systems, seldom appear to be dealt with in common office lighting installations.

There is little doubt that action will replace talk when users and tenants set out detailed environmental criteria for building spaces as pre-conditions for working in them or renting them.

In addition to the need for a qualitative improvement of general lighting, there is a need to provide sufficient switch control for users to switch off the general lighting in the area of their individual floor space.

There is a further need for diverse secondary lighting systems forming part of the furniture sub-system, which is under user control locally.

Aside from the need for basic qualitative improvement of general lighting systems, there is a case to be made for the physiological improvement of lighting systems.

New concepts in open office construction, the same as in open school construction, divide a built environment into two distinct parts, including: the fabric of the building, its frame, outside walls, floors, ceilings, the primary elements of the air-conditioning system, general lighting system, electric/electronic systems and plumbing and washrooms, people and goods transportation systems, and provision for controlling the spread of fire and smoke, and for fire fighting.

These primary elements are designed and spatially arranged by building experts to respond to external conditions, and to provide artificial "land" which has its own control of climate, "daylight and drainage". The architect is providing a controlled "outdoors", indoors. Within this artificial "outdoors", the user or his agent, using a comprehensive secondary "building system", comprising furniture, furnishings, partitions, air-conditioning, lighting, electric/electronic and plumbing terminals, creates micro-built environments to suit his specific and changing needs.

In these circumstances, it can be argued that, especially for very large floors, the general lighting system should more approximate the sky than a task lighting system. As such, it should not have constant output, but rather, fluctuate in intensity as in the overall sunrise, zenith sunset cycle, and simulate the actual outdoor conditions of cloud cover effect.

SUB-SYSTEM 6,
PLUMBING

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

Plumbing equipment and services serving both sexes, for fire fighting and providing potable water, are a legal requirement in all office buildings.

Plumbing services with the following scope of equipment (with the exception of photo copiers), are mandatory equipment in all office buildings:

Fixtures:

lavatory basins
water closets
urinals
food preparation sinks
drinking fountains
water coolers
photo copy

Services

hot/cold
soil returns
vents
drinking water
access

Hardware

fire hose cabinets
sprinkler systems

The following items of washroom hardware are a mandatory requirement in office buildings:

towel dispensers (paper towels)
dryers (alternate to paper towels)
toilet partitions
TP holders
sanitary napkin holders
sanitary napkin disposals
waste receptacles (paper towel)
coat hooks in WC cubicles
soap dispensers
mirrors

Optional equipment which might be used in above average installations could include:

towel rods
towel shelves
kleenex holders

All equipment must meet statutory plumbing and health standards.

From the purchaser's point of view, trouble-free, long-term service is a mandatory requirement for all plumbing systems. Initial and operating costs should be reasonable, with a minimum need for maintenance. Water consumption for efficient fixture operation should be at a minimum level.

To meet these criteria, it is usually most economical to use plumbing fixtures and pipework of a high quality only. The use of inferior

equipment or piping as a means of saving on first cost can lead to disastrously high replacement costs after a few years in the event of a service breakdown.

Tenant and user satisfaction is related to this sub-system's efficiency and ease of operation, reliability, quiet operation, safety and cleanliness. Fixture colours should be light, preferably white.

It should be noted that washroom equipment in office buildings will receive heavy, and often harsh wear and tear. Fixtures and fittings, and particularly their exposed surfaces and operating parts, should be robust, maintain their appearance after heavy wear, and their mechanical efficiency.

Similarly, fixture and hardware equipment design should be as near as possible, self cleaning, and free of all sharp corners and edges. The latter is particularly necessary for metal equipment such as paper towel dispensers.

Plumbing systems should be designed with adequate valves to limit shut-downs only to faulty fixtures or piping. Access panels and clean-outs should facilitate speedy and clean removal of pipe and fixture blockages, without defacing adjoining surfaces.

The durability, performance, initial and maintenance costs of a plumbing installation are a direct function of their quality, design and supervision of their installation. This is best achieved by the commissioning of properly qualified professionals to design and supervise the installation of these services.

While changes can be expected to take place in plumbing fixtures, these will be less frequent than in other sub-systems due to the existing and foreseeable need for water carriage soil systems and centralized potable water systems. Fixtures should be expected to give a fully serviceable life with infrequent difficulties for a 20-year minimum life.

USER AND HARDWARE CRITERIA

An acceptable plumbing system and service from the office user's point of view is one which has the following features amongst others:

- Be reliable. A plumbing system must always work, without failure, or partial failure. It is a part of a built environment that the majority of people like to take for granted, and resent the need to devote undue amounts of their attention to the reliability of the services and equipment involved.
- Be convenient and safe to use. The plumbing fixtures and services of an office building must be convenient and private to use.

Washrooms in office buildings are normally small, due to attempts to save on non-rentable floor space.

Door swings, door screens and equipment (particularly secondary equipment) should be located to avoid collisions between users and these objects, as well as between users.

It is important to ensure that toilet roll holders, door knobs, coat hooks inside WC cubicles are not hazards to users and their clothing. Many coat hooks of the combined door-stop-hook variety used on proprietary porcelain steel partitions, coincide with a standing male's eye level. Some stainless steel multiple toilet roll holders have extremely sharp corners. Other hardware details can be a source of snagging clothing, which a user is attempting to adjust in a confined space.

The doors from public corridors, to washrooms should be wide enough to easily pass a standard wheelchair. In addition, a single WC cubicle, with extra width, wide door, and appropriate grab-bars, should be provided for use by handicapped persons.

Toilet roll holders should be placed on side walls ahead of WC's and be readily accessible by a seated person.

Paper towel dispensers and waste receptacles in washing areas should be so located to avoid the trailing of water drippings across floors.

Taps to lavatory basins should permit the user to obtain water of the desired temperature. Lavatory basins should be provided with stoppers, to permit full washing when desired. Some public installations provide hot and cold taps, with automatic pressure type flow control valves to ensure taps are turned off after a prearranged period. These are used in combination with sinks which do not have plugs. Such arrangements are virtually useless as the user can have either scalding or cold water, but not a mixture, as without a pluggable lavatory basin there is no means of mixing hot and cold water.

SUB-SYSTEM 6,
PLUMBING

Automatic plunger type soap dispensers should be arranged to discharge into lavatory basins rather than on their margins.

It is probable that WC flushing mechanisms should be all foot operated in office washrooms rather than hand lever operated. Many persons foot operate the existing types which are intended for hand operation, putting stresses on the equipment for which it was probably not designed. The reason for this habit is hygienic.

All WC seats should be of heavy, moisture impervious, split front design, having a very simple form.

All fittings and fixtures should have rounded corners and edges. Floors should be non-slip when wet. All pipes, particularly hot ones, should be placed in accessible ducts remote from the room users.

It is probable that floor drains to washrooms should not be provided. Adequate inspection and maintenance of washrooms can avoid water overflows. Floor drain traps tend to dry-out and allow sewer odours to enter washrooms, which can make these places unpleasant to use.

Toilet roll holders which dispense sheets one at a time through a tripped locking mechanism, should be avoided as they frustrate users and invite vandalism.

Mirrors should be as large as practical and run from counter-top to door head height. A full length mirror should be provided in all women's washrooms. Lighting should illuminate user's faces, not mirror face.

A number of new single control type faucets, which control both the flow and temperature of the water, are unnecessarily complex and potentially hazardous to the uninitiated user. They would appear to be prime examples of misplaced technological skill. Cheap toilet seats of pressed plastic construction tend to deflect or split when used by heavy persons, and should not be used.

- c. Be clean. The next worst situation from the user's viewpoint, after faulty plumbing fixtures, are soiled and stained fixtures.

Fixtures of very simple, self-cleansing design only should be used. The strict observation of manufacturers' recommendations for the cleaning of fixtures, particularly plastic fixtures, is necessary. The indiscriminate use of abrasive and corrosive cleansing compounds can be a substantial factor in:

- i. making the cleaning process more difficult through destruction of fixture finishes.
- ii. a significant reduction in the useful life of fixtures due to a need to replace permanently stained and discoloured equipment.

- d. Be quiet. As mentioned elsewhere in this study, under Sub-system 7, Acoustics, and Appendix 2, Acoustic Criteria for Office Buildings, noise is one of the single most difficult problems in office building design and use. The plumbing system and its users can be prime generators of noise, while the pipes and duct spaces associated with plumbing systems can be prime conductors of noise between floors and user areas.

WCs should be of the silent flushing design. All faucets should be of the silent flow type, with service pipes sized and detailed to reduce pipe noise and prevent noise "telephoning" through ducts and plenum spaces.

- e. Look handsome. Washrooms should be light in colour and handsome in layout, detailing and equipment. A washroom so conceived, will be well treated by users and will consequently be a reduced maintenance problem.

COMMENTS

With the advent of the concepts of primary and secondary building systems, and the concepts of spatial and functional flexibility, there is a need emerging for plumbing components which can be relocated with reasonable ease and economy. This flexibility is needed to satisfy changing (internal) tenant requirements, and changes needed as a result of changes in tenancies.

A prime need is for relocatable fire hose cabinets, to suit partition changes.

In very large buildings involving complex tenant layouts, it is important to be able to set up extra washrooms and other wet services in core areas. The concept of a special dropped and raised floor in core areas for computers, called for in Sub-system 4, Electric/Electronic, might serve well for this purpose.

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

The acoustic environment of office buildings is becoming one of the most important factors in ensuring tenant satisfaction.

Noise may emanate from sources outside or inside the building. If they are outside the tenants' control, and are serious, they can be expected to cause problems for the building owner.

With respect to exterior noise sources, care should be taken in the siting of buildings to avoid serious sources of noise and vibration, such as highways, airports, railway yards, and certain industrial processes. Reference is made to Appendix 2 where this matter is reviewed in some detail. The design of building exteriors to resist noise penetration is equal in importance to heat gain and loss control, and the provision of glazing.

Noise which emanates from within buildings and is not concerned with tenant activities, usually arises from elevators, heating and cooling equipment and plumbing services and fixtures. Music systems, in public areas, if not adequately screened from tenant areas, can be a nuisance.

Adequate sound isolation must be provided between tenancies, including bulkheading of the plenum spaces above party partitions.

With a major trend towards "office landscaping", the acoustic absorption qualities of tenant areas require considerable improvement. Floors should be carpeted. With the carpet having an acoustically absorbent under-pad. Most commercially available "lay-in" acoustic ceilings are inadequately sound absorbent for "office landscape" layouts, suggesting the need for the development of special high absorbent lighting-ceiling systems.

Partitions' details and surfaces should also reduce the propagation of sound and control its spread.

The principal acoustic considerations which should concern the purchaser are:

Reverberation Times	floors ceilings walls windows window coverings furniture furnishings baffles doors
---------------------	--

Frequency and Levels - Sources	people machines plumbing impact outside TV and radios vibration
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USER'S CRITERIA - SUMMARY

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing storing
Related Equipment Which Generate Noise and Require Silencing	typewriters calculators duplicators copiers recorders shredders binding equipment cutters postage meters intercoms telephones projectors television sets telex equipment teletypes
Utility	convenience rearrangement movability comfort

USER AND HARDWARE CRITERIA

An acceptable acoustic environment for office areas from a user's viewpoint would be one which might have the following characteristics:

- A sound level which gives a sense of activity appropriate to the office function. The elimination of harsh sounds.
- A sense of acoustic privacy, sufficiently plausible to allow the user to speak on semi-confidential matters at a normal "quiet conversational" level, without fear of being overheard or disturbing others.
- The isolation and insulation of annoying external noise and vibration sources, particularly vehicles, aircraft, building equipment, radios, and other forms of electrically reinforced sound.
- A means of capturing noise at or near source within tenant areas, particularly that generated by typewriters and calculators.
- The development of quiet office machines.
- The elimination of "piped" music and other forms of blanket intelligible acoustic intrusions and pollutions of a user's acoustic privacy.
- The provision of "silent" areas as a contrast to the normal "activity" environment.
- The provision of enclosed areas where voices can be raised without fear of being overheard or disturbing others.

