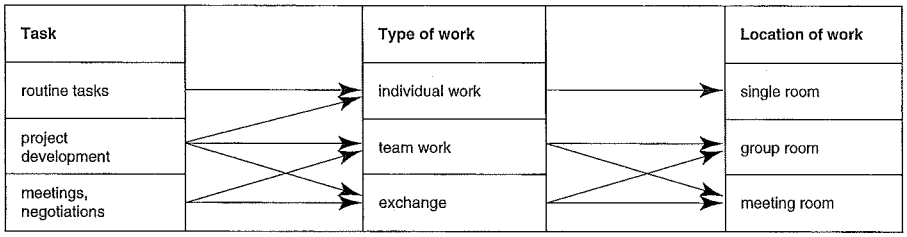
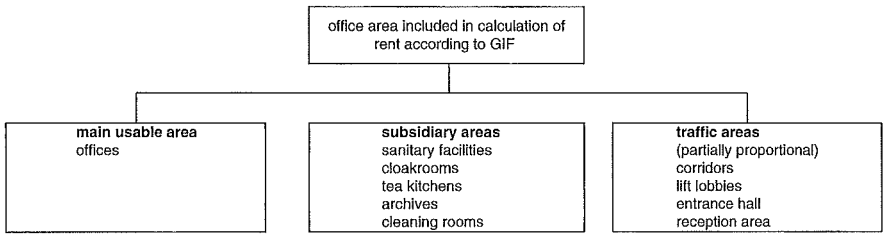
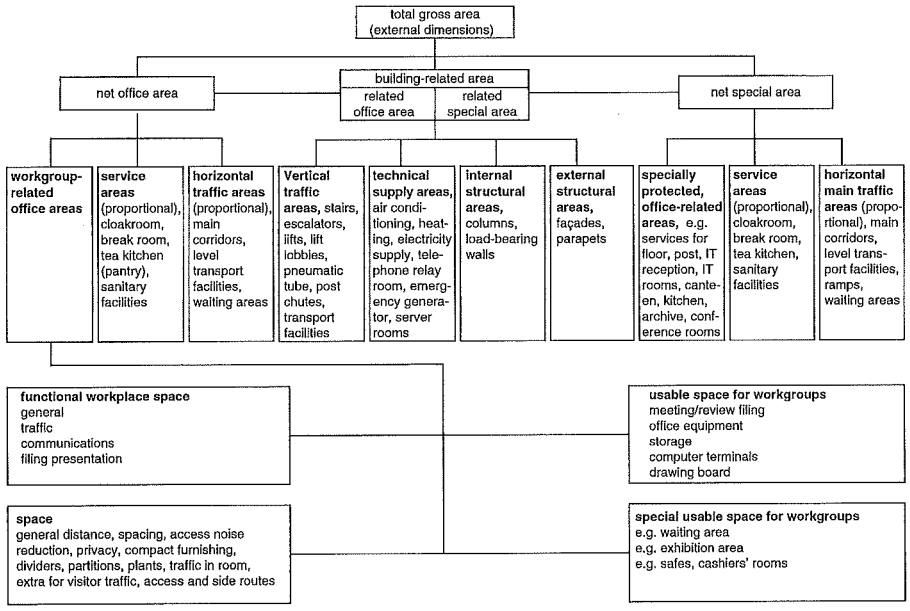


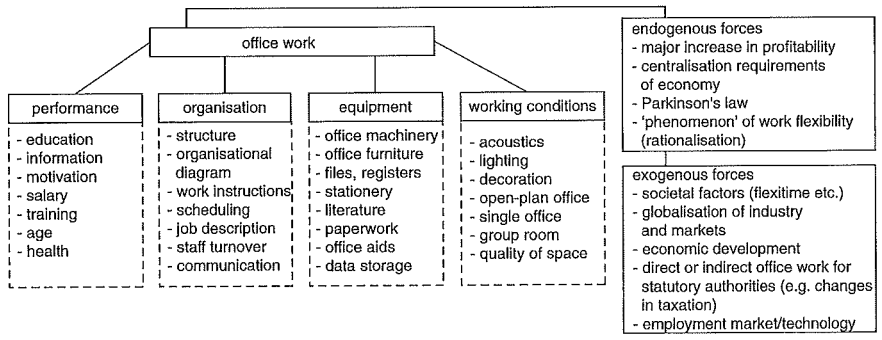
1 Relationship between duties and room type



2 The GIF (Association for Property Economics Research), in collaboration with the DIN standards committee, has developed definitions of working areas in offices ('MF-B') and commercial rooms ('MF-H'), for the purpose of comparing commercial rents. Based on the concepts of DIN 277 1973/87 ('Areas and volumes of buildings'), certain areas have been categorised into 'rented areas for office space' and 'rented areas for commercial space'. Areas with shared use are only considered proportionally. Application is not binding.



3 Organisational structure of office space (Lappat)



4 The factors determining office work (Henkel → refs)

Office work

Administrative work is the processing of information. The emphasis of office work is changing from routine processing of data (traditional card systems) to more creative information processing and evaluation on account of changes in storage and improved ways of accessing information.

Employees are becoming ever more important in the organisation of office work. Factors like the image of the company (corporate identity), design of areas for breaks and relaxation and the individual configuration of workplaces are all intended to increase employees' performance. Global networking means that routine work can be carried out on a decentralised basis (home working, neighbourhood and rented offices).

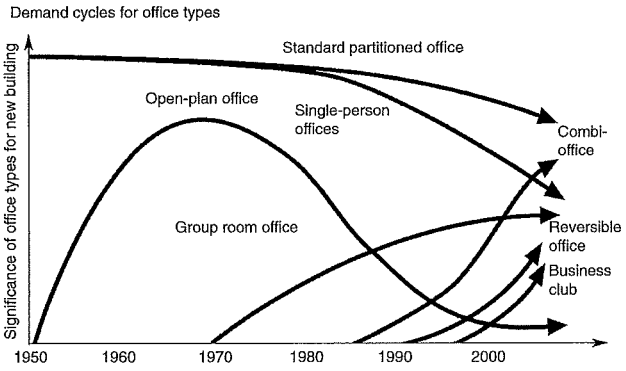
The company headquarters is becoming an information market place, which is made use of by many employees either temporarily or in changing groups to achieve their tasks. These changes result in the very variable demands made on the workplace in an office building.

The range of options runs from the single workplace in a cubicle office through group rooms to workstations which are only used at specific times ('hot desking'). The more flexible the rooms in a building are, the easier it is for the company to adapt to ever-changing requirements.

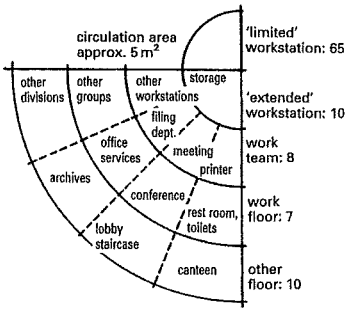
Design

Detailed recording of the business and organisational structure, and thus the specific functions and working relationships in the company, enable the determination of a schedule of requirements (needs assessment).

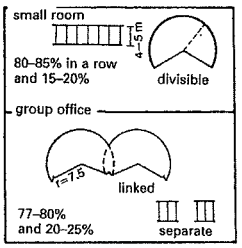
In rented buildings, flexible room layout is of great importance, to achieve the most variable sizes of office unit possible.