These acceptable acoustic criteria would arise from proper consideration of the siting, construction quality, sub-division of space, and the equipment of an office building. These have been dealt with at some length in Appendix 2.

In detailing the furniture, furnishings and building sub-systems in office buildings, consideration should be given to the following points:

- Noise infiltration: in noisy locations, large glass areas, particularly if single glazed, provide poor noise isolation. All window and door units should be tight fitting and carefully sealed if noise infiltration is to be kept to a minimum.

SUB-SYSTEM 7,
ACOUSTICS

- b. Impact: much noise is generated by hard surfaces banging together. Whenever one hard surface is likely to bang or scrape against another, the interface should be cushioned or isolated. Consideration of this principle is of particular importance in the design of office machines. Doors, drawer fronts and other moving surfaces should have bumpers to ensure quiet use, or be formed from soft or resilient materials.

Where the edges of furniture or equipment bang against each other or partitions or walls, soft edging should be considered.

Legs, feet and other supports should be designed for quiet movement.

- c. Reverberation: reverberation, or sound reflection results from the existence of hard surfaces on furniture, and the buildings, walls, floors and ceilings. The softening of these surfaces through the use of sound absorbent and resilient materials, can reduce reverberation times, and improve the working spaces' overall acoustic climate.

In selecting soft finishes to furniture items, due consideration must be given to the surfaces' ability to withstand surface abrasion, and retain a "new appearance" over an extended period.

- d. Electronic Noise: for use in open office planning ("office landscaping"), electronic communication devices should be designed to limit sound generation to the specific user, rather than spread sound over a whole area. Many forms of tape recorder, when played back, generate an extremely penetrating, yet not loud, sound level, making them a prime noise nuisance. Similarly, devices which tend to spill intelligible sound, such as voice or music in broad areas of an open arrangement, should be avoided and replaced by equipment which is "place specific".

COMMENTS

The quality of the acoustic environment in office buildings adopting the "office landscape" approach is the single worst shortcoming of the approach; closely followed by a real and psychological lack of privacy.

There is an urgent need for orderly, scientific research of the acoustic climate of open space office planning, with an objective of determining the proper location, scope and character of acoustic baffling treatment. Together with a need to isolate accurately on a quantified basis, the hierarchy of noise generators, and the practical and economically feasible steps which can be taken to improve the situation for both new and existing buildings and for both new and existing furniture and equipment.

Most building and equipment products being used in "office landscape" schemes were designed for use in traditional sub-divided office layouts. The shortcomings they had in those circumstances are being intensified in open layouts.

Screens being offered for use in office landscape settings are for the most part designed and produced on the basis of design fad, rather than rational analysis of the function to be performed as part of an environmental whole.

There is an urgent need for a major study of the psychological effects of open space office planning on a broad spectrum of office users, with particular reference to noise, privacy, space, territoriality, visual, luminous and tactile qualities, and crowding.

HVAC

Sub-System 8

SUB-SYSTEM 8,
HVAC

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety manufacturing

PURCHASER'S CRITERIA

The heating, ventilating and/or air-conditioning system of an office building is an essential means of ensuring that it is fully usable at all times, and under all climatic conditions. Except in the most temperate regions, and for small buildings, air-conditioning is an essential provision for office buildings. The quality and complexity of the HVAC system, and its consequent capital, operating and maintenance costs will depend on the quality of office building being considered.

A common fault in speculative office building construction is the provision of HVAC systems which lack adequate capacity, and/or zone controls, making the provision of interior conference rooms and meeting rooms very difficult, without costly mechanical changes chargeable to the tenant.

In open office planning arrangements and for all layouts, flexibility is a vital factor in keeping an office building usable over many years. To meet these needs, it is necessary to make changes to mechanical systems, in the same way as to partition, electric/electronic, lighting and furniture sub-systems.

Flexibility in the HVAC system should include not only the ability to move terminals, but also air quantity distribution and all controls.

A primary consideration in the selection of an HVAC system is its long-term operating and maintenance costs. These can outweigh any saving achieved through using cheap as against adequate HVAC equipment, in a short period of time.

Equipment should lend itself to inexpensive replacement when an HVAC system requires renewing. It should be sufficiently flexible to permit partial changes to meet user needs, including increases of a system's capacity.

In all office building types, a further important reason for the use of air-conditioning stems from its contribution to the direct productivity of the building users, through reduction of airborne infections and respiratory ailments. By keeping the humidity of air within office buildings at near 50% humidity at all times, airborne bacteria are substantially reduced.

The air cleaning (through filtration) aspect of air-conditioning systems is a major factor in reducing airborne dirt penetration of buildings. As a consequence, cleaning costs can be reduced and tenants' space decoration schemes retain their appearance longer than in non-air-conditioned buildings.

The holding of internal building temperatures and humidities at reasonably constant levels at all times, reduces temperature movements in the building as a whole, with a consequent reduction in related stress cycles.

The functions to be performed by an air-conditioning unit, include dealing with temperature changes of the following origins:

Temperature
population
inside
outside
heat gain - machines
heat gain - lights

while systems can be expected to deal with the following considerations or have the following elements:

Plant

central
unitary
CFM/sq. ft.
CFM/person
movement/FPM
population
air filter - effectiveness
odours - control
plant type
air changes/hour
room pressure
humidifiers
control/zoning
control/switching

USER'S AND HARDWARE CRITERIA

The following activities will be undertaken in office spaces and would require the provision of appropriate climates, and the levels of air change, humidity and cleanliness:

User Activity	conversation conference seminars meetings reading studying thinking writing eating drinking drawing pasting painting layout modelling filing cataloging sorting collating mailing storing smoking
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The following items of equipment can contribute, in addition to people, to the temperature levels in office spaces:

Computers	Require special air-conditioning provisions and should be designed and installed in accordance with the computer manufacturers' recommendations.
Projectors	All forms of projection equipment use light sources which generate heat. Special provisions must be made for large projectors.
Lighting	The general and secondary lighting systems, apart from heat gains (or losses) through window glazing, are a prime source of heat. The heat generation of the lighting system should be considered as a fuel source as part of a comprehensive design policy towards air-conditioning and lighting.
Copying Machines	Many copying machines use very powerful lighting systems in their operation. These and other equipment using heating elements in their operation, should be specially considered in the air-conditioning design of the spaces in which they are installed.

The principal users' hardware consideration concerning the HVAC Sub-system are its performance in heating, cooling, cleaning, humidifying and moving air.

SUB-SYSTEM 8,
HVAC

Exposed equipment enclosures should be of simple design, and formed to resist the collection of dirt and debris. Where dirt and debris can enter equipment through grills, it must be possible to remove enclosures easily and vacuum clean the enclosed mechanisms easily. If HVAC equipment enclosures are at, or near floor level, they must be resistant to impact from floor cleaning machines, furniture and user's feet, without denting or defacement. The units should be extremely simple and unobtrusive in design to form part of an office space's "background" decor.

HVAC control units for operation by users should be simple to adjust and understand.

Where HVAC equipment is located within tenant or user spaces, it should be silent in operation. Particular care being given to the design and construction of starting and stopping mechanisms, to avoid disturbing additional noise generation. Electrical relays which "click and tick", fan belts, compressors, high pitch whining from rotary devices, are all disturbing noises to a majority of people when they are attempting to concentrate. To call such sound part of background noise or "white sound", is to beg the issue.

We place particular importance on this point, as there can be an expected increase in the use of unitary air-conditioning equipment in the immediate future, particularly in low budget buildings. This equipment will tend to be located in, or immediately adjoining the user spaces it serves. Much of the unitary equipment offered for budget installations would be unsatisfactory for use in open or other office layouts in our opinion.

It is hoped that every attempt will be made by air-conditioning manufacturers to produce solid-state cooling devices at present in the development phase, for widespread commercial use.

In addition to the above considerations, the design and fixing of metal enclosures to avoid rattling and "oil canning" when operating, and after shut-down, should be carefully considered. These noises are often associated with the operation of cheap ductwork and equipment enclosures, as they change temperature.

Interfaces occur between the HVAC Sub-system and Lighting, Electric/Electronic, Partition and Structure Sub-systems. Interface problems are associated with the integration of these services as multi-sub-system working entities, particularly where they are required to perform in situations of spatial flexibility. To achieve this level of combined operation, it is important that the manufacturers of the individual sub-systems make a practice of considering in detail, the technical characteristics, including installation requirements, of the sub-systems with which their products must interface in a finished building.

A secondary, but important, interfacing consideration affecting all of the above mentioned sub-systems in relation to the HVAC Sub-system, concerns the problem of soiling, arising from the flow of airborne dirt from units. The quality of HVAC Sub-system filtration equipment, and particularly its maintenance, are major factors in reducing surface soiling from air-conditioning terminals.

In locating HVAC air terminals, care should be taken to avoid obstructing their efficient operation by furniture, partitions or other items. In addition, air flows and their temperatures must be so located as not to chill persons sitting in fixed locations for extended periods. Air-conditioning terminals and controls should permit easy and simple adjustment of such problems by the users.

Looking into the future, there is a need in the HVAC Sub-system, as in the Partition, Electric/Electronic, Plumbing and Lighting Sub-systems to make all terminal elements directly manipulatable by the user, with the use of no, or only very simple tools. To make environments user oriented, and to make users aware of their potentials, it is mandatory that these changes take place in the nature of building sub-systems. Spatial changes which depend for their occurrence on contemporary building cost levels cannot happen. Meaning that the high cost of building activities is often a primary but hidden factor in holding back evolution in a wide spectrum of other types of human endeavour.

SUB-SYSTEM 9,
STRUCTURE

PURCHASER'S CRITERIA - SUMMARY

User Groups	1 Clerical 2 Private Secretarial 3 Machine Operator 4 Professional 5 Professional (Technical) 6 Senior Executive 7 Communal Areas
Cost/Quality/Utility	Initial cost insurability maintenance economic efficiency renewability construction finish appearance durability user efficiency flexibility
Standards	fire safety fire ratings toxicity general safety and stability manufacturing

standard design details and means of interfacing between common elements, to facilitate user changes of office arrangements.

For the purpose of this study, consideration is only given to those sub-system elements which are directly in contact with the user. The questions of overall building design and stability are considered to be outside the scope of this study.

Glazed areas

shades
fixed
openings
hardware
screens
sliding doors

Walls, Ceilings, Floors, Hardware

safety deposit vaults
materials
dimensions/shape/layout
structural properties
finishes
flexibility
thickness
door hardware

PURCHASER'S CRITERIA

Before enumerating the specific criteria that purchasers should consider when building office buildings, we will outline our view of the trend in office building development, which underlies this report.

We believe that "the Metabolists" view of building and architecture is now clearly evolving, and is now fusing with even more advanced views of user involvement in the built environment.

The metabolic view of building design holds that:

"... architecture is composed of two elements. First, there is the spatial equipment which determines space itself, and second, the living equipment which corresponds to living patterns. In all historical buildings we view the spatial equipment; but in contemporary architecture, we place considerable weight on the living equipment. The spatial equipment is thought of as the spatial skeleton which is not subject to temporal changes in function. Occupying a subordinate position attached to the spatial equipment in order to satisfy current requirements, is the living equipment. It is quite permissible if (1) its position changes in the future, (2) it is replaced by other equipment using different materials, or (3) it can be understood to be the introduction into architecture of a method of replacing and changing the living equipment in accordance with living patterns."

The Metabolists are a group of Japanese architects formed in 1960 when the World Design Conference was held in Tokyo.

The above material is quoted from Carl Hall, "The Metabolists", The Canadian Architect, December 1966, pp. 37-52.

This principle has been put into practice by the Metropolitan Toronto School Board in the construction of 23 schools and two office buildings, under that Board's S.E.F. (Study of Educational Facilities) building programme.

The concept of Cyclical Renewal as it can apply to school and office buildings is described S.E.F. T.I. Introduction To the First S.E.F. Building System, The Metropolitan Toronto School Board. June 1968, pp. 37-41.