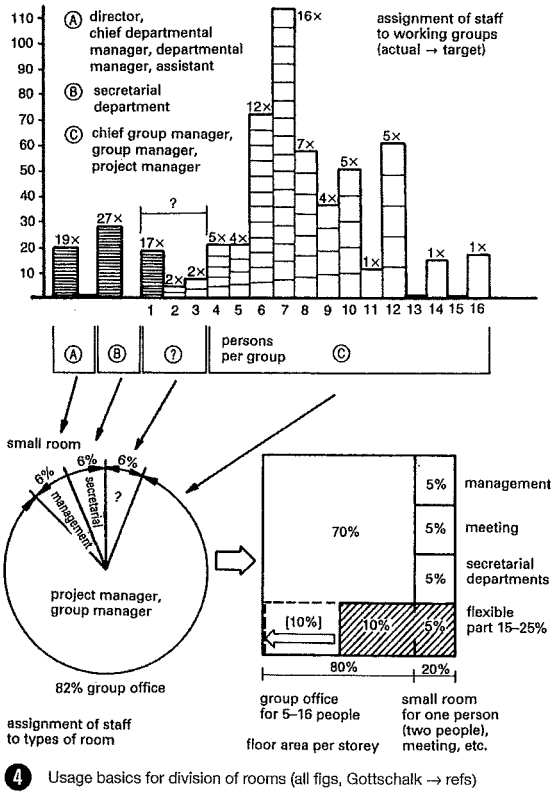
❶ Development of the demand for different types of office (DEGI → refs)



❷ Analysis of daily use in an office, area %



❸ Recommendation for relationship of permanent and flexible room structures in small and group room offices, area %



❹ Usage basics for division of rooms (all figs, Gottschalk → refs)

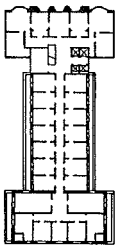
Influence of information technology and office automation
The developments in information and communication technologies are leading to changed working conditions in offices.

Multifunctional terminals are replacing single components in data, text and image processing. Individual systems are being networked into integrated office communication systems. The ever-improving public data networks (ISDN, DSL, 3G) make it possible to exchange great quantities of data over long distances. Flat screens, laptops and mobile telephones reduce the amount of space required at each workstation. The effect of office technology on the office layout and workstations is creating evaluation criteria like: more emphasis on immediate workplace quality; ensuring company-wide flexibility; ecologically sound working environment, to whose spatial configuration older office buildings no longer measure up. New Workplace Regulations stipulate working areas according to demand (no more minimum areas).

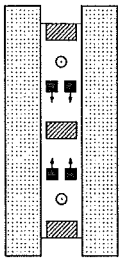
The rationalisation potential of administrative activities (filing, sorting, copying, searching, acquisition of material) and communication activities (conferences, meetings) is about 25% of weekly working time. Routine tasks acting as active relaxation breaks would be reduced by about 50%. Increasing telecommuting leads to a reduction in office space, because only some activities (meetings etc.) then take place in the office building at specific workstations, which are no longer personalised and can be used by various employees as required ('hot-desking'). Personal areas are reduced to office containers, which contain a post box and files. Mobile telephone and computer WLAN networks make a change of location simple. The potential independence of location (decentralisation) is countered by other possible losses (concentration of staff at central locations, headquarters in prestigious situation, urban location as sign of continuity, ambience, work and leisure activities in one place), which can play important roles.

Changes at the workplace
The rationalisation effect of information technology and altering workplace requirements (procedures and organisational pattern) are changing the structure of offices. Staff levels are falling and work groups are getting smaller. The former hierarchical division of labour among staff, like manager, secretary, specialist employee etc., is changing to integrated work groups and thus altering the assignment of office space.

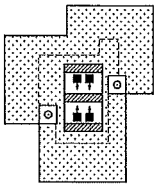
A more sensitive relationship to the direct working environment is closely linked to the predominant value orientation in the company. This is reflected in the attitude to the quality of the workplace (daylight, environmental context, energy consumption), and the activity (ecological viewpoints, material use, waste disposal). The workplace is an important place for social interaction among the users, which is increasing in relevance due to formalised work structures (IT, work organisation etc.). Increased mental and physical stress leads to a greater awareness of the working environment (sufficient space, some personal choice in furnishings, ventilation, lighting, sufficient protection from disruptions). 75% of daily work takes place at the 'close and extended workplace' → ❷. Necessary work contacts and collectively used facilities are significant, thus the requirement for a mixed provision of single and group rooms, 'personal' and 'collective' workplaces → ❸ – ❹. In addition to the refurbishment of existing office space, new spatial concepts involving single and group rooms are starting to appear (Fuchs, Gottschalk, Henkel → refs).