This latter text presents a view of building which we would support in this report, dividing building into two parts with respect to useful life span.

For the spatial equipment, comprising foundations, underground services, building frames, exterior walls, windows and doors, fixed vertical circulation systems (stairs) and roofing a life of 30 to 60 years.

For the living equipment, comprising HVAC, Plumbing, electric/electronic, lighting, partition, furnishing, furniture, finishings, people and goods moving and handling systems and equipment, a life of 10 years, as part of a fully industrialized process.

We would suggest further, that the design and construction of the spatial equipment and the basic elements of the living equipment are the responsibility of building professionals. The movable portions of the living equipment should be the design responsibility of the user, although furnished in the first instance by design professionals. In order to facilitate easy use of the movable portions of sub-systems, it is vital that manufacturers of common sub-system products develop

From the purchaser's viewpoint, initial, maintenance and operating costs are of crucial consideration in the selection of structural materials. The quality and fire rating of these materials are prime factors in establishing a building's insurability and insurance rates.

Flexibility in the construction of office buildings should suit them to a wide variety of users, in addition to office use. Many of these uses are at this time unpredictable.

From a rental point of view, large buildings should be of the "Mixed Use" type, offering the widest possible diversity of income sources. Such "Mixed Use" buildings will also tend to be more attractive to users, being in a sense, villages or small towns, rather than "Functional Ghettos", so characteristic of many large new office buildings.

USER'S AND HARDWARE CRITERIA

Structures used for office purposes must be able to house with convenience, safety and efficiency, the activities listed below. It must be possible to rearrange spaces and their related HVAC, plumbing, electric/electronic and lighting services, with ease, speed and economy. Furniture must be readily movable in office spaces, and the daily maintenance of user spaces must be inexpensive and capable of keeping the structural materials of walls, floors, ceilings and glazing in a "near new" condition for several years (minimum of 5 years).

User Activity

conversation
conference
seminars
meetings
reading
studying
thinking
writing
eating
drinking
drawing
pasting
painting
layout
modelling
filing
cataloging
sorting
collating
mailing
storing

As mentioned under a number of other sub-systems, the need for users to be able to "customize" their working spaces will grow rapidly in the coming years, as society accepts the concept of "individualism". To meet this need, the Structure Sub-system should allow users to influence the choice and colour of wall, ceiling and floor finishes, or make changes to, or "add onto" basic general finishes. If the user is to be permitted to fully "customize" their space, the basic building colour for walls and ceilings should be white.

SUB-SYSTEM 9,
STRUCTURE

With the rapidly growing interest in the natural environment, and its rescue, basic changes in office building users to natural light and air should be expected. It is most probable that office buildings with extensive windowless inhabitable cores, will become very difficult to rent. The use of "office landscaping" will offset this trend for most buildings except those with very deep windowless space.

A major demand for windows that open (and air-conditioning systems concerned around this condition) and terrace spaces for user relaxation or working space can be expected.

Buildings in the form of simple shafts, with only one or two levels and points of access and egress can be expected to wane in user acceptance. As also will gigantism in tangible building concentration. Projects with 500,000 square feet or more in a single, simple geometric architectural form can be expected to be less acceptable to users than those which seek to be less oppressive of the user in their design expression. Users will also be influenced in this direction by fire disasters in ultra-tall and concentrated structures.

With a general loose social trend "back to nature", a reaction by users against buildings which are spatially mean can be expected. Low ceiling heights, especially associated with open office planning, express clearly to the user, a purchaser's desire to squeeze the last dollar from a building, even at the user's environmental expense. Buildings with "indoor airiness" will be popular. It is recommended that office buildings be provided with generous floor to floor heights, for the reasons stated above, and also to facilitate unpredictable changes to mechanical and electrical systems.

Terminology

Adaptability

The ability of a structural or furniture item to accommodate changing conditions of use, through the inclusion of additional components and/or the rearrangement of the item's constituent parts.

Anthropometrics

The comparative study of human body measurement.

Component

A part or a sub-assembly of parts, which in order to function must be linked to other components.

Cost

The cost of an item of furniture, for example, to a purchaser, includes not only the initial cost of the item or its amortization, but also its cost of maintenance, depreciation and replacement.

Dimensions**

The appearance of the word "dimensions" in the list of structural considerations, is meant as a reminder to the user of this document that anthropometrics should be a determinant in the selection of dimensions.

Durability

The ability of a structural or furniture item to successfully meet its conditions of use over a long period of time, without losing its original appearance or other properties.

Ergonomics

The science of making an environment fit its user, for example, of making a job fit the worker. In this context, ergonomics would relate the work station to its user.

Flexibility**

The word flexibility may have at least two meanings in relation to the office. The first, short-term flexibility, describes a requirement of both user and purchaser, for fast and convenient relocatability of furniture, for example. The second, long-term flexibility, is primarily a requirement of a purchaser and relates to meeting the demands of changing use. Flexibility here describes the ease with which a complete environment might be changed.

Hardware to Hardware Interfaces

Where this term is used, it indicates the existence of physical relationship between hardware components or items. The implication here, is that careful

attention should be given to achieving a compatible relationship or interface between the items in terms of cost and performance.

Maintenance

This word appears in a list of purchaser's requirements as a reminder that maintenance problems bear directly on labour costs. With this factor in mind, purchasers of furniture would be wise to place some importance on ease of maintenance as a criterion of purchase.

Materials** (Type)

Structural, Furniture and Furnishings

Materials chosen for use in offices and work stations should be selected on the basis of their ability to meet the conditions of use to which they might be subjected.

Module

A standardized unit of length, applied to components.

Purchaser's Criteria

The purchaser in this instance refers to the individual charged with the responsibility of furnishing the office environment. Purchaser's criteria refers to all of the requirements of an owner who is purchasing furniture, furnishing or building components.

Quality

One of many of a purchaser's criteria, quality, refers to an item's craftsmanship, durability, appearance, and to the contribution it might make to an establishment's image as well as to meeting a user's requirements.

Renewability

Here the word renewability refers to the ease with which an object is refinished or rehabilitated to a like-new condition.

Security

One of many of a purchaser's criteria, security, refers to his requirement for the prevention of theft of office property.

Structural Properties**

The structural properties of an item include its resistance, characteristics when loaded, rigidity, stability, etc.

Sub-system

A sub-system is an identifiable, complete designed, physically integrated, dimensionally co-ordinated series of parts which function as a unit.

System

An identifiable, complete, designed, physically integrated, dimensionally co-ordinated series of sub-systems which function as a unit.

Task Lighting Levels**

The amount of light required to efficiently execute a particular human activity.

Thickness**

One of many considerations in selecting materials and detailing furniture, furnishing and structural components, thickness may be a major consideration in the work station where space is at a premium.

User's Criteria

The user in this instance is the user of the work station. User's criteria refers to the requirements of a person who is using the furniture and furnishings within the office environment.

This paper is an attempt to sketch the major lines of development in "Organizational Theory" which have dominated management thinking and practice over the last sixty years. A few assumptions associated with the major theories discussed are actually no longer valid and, in fact, are inappropriate. Others, while still applicable, are fast becoming inadequate. To try to achieve some focus, I took as my point of departure, the sequence: industrial psychology, human relations, organizational behaviour.

From Taylorism to the Emergence of The Task Approach to Management.

Four different theories have been noted in the brief history of management studies. These theories dominate, overshadow, and sometimes absorb the lower ranges of more specific theories. They are:

1. The classical theory of Management.
2. The human relations school.
3. The task approach to Management.
4. Industrial humanism.

1. The Classical Theory of Management

The first, the classical theory of management, one strand of which is known as the machine theory of management and is sometimes called Taylorism, treats work primarily as an economic activity and is obsessed with the scientific

measurement of productivity to the neglect of the human aspect of work. This machine theory of organization is built on a combination accounting and industrial engineering model. It has certain advantages. For a start, it focuses attention on the scientific measurement of productivity. This particular theory is of great historical value because it introduced scientific techniques into industrial management. In particular, the machine theory improved productivity by introducing such techniques as production planning and control, work study (including method study and time study), quality control, rate fixing and piecework.

Taylor, 1911, the principal proponent of the machine theory, introduced the principle of functional management. In general, it represents an attempt to break the total job down in a rational manner and introduces a balanced system of authority and responsibility. Mason Haire (1962) comments:

In principle, a certain amount of authority is pumped into each one of the boxes (in the organization chart) and along with this goes a responsibility to beam out a certain amount of productivity. This kind of double-entry system of in-put and out-put seems to be one of the first essentials.

The main criticism of the machine theory is that it over centralizes authority,

maximizes neatness and control, and assumes men to be relatively homogeneous and relatively unmodifiable.

"Boxitis" is the term used to describe this system of management that assumes that when an organization chart has been constructed, then a simple picture of authority and responsibility has been created. In other words, it fails to recognize the problems that arise at the boundary between one command area and another, the consequences of the development of the informal organization. Basically, this first theory of management under-estimates the difficulties of balancing authority and responsibility.

The division between line and function management can become too rigid. There is a tendency to think that line has the exclusive responsibility for producing the product and that staff is there to advise and provide expert assistance to line. Therefore the staff has no authority except with the staff group. It would therefore seem if we accept the argument that authority and responsibility are balanced, then the staff, because they are lacking in authority, have no responsibility. This picture is obviously unrealistic.

This early approach, which puts special emphasis on the avoidance of error rather than on the necessary acceptance of calculated risks, encourages a negative attitude and does not necessarily maximize efficiency.

In general, this organization theory is based on the belief that there are people (but not oneself) who are unfortunately lazy, and consequently they will not do anything unless they are forced to do so.

2. The Human Relations School

The human relations school, (from Elton Mayo and Kurt Lewin to Rensis Likert), rejects the organization model built on the accounting and industrial engineering model and gives central place to the individual and the primary working group. Its advantages include the fact that this approach emphasizes initiative and

innovation. Particular emphasis is placed on the need to facilitate self-actualization. Definitions of rules, roles, and relations are held to be vital in management research. It seeks to maximize individual participation by encouraging consultation.

In order not to stifle initiative, it assumes that individuals will make mistakes but does not assume that this will necessarily maximize error. Inherent in the human relations approach is the proposition that man is modifiable, and the theory seeks to provide a climate within which the worker may meet his social needs - particularly the need to belong, to win approval, and to feel secure. The ideal type of organization is decentralized. (One prominent view of human relations - very much received in both North America and Europe, is represented by McGregor, 1960).

The argument against human relations as a management philosophy include: because it lays such great emphasis on getting the worker involved, it may lead to pseudo-participation; i.e. participation which looks like, but is not, real participation. True participation means, in fact, that the rules can be observed by subordinates and yet they feel free to make any contributions they feel appropriate.

Many human-relations-oriented managers fail to realize that shop floor workers prefer "adaptive segregation" rather than being over-involved in organizational matters. Perhaps more important is the objection that this philosophy can encourage the wrong type of executive, who thinks that his responsibility is to keep everybody happy instead of getting his work done. And further, it may well breed patronizing attitudes towards subordinates because of a faulty understanding of what kinds of relationships people expect.

It tends to be unrealistic in assuming that organizations can prosper without proper role definitions, for without these accurate and comprehensive job descriptions, it is impossible to anticipate and minimize the conflicts that arise at the boundary between functions of one role and another.

3. The Task Approach

The Task Approach, which could not have emerged as an acceptable theory of organization without the two previous systems having run their historical course, represents a fusion of the best features of both its predecessors. The task approach as Brown (1960) has pointed out, is concerned with the development of optional organization within which "the work to be done and the resources available, both technical and human, determine the methods of work to be employed". The title "task approach" gained currency in World War II where special formations which cut across traditional organizational lines were called task forces; they were designed to achieve a particular task or mission.

The advantages of this theory lie in the fact that it focuses attention on developing an optimum organization by considering both the task to be done and the resources available; the resources available can be divided into three categories: personnel, technical and economic. Great care and effort are expended to ensure that specialists are properly used. It avoids the basic misuse of functional specialists that arises in the classical theory of management. The traditional division of line and staff is treated as irrelevant.