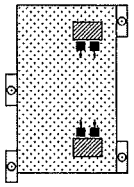
1 Single-room offices, Garrick Building, Chicago
Arch.: Dankmar Adler and Louis H. Sullivan, 1892



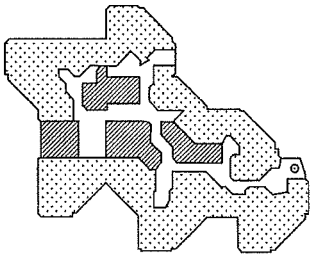
2 Single-room offices in group of three



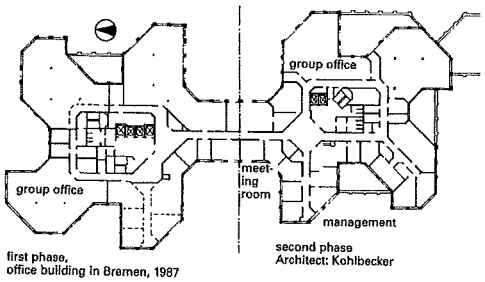
3 Reversible offices

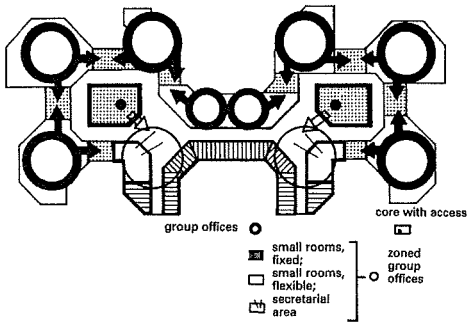


4 Open-plan office

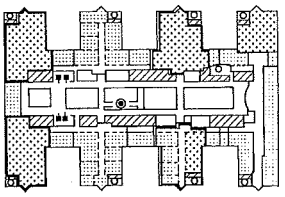


5 Group-room office for ÖVA insurance, Mannheim 1977
Arch.: Striffler





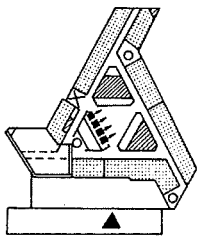
8 Application of linked and partially zoned group rooms; these are connected by reversible small-room zones and can be partially zoned when required for common areas.



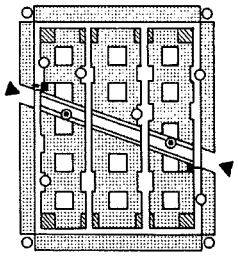
9 State Central Bank of Hesse, Frankfurt am Main, 1988
Arch.: Jourdan, Müller et al.

Forms of office organisation

Open-plan offices (Mies van der Rohe: '... clearly laid-out, undivided, only structured...' → refs) are suitable for large groups of employees who are predominantly engaged in shared work and for routine activities with a low concentration threshold. This is increasingly the exception rather than the rule today. The concept appeared in the 1960s with arguments like transparency and manageability of work processes, development of community feeling, and a rationally organised multifunctional area. IT machines were in separate rooms and not available in offices. The extensive room depths of 20–30 m resulted in high costs for building services, which is of limited suitability for the conversion of buildings, and the potential flexibility has its limits in the light of today's demands (opening windows, control of lighting, air conditioning and electricity supply) (Henkel → refs). The open-plan office is attested by sociologists to be afflicted with a character of compulsion (social controls, dependence on technical equipment, optical and acoustic disturbance), and therefore led to a negative reaction among its occupants.