It formalizes consultative procedures at every level through staff consultation and work councils. This theory minimizes the importance of personality and assumes that roles can be objectified; thus, efficiency is maximized and conflict minimized.

The task approach assimilates the advantages of both the classical approach and the human relations school. Human relations is reserved for shop floor operatives; good human resources planning for middle management; and optimal organization for top management. The concept of socio-technical systems, borrowed from Tavistock, is used to describe and predict the organizational behaviour. Organizations are seen as giant molecules with roles for atoms.

Effectiveness and efficiency are seen as measures of the choice of goals and the ability to exploit the means to achieve these goals respectively (effectiveness refers to selection of ends; efficiency measures performance on the means). The relation between effectiveness and efficiency is seen as both complex and complicated. Extensive use is made of models which simulate the business environment, quantify the factors structuring out-comes, frequently involve the use of computers, and enable executives to operate in a meaningful way on their environment. Technology is seen as a major determinant of organizational behaviour.

A very fruitful marriage appears to have taken place in the United States between the Sociotechnical System concept and the total marketing concept. A new approach to management has been developed by U.S. aerospace companies who have to decide which business they are in and think the problem through. This has led to the development of C.F. - C.D.: (i.e.) Concept Formulation-Contract Definition. This very successful frame of analysis has led to development of organizations which specialize in finding "interesting problems" and then solving them.

In the task-oriented organization, there are the presumptions of bounded rationality that information is expensive and that organizations work by programmed decisions. The "technostructure" is in command and the objective, to satisfy a number of variables rather than maximize profit, is achieved by the formation of coalitions which, overlapping one another, achieve a number of inconsistent goals.

The new organizations expected to emerge under the "task approach" will approximate the Organic Model of Burns and Stalker (1961) where the emphasis will be on:

- i. A lateral rather than a vertical direction of communication through the organization; also, communication between people of different rank, resembling consultation rather than command;

- ii. A content of communication which consists of information and advice rather than instructions and decisions;
- iii. A commitment to the concern's tasks and to the "technological ethos" of material progress and expansion, which is more highly valued than loyalty and obedience; and
- iv. An importance and a prestige which attach to affiliations, and an expertise valid in the industrial, technical, and commercial milieux external to the firm.

Research and Development

In the task-oriented organization, there is a current speculation that Research and Development would be exactly defined and therefore managed; objectives are of necessity less detailed, but both modern organizational investigation and experience confirm that scientists and technologists are able to work within such discipline. Integral to this approach are the notions that research can be evaluated on a cost-benefit-analysis basis, and that technological pioneering does not create automatic commercial supremacy. In essence, in the task-oriented enterprise of the future, scientists would be taken out of back rooms and ivory towers and treated, not as prima donnas, but as technocrats who manage innovative information which other technical departments utilize to achieve the organization's objectives.

The disadvantages of the task approach include: the system may become too efficient in the short run by being too "tough". It will encourage resistance not only among workers but in the management groups. This resistance may manifest itself both at the level of the group and of the individual, then it may serve only to encourage the development of informal organizations which are directed against the best interest of the firm. At the individual level, if the task is pitched too high, it may serve to increase labour turnover or increase the incidence of psychosomatic disorders.

4. Industrial Humanism and the Issue of Values

The major attack on the anticipated consequences of the "task approach" to management has come from a group of well known writers in organizational theory. Call them the "Industrial Humanists". They reject those forms of task organization and management which deprive workers of "job satisfaction" and, what is worse, violate their human dignity. Basic in their philosophy is the design of work environment to provide for the restoration of "Man's" dignity. This philosophy has taken numerous forms - Argyris (1964); Likert (1961); McGregor (1960); Bennis (1966).

These writers along with a number of other personality theorists - especially those with new interest in psychoanalysis and existential philosophy, are influencing current management thinking with the need to change the 'bureaucratic organization' with concepts and practices such as:

- a. Job enlargement
- b. Sensitivity training
- c. Democratic - participative leadership - disclaims any part of organizational cults of personality.
- d. "Consensus" in decision-making.
- e. "Rationality" in conflict resolution - conflict is good and when brought to the surface, the better.
- f. "Planned-change" - and supportive supervision.

Research evidence strongly supports a number of these concepts and practices. For example:

- i. That a group must experiment with democratic, participative, consultative, group-discussion or leader permissive process in order to arrive at a suitable authority structure and to work within the structure without resentment or differences.

ii. The best or optimum structure cannot be imposed externally with the expectation that it will work. It apparently must arise through social processes that take place within the group.

iii. One leadership function is to help provide the group with means for continually readjusting its authority structures in the face of changing individual competences and changing external demands.

Research evidence also suggests that Industrial humanism has emerged as a potent force in industrial relations. Thus, Strauss (1968) acknowledging this fact pejoratively remarks that ...

"It is as if their purpose were to create a "Love Generation of Managers, a hippie organization in which all relations are "trusting", "authentic", and open; each employee "can do his thing" in his own unique way, hostility can be expressed openly, when it is felt and everybody works for organizational objectives - all at the same time" p. 246.

But steadily the traditional theories are being outmoded by independent - or at least only partially dependent developments in society, in economy, in technology, and in the world view of this age. It is not surprising then, that the focus in management theorizing and practice has had to shift from the functions necessary for goal achievement to the goals themselves.

Today, the most difficult problem for the manager and the organizational theorists is the question of values. The studies of what makes leadership in this day and age have suddenly become very much explorations of the "noble actions" that "society exists for the sake of". A concept of healthy organization in a society is very much at stake in this view. And with this development has come increased interest in the value identities of effective leaders.

The shift in emphasis is evident in this definition of leadership by Zalesnik and Momen (1964):

"We would define a leadership event in which the conscious intentions of one person are communicated in his behaviour, verbal and otherwise, with the consequence that the other person wants to and does behave in accordance with the first person's intentions." p. 414.

This definition includes intentions, behaviour, and consequences:

"The person who set out to learn ... how to be a better leader ultimately has to learn how to be himself in order to improve his performances in any role. This direction of inquiry does not eliminate the need for choice; it only makes the choices more fundamental. Rather than choosing between being tough or nice, for example, the individual has to choose what he wants to become. Thus, the leadership problem, as it affects individuals' behavioural choices, come down to a more fundamental problem of identity. Any individual, regardless of occupation, profession, or social role, has to deal with the problem in order to enhance his personal competence". p. 428.

The intentional aspects of leadership; the "Who am I?" and "Where am I going?" issues of intentions underlying behaviour are the current concern of the manager and the social scientist.

The forces of honest scientific inquiry has impelled organizational theorists to confront the value issues already in the focus of their studies of leadership. In this they are getting support from a few personality theorists - those with new interests in psychoanalysis and in existential philosophy. For example, in 1962, Maslow, in discussing current concepts of motivation, hypothesized:

"... that the so called higher values, the eternal virtues, are approximately what we find as the free choices, in the good situation, of those people whom we call relatively healthy (mature evolved, self-fulfilled, individuated, etc.), when they are feeling at their best and strongest - Furthermore, I suspect that what is good for the healthy persons (chosen by them) may very probably be good for the less healthy people, too, in the long run, and is what sick ones would also choose if they could become better choosers. Another way of saying this is that healthy people are better choosers than unhealthy people."

Is it then true that, in the long run, socially effective leadership must amount to growth toward an increasingly healthy, mature, individuated identity and free choice of the higher values, the eternal virtues? This would seem to be the implication of current developments in the behavioural science of organizations that are deeply existential, phenomenological and experiential; and these developments are gathering many inquirers into their point of view.

Summary

This paper has presented a short account of the major lines of developments in management studies over the last sixty years. As I have already noted, management theorizing has gone through three major phases which more or less correspond to changes of role for the manager. First, there was the classical theory of management which regarded the worker as just another instrument of production; Taylorism with its emphasis on time and motion study and incentive bonus schemes is a manifestation of this school. The manager - especially the personnel manager - was a welfare officer whose responsibility in this phase was to provide the human antidote to this managerial pre-occupation with people as things. For example, it was the excesses of Taylorism, which made work study a dirty word in the shipyards of the Clyde, that pushed management into the next phase of management theory - the human relations phase. In this approach, many executives tended to view management as if it were identical with personnel management. The human relations school in turn gave way to the task approach to management, which represents a dialectical fusion of the two previous schools. The hard-headed, task-oriented manager, both a product and a producer of this contemporary management philosophy, has styled himself as an organizational analyst who is pre-occupied with optimizing organizational

effectiveness. But he has also to watch his values!

For to operate in the no-man's-land separating behavioural science, ethics, and organizational actualities, the modern manager is going to need a lot of help from moral philosophers unless he is going to recapitulate the history and errors of earlier ethical systems. Armed with the new and more powerful techniques of logical analysis, helped by developments in utility theory and decision making, his motives clarified by psychoanalysts, his role described in detail by the group dynamicist, his language clarified by the techniques of the semantic differential, the modern manager will still have some choices to make.

Bibliography

1. Argyris, C.
Integrating the Individual and the Organization, New York. Wiley, 1964.
2. Bennis, W.G.
Changing Organization, New York. McGraw-Hill Book Co. Inc. 1966.
3. Brown, W.
Exploration in Management, London: Heinemann Educational Books Ltd. 1960.
4. Cartright, D. and Zander, A.
Group Dynamics, Evanston: Row Peterson, 1953.
5. Haire, M.
The Concept of Power and the Concept of Man in Social Science Approach to Business, (ed.) S.B. Spother, Homewood, Ill. Irwin and Dorsey Press, 1962.
6. Kelly, Joe
Organizational Behaviour, Irwin and Dorsey Ltd. Georgetown, Ont. 1969.
7. Likert, R.
New Patterns of Management, New York. McGraw Hill, 1961.
8. March, J.G. and Simon, H.A.
Organizations, New York: John Wiley & Sons, Inc. 1958.
9. Maslow, A.H.
Toward a Psychology of Being, Princeton, N.J.: D. Van Nostrand Inc., 1962.
10. McGregor, D.M.
The Human Side of Enterprise, New York: McGraw-Hill, Co. 1960.
11. Pugh, D.S.
"Modern Organizational Theory: A Psychological & Sociological Study". Psychological Bulletin, Vol. 66 No. 4, Oct. 1966.
12. Slater, P.E. and Bennis, W.
"Democracy is Inevitable" Harvard Business Review, Vol. 42 No. 2, March-April, 1964.
13. Strauss, George
"Human Relations - 1968 Style" Industrial Relations, 1968 Nov. P. 264.

14. Taylor, F.W.
Scientific Management, New York
Harper, 1947, pp. 5 - 143.

15. Zalesnik, A. and Moment, David
The Dynamics of Interpersonal
Behaviour, N.Y.: John Wiley
& Sons Inc. 1964.

Appendix 2
Acoustic Criteria
For Offices

- 1.0. Introduction
- 2.0. The Nature of Sound
- 3.0. Acoustic & Noise Control Technology
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Acoustical Criteria Sheet, Office

Acoustical Criteria Sheet,
Conference Room

References

1.0. Introduction

During the course of recent years, increasing attention has been and continues to be focused on the inter-related technologies of acoustics and noise control. Concurrent with a heightened sensitivity to the quality of his total environment, man is demanding a level of acoustic and noise control performance in his buildings that is consistent with the greater intensities of noise exposure, human interaction, and general environmental deterioration he experiences in our modern society.

In many countries of the world, notably in Europe, the physical and psychological needs for controlling noise and the acoustical environment have been recognized and given substance in the form of building codes, standards or performance criteria, zoning ordinances, and equipment operating limitations. Although governmental agencies in North America have been slower to define and establish controls of this nature, the complaints and awareness of an aroused populace is manifested in a range of actions from community legislation (Miami, Florida) against excessively noisy residential air conditioning units, to the public out-cry regularly raised against airports, highways, and rail beds programmed for expansion.

When any building enterprise is undertaken, a primary objective should be to provide an acoustical environment that minimally is acceptable and optimally is desirable.

The characteristics of such an environment can be expressed quite simply in a qualitative manner. The use or users or innocent forced participants should enjoy a reasonable degree of privacy from noise intrusion into their physical and psychological worlds. They should enjoy a sense of security about their own generated noises both in regard to not disturbing others and in regard to not having confidential or semi-confidential sounds (speech or otherwise) become publicly exposed. Finally, they should have the ability, provided by the building of interest, to communicate effectively and easily with a person or persons of their choice and consistent with a building's or room's intended use.

2.0.. The Nature of Sound

Let us briefly examine the nature of sound from two points of view; that of sound as a physical phenomenon, and that of sound as a sensuously perceptible medium. In the former case, the physical nature of sound can perhaps be most easily described as analogous to the concentric outwardly expanding waves generated by a stone dropping into a pool of water. These waves, representing pressure variations from a central source, proceed uniformly in all directions until reflected, absorbed, or attenuated to an imperceptible state by edge conditions and/or a combination of distance and frictional forces within the transmitting media itself, in this case, water.

This description is, of course, grossly over-simplified, but the image can be readily transferred to the more complex cases of three dimensional wave propagation resulting from such sources as the human voice in air, sharp heels striking a hard dense floor such as concrete, a jet airplane flying nearby, or a radio/TV playing loudly in an adjoining and supposedly unrelated room. Each case obviously has its own complex set of parameters, but the important fact to bear in mind is that in homogeneous media, sound propagates similarly to the water analogy. For instance, sound waves generated by the vocal cords or a siren are manifested as pressure waves in air similar to the waves in the water. These waves occur physically as slight deviations above and below the static pressure of the transmitting air and produce

measurable sound pressure. As these waves impinge on the eardrum, they cause it to vibrate in direct proportion to the wave intensity or sound pressure level, and thereby, produce the sensation of hearing in varying degrees of loudness.

In addition to pressure, sound waves have the important attribute of frequency. This is defined as the number of times per second that the sound pressure alternates above and below the ambient, atmospheric pressure. Each complete alternation is called a cycle, and frequency is expressed in cycles per second (cps). The frequency of the human voice is determined by the rate of vibration of the vocal cords, and the changes in frequency are perceived by the ear as changes in pitch. The higher the frequency, the higher the pitch. The extreme range of frequencies which the normal ear can perceive is approximately 20-20,000 cps. although the upper limit decreases considerably with advancing age. The acoustical properties of building materials also vary with frequency as does the loudness response of the ear.

A frequency related phenomenon to sound is vibration, in buildings this is a generally undesirable response to energy input. While the basic propagation characteristics of vibrations are similar to those of sound, the methods of isolation or containment are quite different.

In the case of sound as a sensuously perceptible medium, let us consider that man is continuously experiencing various qualities of his environment through the senses of sight, smell, taste, feel and sound. Hearing, like the other senses, is constantly responding to the characteristics of a given situation. The ability of man to perform many tasks, his inclination to perform, as well as his emotional state are determined in part by what he hears. Sound can be a friendly and pleasant companion just as it can be an annoying, enervating intruder.

3.0. Acoustic & Noise Control Technology

The technologies associated with acoustics and noise control are relatively new, for the most part developing since the turn of the century. Standards are continually under development, test, and revision. Some criteria have been defined which are capable of simple numerical expression. However, caution must be exercised in using acoustic and noise control criteria since the complex inter-action of the relevant physical laws under diverse situational modes can result in numerical criteria having relative rather than absolute values, and in single number criteria being unsuitable for certain specific situations. The guidelines established here will attempt to avoid these pitfalls.

In our daily activities, we are surrounded by sounds varying from the rustle of leaves in a slight breeze, to the passing of a locomotive or a jet aircraft taking off. In this increasingly noisy environment, it is difficult to imagine the absence of sound or noise, and indeed such an absence may be far more disturbing than the presence of moderate amounts of what we refer to as background noise. This is noise or sound that continuously exists but which is not perceived by man as worthy of special notice or as a disturbing element.

3.1. N.C. Background Levels

Certain levels of sound pressure, over the frequency spectrum associated with man's hearing, have been determined through experimentation and extensive sampling to be acceptable levels for background noise in which that noise will not appear obtrusive or interfere with activities occurring within a given space.

These levels have been organized graphically as Noise Criteria (NC) Curves and appear as figure 1 of this section. Table 1 following here, will help to explain, in simple single number related terms with which the layman is familiar, the general levels of sound these curves represent.

The significance of considering acceptable background levels becomes readily apparent when one appreciates that even though it is technically feasible to provide near perfect sound isolation and silence between all parts of a given building, it is not only prohibitively expensive to do so but also rarely desirable.

The NC background levels serve two useful functions. First, they provide guidance as to what levels of background or ambient noise might become objectionable to the occupants of a given space or interfere with their tasks such as speech communication. Secondly, they define background levels which are considered acceptable for various activities and therein furnish a cushion or masking level of sound which can be used to hide undesirable intruding sound. This masking feature is most effectively applied when constant levels of noise in a space can be relied on, such as the continuous "whoosh" produced by ventilation system diffusers. The level of the masking noise in a space can then work in conjunction with the sound isolating properties of surrounding walls to make an external intruding sound or acoustical disturbance undetectable, whereas in the same room without the background noise, that same noise could easily be heard. The foregoing becomes more clear if we think of an external sound generating a level of about 80 decibels which then penetrates a room whose walls will effect a 50 decibel loss on the sound. The sound inside the room is then as a 30 decibel level. If a background of 30 dB or greater is present in the room, then the intruding sound will be hidden in the background and pass unnoticed. If the background is less than 30 dB, then obviously the intruding sound will be heard.

3.2. Decibels

The scale of values in Table I is expressed numerically in decibels. The decibel is a quantity expression adopted by the acoustic community to represent the ratio of sound from a source or within a space to a standard referenced sound intensity.

It is a logarithmically derived number designed to translate the absolute range of sound intensities encountered by man, about a million billion to one, to an equivalent manageable range described by

decibels on a scale from 0 up to 150. Decibels cannot be added like ordinary units of measure such as pounds, square inches or even watts. A doubling of sound intensity is represented by an increase of 3 decibels. Conversely a reduction of 50% from a 100 decibel level yields a 97 decibel result. It can also be shown that 60 decibels added to 66 decibels will yield an intensity level of 67 decibels. This can be readily accomplished by logarithmic calculations. Suffice to say that, although reference values are reasonably standard, the term decibel should be used with caution and calculations made by knowledgeable consultants.

4.0. Considerations & Decisions

Acoustic and noise control considerations can in general be made at three different levels of activity which, incidentally, correlate with three different phases at building development.

4.1. Project Planning Stage

The first is the project planning stage where basic site selection occurs and usually shortly thereafter decisions about siting of the building itself. During this stage, application of some common sense rules-of-thumb can save considerable design and construction expense at a later date to compensate for, if possible, an undesirable acoustic environment.

4.2. Site & Design Considerations

Obviously, facilities located near active airports will have severe noise problems to overcome if disadvantageously sited. If airport proximity is essential, then locations upwind (prevailing) of the primary runway and out of the traffic patterns will avoid landing flare-out noise, engine run-up for take-off, and fly-over after take-off as aircraft bank into a climbing pattern to pick up their flight azimuth. Normal procedure is to turn up to the left, but a check with airport officials can confirm this and reveal other tips on flight operations. Where one has choice, locations away from the aircraft are the most desirable with regard to noise control.

Similar reasoning can be applied to sites next to major traffic arteries, bridges, tunnels or motorized transport beds of any kind. If possible, avoid sites near hills, stop lights or stop signs as vehicles accelerating or decelerating generate considerably higher noise levels than constant traffic flows do.

These effects will likely be more pronounced in built-up areas where a high degree of reflection and build-up occurs between buildings or other structures. This is not to say that buildings erected on air rights or adjacent to major transport nets cannot be successful in terms of an internal acoustic environment. However, this has been achieved through early recognition of the problem and accounting for it throughout the building development activity. Barriers, buffer spaces, relative remoteness of noise sensitive rooms, and careful detailing of walls and windows are typical design techniques to achieve this end. The best guideline is to stay back from or avoid the high noise conditions if possible. If not, then the building owner must be prepared to either pay for engineering out what undesirable effects are possible, or to accept a less desirable acoustic environment as a trade-off. In any event, a competent acoustical consultant can usually, in the planning stage of projects, make some good fundamental recommendations which might preclude unnecessary expense during later project stages.

4.3. Typical External Noise Levels

Typical external noise levels one might encounter in a variety of site situations are shown in Tables 1 and 2. While this data can be useful for gross planning, it should not be relied on for design purposes. If a noise problem is identified or suspected, special measurements should be taken.

4.4. Design & Construction Stage

The second important level of activity is the design and construction stage. It is here that the factors affecting the immediate environment can be most directly influenced.

Fortunately, it is well within the scope of acoustical technology to satisfy within reasonable limits the needs and desires of the ear. The control of sound can be reasonably well achieved in regard to room acoustics, inter-room privacy, noise intrusion, impact and vibration, and the treatment of mechanical or special equipment essential to the planned and proper functioning of spaces.

It is well to remember that sound can be transmitted through the structure of buildings as well as through the air within and around it. In general, structure-borne sound is usually of an undesirable nature and will be discussed in terms of containment or suppression. Airborne sound, though sometimes also undesirable, is the primary constituent of intelligent communication between people, and we shall comment briefly on the control of its quality and the effectiveness of its dispersion.

4.5. Room Acoustics

A sound wave, in passing through air, loses a certain fraction of its energy for each unit of distance travelled by absorption in the air itself. The total contribution of air absorption in a room is directly proportional to the volume of the room.

This is added to the absorption furnished by the room surfaces and contained objects to give the total room absorption. The amount and location of highly absorptive finishings can be dominant factors in determining the quality, duration and loudness of sound within a room.

One useful quantitative measure of the acoustics of many spaces is reverberation time. Reverberation is the persistence of sound within a space after the sound source has been stopped.

If the sound persists for a prolonged period (due to large volume or the absence of sound absorbing materials), we say that the "reverberation time" is long; speech and other articulated sounds may become confused and garbled, though music will sound rich and warm. If the reverberation time is short, speech intelligibility will be clear but music will sound dry and brittle. As rule-of-thumb, let us consider times about 1.0 second or less as being short, and times about 1.5 seconds or more as being long.

Reverberation time for measurement purposes is defined as the time in seconds required for a sound to diminish by 60 decibels from its original level. The reverberation time of a room is directly proportional to the cubic volume and inversely proportional to the acoustical absorption present. Further, since the sound absorbing properties of most architectural materials vary with frequency it is necessary to calculate and measure reverberation times in rooms as a function of frequency.