6 BfG Frankfurt
Arch.: Nowotny-Mähner, HPP, Speer und Partner



7 Cantonal building, Berne
Arch.: Matti, Bürgi, Ragaz, Liebefeld

Single-room offices are suitable for independent or concentrated work, as a single-person room or for a few people in very small groups who need to exchange information constantly. This arrangement has been common in Germany since World War II and still has its justification when the requirements of the workplace correspond (→ Gruner, Jahr; Steidle, Kissler; or → new offices for the Federal Environment Office, Dessau, Sauerbruch, Hutton) or in newbuild high-rise offices, where the structure of the building can be so decisive that it leads to the very standardised character of spatial and organisational working practices.

Reversible offices constituted an attempt to improve the working conditions in open-plan offices, which are often found to be inadequate on many grounds (no differentiated air conditioning, daylight, optical and acoustic disturbance). The possibility of partitioning producing a more effective single-room office structure (i.e. cubicles) when required for more concentrated work considerably increased technical input to enable flexibility. However, not only the dissatisfaction of the users but also the increasing lack of cost-effectiveness with increasing energy prices led to this form of office being questioned. The working structure as changed by new technologies (e.g. the use of PCs) enabled organisation into small groups. First example: the building of the ÖVA, Mannheim.

Group rooms (smaller open-plan) are suitable for work groups with constant information exchange. This form of office was an attempt to install room layouts with more scope for individual decisions (→ **Changes at the workplace**, p. 232), via the size of the workplace surroundings (max. 7.5 m to a window), and thus improve the working conditions of an open-plan arrangement (light, air, individuality), which were found to be inadequate with the increasing demands on office work. It is possible to do without full air conditioning in favour of back-up ventilation services, in addition to opening windows and using radiators.

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Computer workstations
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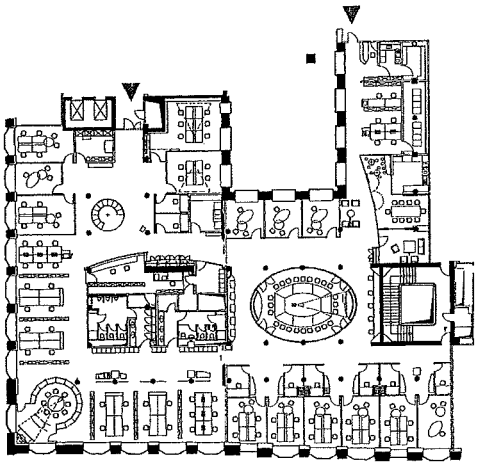
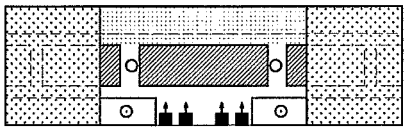
OFFICE BUILDINGS