The placement of acoustical treatments is quite often dictated by the relatively large amounts of absorption which are required for reverberation control in various spaces. Since in small and medium sized spaces the ceiling surface is usually the largest and most readily available for treatment, it is common practice to begin there. As a general rule this is acceptable although certain situations will call for a hard reflection

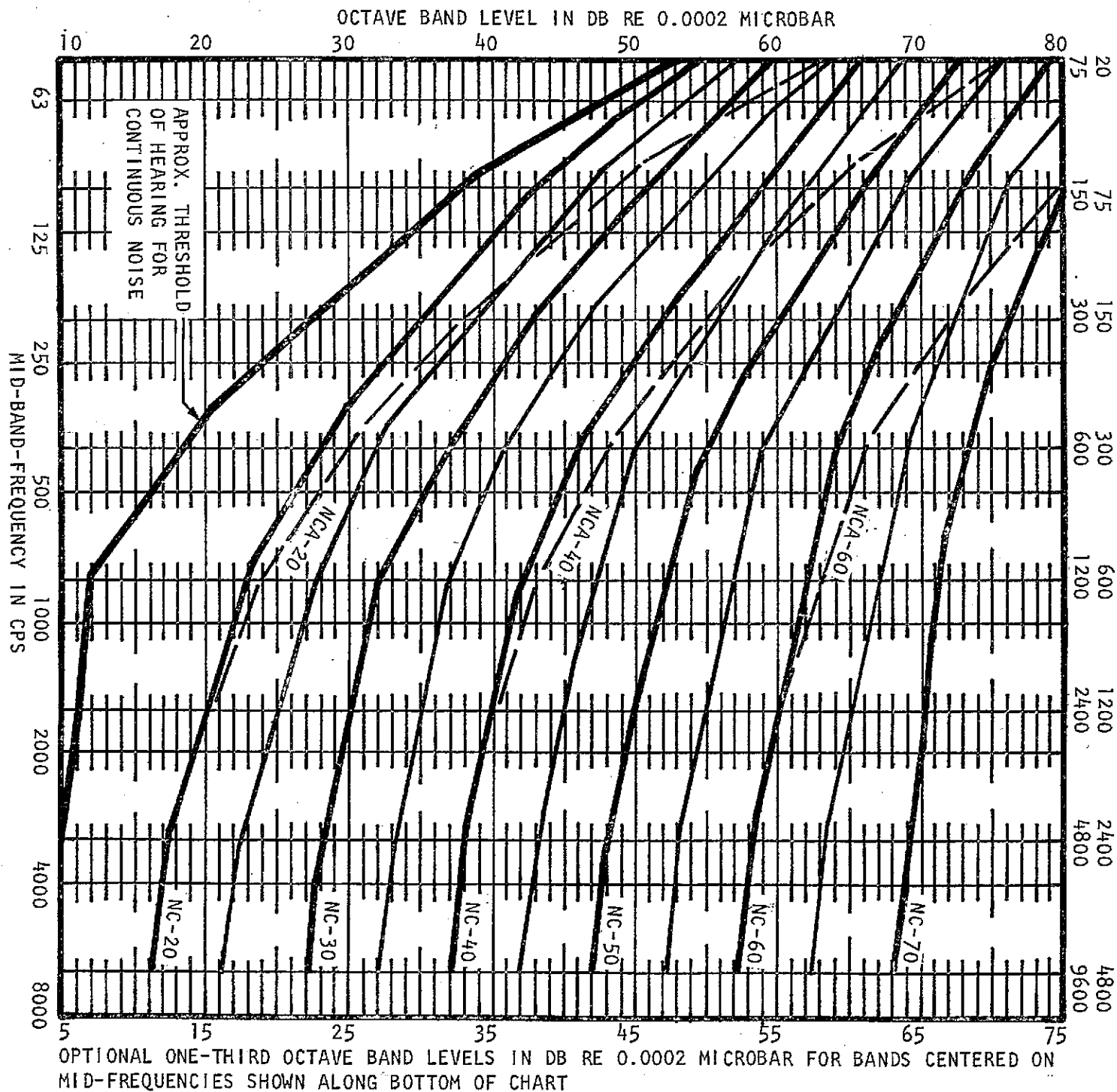


FIGURE 1 NOISE CRITERION CURVES

Threshold of Feeling & Severe Damage to Ear	Deci- bels	Jet aircraft take-off up to 300' - 0"
Deafening	120	Thunder, Artillery Nearby Riveter Elevated Train Boiler Factory Jet Aircraft take-off over 300' - 0"
	110	
	100	
Very Loud	90	Loud Street Noise Noisy Factory Truck Unmuffled Police Whistle
	80	
	70	
Loud	60	Noisy Office Average Street Noise Average Radio Average Factory
	50	
	40	
Moderate	30	Noisy Home Average Office Average Conversation Quiet Radio
	20	
	10	
Faint	0	Quiet Home or Private Office Average Auditorium Quiet Conversation
Very Faint		Rustle of Leaves Whisper Sound Proof Room Threshold of Audibility

TABLE I

Average sound levels as measured by a standard sound level meter with appropriate frequency weighting networks.*

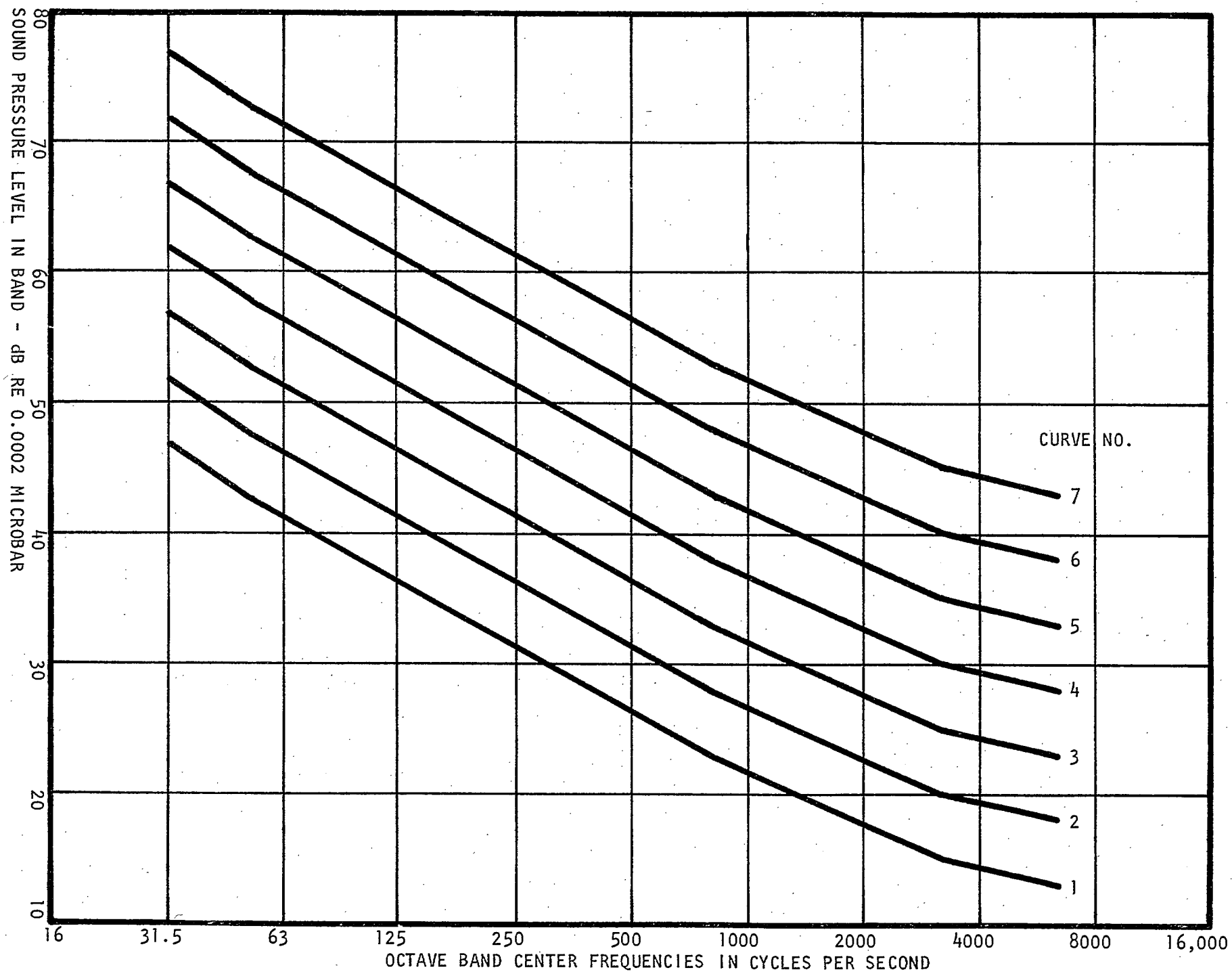
* For simple sound measurements frequency weighting networks are used which "weight" or ignore certain parts of the spectrum to correspond with how one's ear responds to the overall sound.

TABLE 2

ESTIMATE OF OUTDOOR BACKGROUND NOISE BASED
ON GENERAL TYPE OF COMMUNITY AREA AND
NEARBY AUTOMOTIVE TRAFFIC ACTIVITY

Condition	Curve No. In Fig.2
1. Nighttime, rural; no nearby traffic of concern	1
2. Daytime, rural; no nearby traffic of concern	2
3. Nighttime, suburban; no nearby traffic of concern	2
4. Daytime, suburban; no nearby traffic of concern	3
5. Nighttime, urban; no nearby traffic of concern	3
6. Daytime, urban; no nearby traffic of concern	4
7. 300 to 1000 feet from intermittent light traffic route	2
8. 300 to 1000 feet from continuous light traffic route	3
9. Within 300 feet of intermittent light traffic route	3
10. Within 300 feet of continuous light traffic route	4
11. 1000 to 2000 feet from continuous medium-density traffic	4
12. 1000 to 2000 feet from continuous heavy-density traffic	5
13. 300 to 1000 feet from continuous, medium-density traffic	5
14. 300 to 1000 feet from continuous heavy-density traffic	6
15. Within 300 feet of continuous medium-density traffic	6
16. Within 300 feet of continuous heavy-density traffic	7
17. Nighttime, business or commercial area	4
18. Daytime, business or commercial area	5
19. Nighttime, industrial or manufacturing area	5
20. Daytime, industrial or manufacturing area	6

APPROXIMATE AVERAGE OF MINIMUM BACKGROUND SOUND PRESSURE LEVELS ASSOCIATED WITH THE CONDITIONS OF TABLE 2.



ceiling. In addition to size and accessibility there are generally some valid practical reasons for placing treatment on all or parts of a ceiling. However, wall treatments are sometimes required in addition in various types of rooms for purposes of absorption to minimize undesirable room resonances or for the break-up of a condition called flutter.

This phenomenon (flutter) connected with the treatment of small rooms deserves special mention. If only the ceiling of a room of the size, for example, of a small office or work cubicle is treated and the walls are left perfectly bare and reflective, it is often observed that the room sounds much more live and reverberant than would be expected from the amount of absorption installed. This is due to the fact that sound waves travelling at angles which strike the ceiling are quickly absorbed, but those components which travel in horizontal directions continue to be reflected back and forth between the parallel walls with a much slower rate of absorption. When this horizontal multiple reflection occurs between a pair of parallel walls whether caused by speech or by sharp impact sound, it is often heard as a ringing or buzzing which is termed a flutter echo. This condition can result in dis-satisfaction among the occupants of small, sparsely furnished rooms but can be easily corrected by proper acoustical treatment of the walls.

Corridors represent another special case where the intelligent use of absorptive material can be highly beneficial. Since the dimensions are so disproportionate, a corridor with reflective surfaces acts less like a room and more like a large speaking tube which conducts sound with very little loss of energy over its entire length. Acoustical treatment can result in a continuous drop in loudness along the length of the corridor away from the noise source, thus tending to confine disturbances to the immediate vicinity of the source.

A final special room acoustics condition exists when the use of a space requires essentially an absence of reverberation

over a substantial range of the audible spectrum. In the extreme, we speak of completely "free field" conditions in which all six surfaces of the room are made virtually non-reflective to sound above some lower frequency limit. Certain special purpose spaces demand this degree of control of the room's acoustics environment and, of course, criteria in terms of reverberation time is not appropriate.

4.6. Sound Transmission

Two basic types of sound transmission are encountered in buildings: airborne sound transmission and structure-borne noise transmission, of which a very important sub-category is so-called "impact sound".

4.7. Airborne

Airborne sound is radiated from the human voice, musical instruments, machines, etc. This sound passes through the air of the space in which it originates and is transmitted through partitions, floors, and/or ceilings, from which it re-radiates into the air until it reaches a listener. Airborne sound can be attenuated in several ways: by increasing the distance between source and listener, by sound-absorbing materials, or by sound-isolating barriers.

With regard to sound absorption, when the listener is very close to the source of sound, sound-absorbing materials on the room surfaces will have little or no effect on what the listener hears. In the case, for example, of an operator seated at a noisy electronic data processing machine, treatment of the room boundaries cannot provide noise control for him. In this case, noise control must be provided by modification or enclosure of the machine which would lead to a reduction of its noise output.

When the listener is at a greater distance from the source but within the same room, sound-absorbing boundary surfaces of the room can provide some useful noise control. This ability of absorbing materials to control the general noise level as well

as reverberation is significant in rooms having noisy activities or equipment. These include practically all types of occupied spaces and especially typing rooms, mechanical rooms, etc. The maximum noise reduction that can be expected is on the order of 10 dB; more typically, only 3 to 5 dB of reduction will be achieved.

When the source is in one room and the listener in an adjacent room, the degree of disturbance due to the transmitted sound will be determined approximately by:

- a. The amount of noise generated by the source.
- b. The sound transmission loss of the barrier (partition or floor) dividing the source room from the room where the potentially disturbed listener is located.
- c. The continuous background noise in the receiving room.
(This noise corresponds to that defined by the recommended NC values appearing on all criteria sheets.)

The basic procedure for estimating whether or not a given partition or floor construction will provide adequate sound isolation, involves subtracting the expected background noise, (c, above) from the expected source room noise levels (a, above). This difference determines the amount in decibels by which the source room levels must be reduced to match background levels in receiving room and thus constitutes the design goal for the isolation which walls and floors must provide. This difference is nearly equal to the transmission loss of the barrier.

This calculation should be made across the eight standard frequency bands. A more precise determination includes factors pertaining to the nature of the intruding sound, the size of the transmitting partition and the amount of sound absorbing material in the receiving room, etc.

4.8. Structure-borne

Structure-borne noise, which invariably occurs when a vibrating or rotating machine is mechanically attached to a portion of the structure, can be dealt with by mounting the equipment on springs, rubber pads, or other forms of vibration isolation. In particular, this class of treatment is applicable to electrical equipment, mechanical equipment and plumbing installations. Although, because of the specialized nature of these problems, no specific references to the required type of treatment are made in this report. However, these are extremely important details which must be appropriately handled to achieve the recommended background noise criteria.

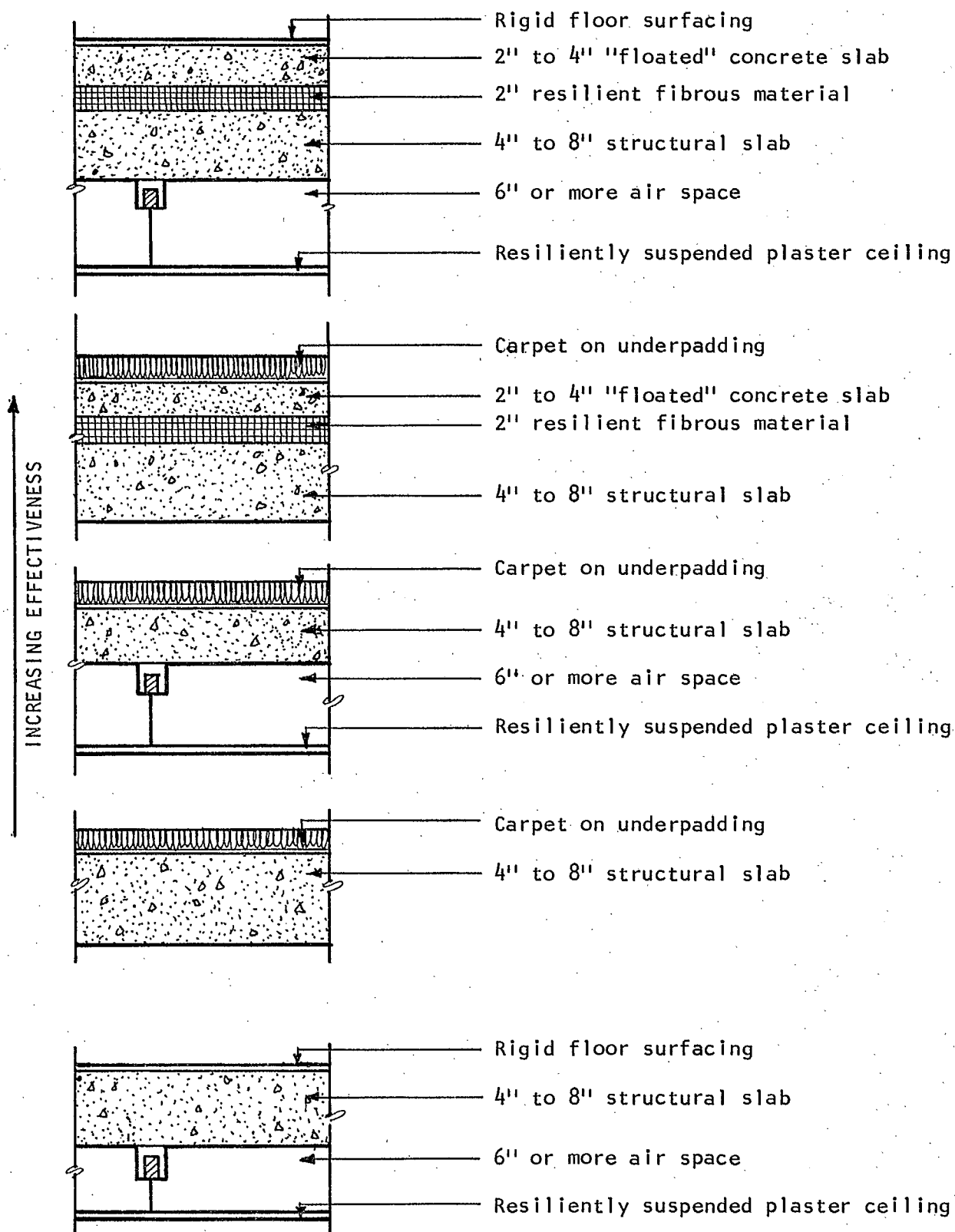
4.9. Impact Noise

Impact noise is somewhat in the same category as structure-borne noise. Considerable work remains to develop adequate criteria and simplified engineering techniques to handle this type of sound transmission. For the present therefore, problems must be resolved in a rather general qualitative manner. Noises such as those generated by foot falls, dropped objects, chair scraping, etc., are accommodated in a variety of construction forms which are standard to the building types under discussion. This is partially a function of the relatively heavy floor constructions required for structural and fire code reasons.

Additionally, some form of carpet or resilient floor covering is essential if critical spaces below do not have suspended plaster ceilings. Typical constructions for moderate to severe conditions are shown in Table 3. Careful attention should be given to detailing of this kind in combination with background NC. Occasionally, structural discontinuities may be required. Reference 3 also indicates the relative impact isolation provided by a number of typical floor ceiling constructions.

TABLE 3

TYPICAL FLOOR CONSTRUCTION REQUIRED TO SOLVE
MODERATE TO SEVERE IMPACT NOISE PROBLEMS



4.10. Design & Construction Features.

A number of useful design and construction features which can affect sound transmission and room acoustics in both general and specific ways should be kept in mind throughout the development of a building design. When dealing with any abnormal and persistent noise source whether it be airplanes, an elevator, a highway, a bowling alley or other primary noise sources, attempt to introduce buffer areas or rooms if at all possible. Simple devices such as attic plenum spaces, hallways, social spaces, lobbies, storage rooms and closets help considerably in this regard. Sometimes exterior barriers can be effective if high enough, wide enough, or close enough to the source and dense enough, but usually they are over regarded in terms of noise control benefits. Rows of trees or shrubbery provide no acoustic benefit at all since they are transparent to sound. The so-called mass law which relates transmission loss to the mass of a barrier, "wall or floor", which sound must penetrate results in a reasonable efficiency/economy trade-off in the middle zone of 4"-12" homogeneous walls.

For greater loss however, it is more economically advantageous to go to double, separated, or laminated walls which will yield more efficient loss due to their discontinuous nature.

The ideal sound barrier would be a lump high-density mass such as sheet lead might provide. Although sheet lead has some very useful applications in this regard, it has little utility as a structural or partition wall.

In any event, the principle of discontinuity is of considerable importance to isolate building sections or machinery or pipes or ductwork or portions of a floor if by so doing, vibration or impact or low frequency noise can be contained in a defined area. All moving machinery sets up vibration fields which must be absorbed or contained, and in addition, selective frequency resonant fields are often generated. HVAC, plumbing and electrical installations provide a myriad

of opportunities for these unanticipated noise sources to creep into buildings. Fluorescent lighting ballasts, valve flush toilets, pipes of all sizes, fans and pumps must all be isolated from the building structure by introducing discontinuity through the medium of support devices. Many installations will require more sophisticated treatment, some less; all should be considered and properly designed.

A number of air pathways are frequently overlooked between adjoining but unrelated rooms. These include inadequately sealed and gasketed doors, common ventilation shafts in back to back bathrooms, recessed fixtures, devices, and cabinets of all kinds in back to back rooms, ceiling plenums common to adjoining rooms with "semi-transparent" ceilings, and common ductwork without sound trap between adjoining rooms, through wall ventilation units with inadequate sound traps, inadequate window thickness for exterior noise conditions, or too low a quality door for hallway conditions.

The specific acoustic and noise control measures that are implemented beyond those required by law in any given building or situation will derive from a conscious effort on the architects' part to identify these potential trouble spots and advise the owner accordingly. Solution of these problems rests in the final analysis upon the willingness of owners to act upon the professional advice they have been given, especially when this involves higher capital costs. The record in this regard is not good. The unfortunate history of much acoustical engineering is that it has been of a corrective rather than preventative nature and, as a consequence, much more costly than if incorporated in the original design.

4.11. Administrative Stage

The third level of activity where acoustic and noise control considerations and decisions can be made is at the administrative level during final building,

furnishing and occupancy. This is a level of decision which is rarely exercised strongly if at all. Fixed volume controls on radio and TV sets, location of telephones in rooms, wake-up buzzer systems, control of children, closing hours for recreational facilities, location of vending machines, volume and closing time of evening musical entertainment groups and the prompt attention to complaints; all of these are common sources of complaints from dissatisfied hotel/motel users. The selection of furnishings and finish materials can have a pronounced effect on the reverberant quality of a guest room. As a general rule, these rooms should have a "soft" character. This means high absorption across the frequency bands. Manufacturers' specification sheets will be helpful in this regard. Fibreglass drapes and plastic products of almost all kinds have little absorptive value. Cottons, wools, deep synthetic yarns and upholstery are desirable.

5.0. Special Considerations

- Office Space

Over the past twenty-five years, considerable advances have been made in the technology of acoustics and noise control. A relatively large amount of relevant material in support of these advances has been developed around the activities and requirements of office spaces. This can be attributed to not only the ready access researchers had to many types of office spaces, but also to a realization that the intelligibility and confidentiality of speech in day to day human activity and exchange were two critical parameters on which acoustic and noise control standards could be developed.

Extensive work and surveys of many offices by Beranek led to establishment of the NC curves. Subsequent work by Cavanaugh, Farrell, Hirtle and Walters explored speech privacy in buildings in great detail. Their work defined and established the Articulation Index (AI) as a measure of merit with regard to user satisfaction in terms of privacy.

5.1. Open and Closed Office Spaces

With the increased popularity of open space planning, the demand also grew for greater understanding of the behaviour of sound in spaces of this type. Historically, open space planning or flexible division of space, has been

practised for many years. This is particularly true of Sunday schools and small country schools where one or two rooms accommodate a wide range of classes and activities. Recently, open space planning for offices has generated considerable interest. This was given major impetus as a result of studies for schools sponsored by the Educational Facilities Laboratory Inc., and development of the office landscape concept by the Quickborner Team from Quickborner, Germany.

The high level of interest resulted in a continuation of work on open space acoustics in buildings by Cavanaugh, Hirtle and Walters, which will be drawn on in succeeding paragraphs.

There are some significant differences in the response of open and closed office spaces to speech. In a closed office, the boundary walls facilitate a reverberation build-up and containment of the source noise within the given space. This can make the perceived sound in a closed space greater than the same source of sound perceived at the same distance in an open space condition.

The kind and amount of sound-absorbing treatment as well as the size of the room and the level of speech effort will determine the sound level in a closed space. In an open office condition, the

speech levels will decrease approximately 3 to 6 dB per doubling of distance from the source. The absorbent treatment of the floor and ceiling will influence the same amount of this decrease.

The speech effort in an average enclosed office will range from normal to loud voice, a spread of 12 dB. The range in an open office environment seems to be somewhat greater on the order of 18 dB. This is probably due to what appears a psychological tendency for many people to speak sometimes at a lower level of intensity than they might in a closed situation.

In closed space conditions, considerable loss or reduction of speech levels (or other noises) is provided by the room boundaries, i.e. walls, floor and ceiling. The amount of this reduction may range from 20 dB to 50 dB. In contrast, the noise reduction or loss in open plan offices may range from 0 to 20 dB and will come for the most part from barriers, distance and the absorbent treatment of floor, ceiling and the barriers.

The significant parameters outlined above are assembled with assigned values and value ranges in figure 3 for comparison. Cavanaugh et. al. have worked out a standard analysis scheme for the quality of speech privacy in open plan spaces. It is included as figure 4 in this report. The various items have already been explained somewhat. Speech Effort refers to that generated at the source. The Distance Source to Listener is self-explanatory. The Barrier refers to any vertical barrier between the source and listener, and the height is measured in feet above the level of a seated man's head. Background Noise Rating refers to the standard NC numbers, the L.M.N.H. refer to special weighting factors beyond the scope of this report to explain. The Privacy requirement is also self-explanatory. The analysis sheet should be used by selecting appropriate values for the five items and placing those values in the blanks to the right of the chart. If the sum of those numbers exceeds 102, then the speech privacy condition is likely to be satisfactory. If below 102, the privacy satisfaction will be marginal to impossible.

It should be kept in mind that this method of analysis is still in very early stages of development and will yield best results in the hands of informed persons. One should be alert for trade-offs between "intelligibility" as a function of space reverberation and privacy as a function of sound absorption. One implication here is that small groups of people fare best in open spaces and too much absorption can be as bad as too little.

The range of values for item 2 on the analysis sheet highlight the importance of the differential height between the source and the type of the barrier.

A 5' high barrier is only effective out to 25' and the maximum effect one can hope for with the source and listener both within 3' of the barrier is 11 dB.

Overall, the matter of determining acceptable acoustic environments in open office spaces is complex, though not insurmountable. It is likely however, that it can best be handled by persons informed on the subject as well as on acoustics in general.

5.2. Recommended NC

There are numerous sources of data on office background noise and recommended NC. One of the most comprehensive and still valid, is the original Beranek study of 1957. A table out of that study is included here. The range of activities conducted in offices is extremely wide and various NC are obviously going to apply to various offices as a function of these activities. It should be kept in mind that larger offices will be 5 to 10 dB louder when occupied than when empty just from people movement and machine activity. Allowance should be made for this in various calculations.

5.3. Construction Details

Offices must provide a proper acoustic environment in terms of privacy and ease of communication. The intrusion of unwanted noise is going to be a function of the boundary element transmission losses

and the internal background noise. A proper selection and design of the second to complement the first will yield the desired results for closed spaces. Open space planning is somewhat more difficult but the basic pattern of balancing the background noise and the reductions attributable to the several parameters of consequence is the same.

Special details to watch for are poor joints in walls and ceilings, leaky gaskets around doors; inefficient or poorly placed barriers in open spaces; crossfeed through HVAC ductwork (no sound traps or lining between adjacent spaces); unpacked openings around electrical fixtures; doors and windows back to back thus providing short pathways for sound; under-designed floor - ceiling construction improperly adjusted orifice or diffuser vanes on HVAC system. Toilet fixtures should be neoprene mounted, particularly valve flush toilets. Electrical fixtures serving back to back spaces should be staggered in the wall, packed and caulked against air leakage.

Corridor conditions can affect the probability of noise intrusions into individual rooms. Ideally the corridor should have the similar characteristics as the rooms in terms of NC levels and reverberation control.

Windows and through wall ventilation units should be designed carefully to insure that their performance in terms of noise admission is consistent with that of other boundary elements in the room. Through wall HVAC units are quite often a straight conduit with no provision for sound trapping or filtering. While this may not be of significance where the noise background level is low, it could be critical in high noise areas near heavy traffic or industry.

Reverberation time is of some importance in office buildings, particularly in conference rooms. It is often calculated only in mid-frequency range ($f=500$ Hz). This can lead to disappointing results, particularly for small rooms where the use of sound absorbent material primarily efficient in the mid-frequency range often results in a "boomy" sound.

The frequency range around 250 Hz can be very critical for the male voice and spaces where extensive speech exchange will occur should be checked in that frequency also. Another possibly desirable feature of conference rooms or small assembly/lecture rooms is to leave the centre portion of the ceiling hard and reflective (not absorbent) so as to enhance the speech distribution in the room. This should be designed in conjunction with wall treatments to insure adequate absorption.

5.4. Site and Layout Factors

Major noise sources above NC - 80 have the potential of being difficult to cope with in terms of economic solution. If some flexibility exists, noise intensive areas of sites should be avoided. Construction near major traffic arteries and on air rights can be successfully accomplished from an acoustic point of view. The possibility of some economic premium does exist however. Generally one can stand at a site and just by listening exercise reasonable judgement as to the appropriateness of the site. If noise levels are very high or some question exists, measurements should be taken.

A frequently overlooked source of noise is major mechanical equipment associated with or within the building. Large office buildings particularly must cope with a multitude of equipment items which are prime noise and vibration generators. Not only should this equipment be physically remote from the office spaces, but also remote in a structural sense through vibration mounts, shock hangers, flexible connections, inertia blocks and sound absorbing material. If these equipment items are grounded and transmitting noise or vibration into the structure, manifestations of that energy input can appear at unsuspected locations throughout the building.

If possible, basement equipment rooms with isolated floor slabs are ideal locations. Equipment floors and pent-house need very special attention. Roof top units and rotating machinery of all

kinds should be kept away from windows leading into the office spaces.

The consideration of noise and acoustic issues should ideally begin in the planning and site selection stages and continue right on through design, construction and administration. Periodic consultation with informed persons on these issues can return many benefits in the form of satisfied clientele and a wholesome acoustic environment.

Comparison of Significant Parameters in
Enclosed Vs Open Plan Speech Analysis
Figure 3

Approximate Range in dB

12	Speech Effort
15	Source Room Characteristics
20-50	Noise Reduction of Enclosure
30	Ambient Background Noise Levels (Ventilation, Artificial)
6	Privacy Requirement

Approximate Range in dB

Speech Effort	18
Source Room Characteristics	3- 6/doubling
Noise Reduction of Barriers	0-20
Ambient Background Noise Levels (Ventilation, Activity, Artificial)	30
Privacy and/or Communication Requirement	6/18

Open Plan Speech Analysis
Figure 4

1. Speech Effort



2. Distance - Source to Listener

	3'	6'	12'	25'	50'	100'	200'
Hard Floor and Ceiling	25	28	31	34	37	40	43
Carpet Only	25	29	33	37	41	45	49
AC. Tile only	25	30	35	40	45	50	55
Carpet and Tile	25	31	37	43	49	55	61

3. Barrier

Barrier Height (assumes a ceiling = 0.75)

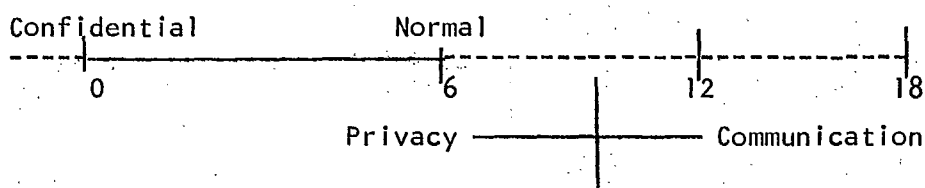
	0'	1'	2'	3'	4'
0'	0	0	0	0	0
1'	11	7	4	2	0
2'	14	10	7	4	3
3'	15	11	8	5	4
4'	16	12	9	6	5

4. Background Noise Rating

If L or M use rating

If N or H use rating + 5

5. Privacy and/or Communication Requirement



TOTAL

Table 4
Recommended Noise Criteria for Offices

Noise measurements made for the purpose of judging the satisfactoriness of the noise in an office by comparison with these criteria should be performed with the office in normal operation, but with no one talking at the particular desk or conference table where speech communication is desired (i.e., where the measurement is being made). Background noise with the office unoccupied should be lower, say by 5 to 10 units.

NC Curve of Figure 3	Communication Environment	Typical Applications
NC-20 to NC-30	Very quiet office - telephone use satisfactory - suitable for large conferences.	Executive offices and conference rooms for 50 people.
NC-30 to NC-35	"Quiet" office; satisfactory for conferences at a 15 ft. table; normal voice 10 to 30 ft; telephone use satisfactory.	Private or semi-private offices, reception rooms, and small conference rooms for 20 people.
NC-35 to NC-40	Satisfactory for conferences at a 6 to 8 ft. table; telephone use satisfactory; normal voice 6 to 12 ft.	Medium-sized offices and industrial business offices.
NC-40 to NC-50	Satisfactory for conferences at a 4 to 5 ft. table; telephone use occasionally slightly difficult; normal voice 3 to 6 ft; raised voice 6 to 12 ft.	Large engineering and drafting rooms, etc.
NC-50 to NC-55	Unsatisfactory for conferences of more than two or three people; telephone use slightly difficult; normal voice 1 to 2 ft; raised voice 3 to 6 ft.	Secretarial areas (typing), accounting areas (business machines), blue-print rooms, etc.
Above NC-55	"Very noisy"; office environment unsatisfactory; telephone use difficult.	Not recommended for any type of office.

Acoustical Criteria Sheet, Office
(closed) up to 300 ft.

1.

Recommended Ambient Noise Levels:

- a) Top Limit NC - 35
- b) Bottom Limit NC - 30

2.

Recommended Reverberation Time (in seconds)
at Frequency (Hz) 500 - less than 1.0.
Design to this value or below for un-
occupied room conditions.

3.

Other Room Acoustics Considerations:
Occasionally in offices or conference
rooms, a wall to wall flutter occurs.
Tack boards, book cases or drapes on one
of a pair of parallel walls are good
precautions against this. Normal
furniture disposition will contribute
to desired break-up.

4.

Sound Amplification Requirements: None.

5.

Noise levels likely in this Room (in dB
re. 0.0002 dynes/cm)

Octave Band Centre Frequency (Hz)

63	125	250	500	1000	2000	4000	8000
60	66	72	77	74	68	60	-

6.

Impact and Structure-borne Sound:
Negligible to Moderate on floors above
executive offices.

7.

Special Considerations: In any room
where sound intrusion or privacy
considerations are a potential problem
and the partitions run to the underside
of a suspended ceiling, the adequacy of
the room to room transmission via the
common plenum and connecting air ducts
should be examined closely.

Acoustical Criteria Sheet - Conference
Room (closed)

1.

Recommended Ambient Noise Levels:

- a) Top Limit NC - 35
- b) Bottom Limit NC - 30

2.

Recommended Reverberation Time (in seconds): at Frequency (Hz) 500 - 0.5 to 1.0. Design within this range for unoccupied room conditions. Centre 50% of ceiling should be finished with a non-absorbent material like plaster.

3.

Other Room Acoustics Considerations: Occasionally in offices or conference rooms, a wall to wall flutter occurs. Tack boards, book cases or drapes on one of a pair of parallel walls are good precautions against this. Normal furniture disposition will contribute to desired break-up.

4.

Sound Amplification Requirements: None.

5.

Noise levels likely in this Room (in dB re. 0.0002 dynes/cm)

63	125	250	500	1000	2000	4000	8000
Speech							
60	66	72	77	74	68	60	-
Audio-Visual							
65	74	78	80	79	75	68	60

6.

Impact and Structure-borne Sound: Negligible to Moderate on floors above executive offices.

7.

Special Considerations: In any room where sound intrusion or privacy considerations are a potential problem and the partitions run to the underside of a suspended ceiling, the adequacy of the room to room transmission via the common plenum and connecting air ducts should be examined closely.