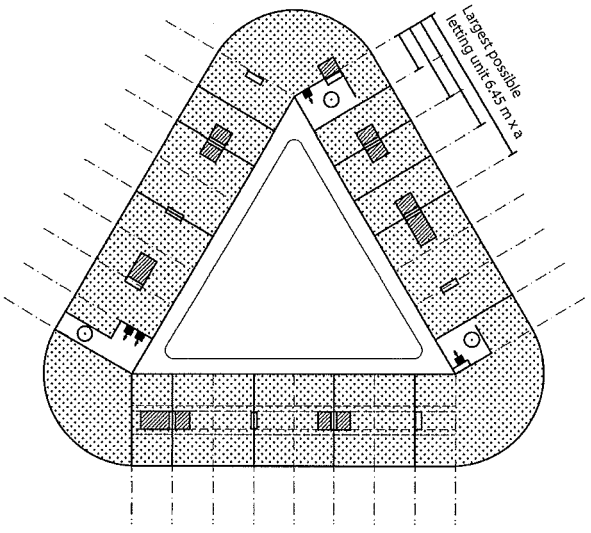
Typology Since 1980



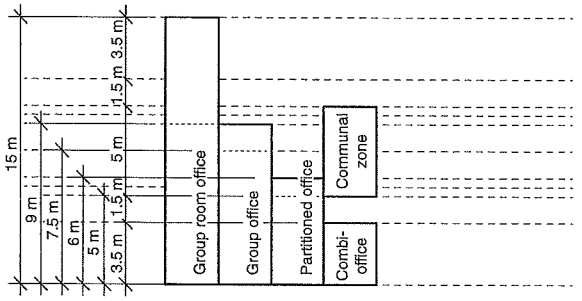
❶ Office in an existing building with workplaces laid out to meet needs, which can be occupied by employees for specific tasks. This form of organisation with non-territorial workstations is called a 'hot desk office'.
Arch.: Schnell und Partner, Munich



❷ Scheme of a small group of three rooms (high-rise plan) with flexibly usable zones at the ends and areas for cubicles in the core

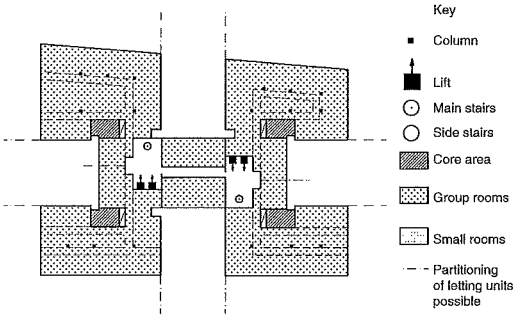


❸ Scheme of a building with variable areas for rent. The external access to the rented units along the gallery leaves the internal access to be decided by the tenant. The smallest possible unit is a half grid between two supply cores. Building depth approx. 15 m and spacing of the supply shafts 12.90 m, the smallest letting unit approx. 90 m². UFO, Frankfurt am Main Arch.: Dietz Joppien Architekten AG

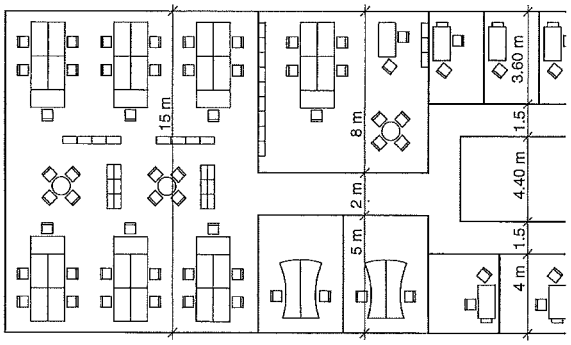


❺ Room depths for various types of office

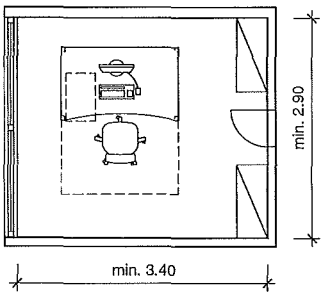
The continuing progress of information technology is resulting in new job descriptions for employees. The requirements for office space are also changing and often require the **refurbishment** of existing office buildings. An additional factor of equal importance is that the open-plan configuration has been found to be inadequate (→ **Changes at the workplace**, p. 232).
The means used for this reorganisation are rebuilding, provision of daylight from inner courtyards, straightforward plan layouts, creation of workplaces of equal rank with regard to light, air and sound reduction, or the use of office furnishing systems, which can increasingly undertake the function of building services like cabling, sockets etc., and also of partitions.
The **combi-office** principle attempts to provide a suitable room concept for the specific requirements of an office organisation. This entails a room arrangement that is flexible where required, enables group work, provides individual rooms for concentrated work and a temporarily usable collective layout for particular communal activities. It is particularly suitable for independent, highly qualified work where the workplace can change with the daily programme.
'Hot desk offices' or **'business clubs'** are not spatial layouts but denote a particularly flexible organisation of work without fixed personal workplaces. Particular value is placed on variable room use possibilities and differentiated room qualities. For combi-groups and open-plan offices, efficiency is not achieved through rebuilding of rooms but via the business organisation and a flexible 'club' atmosphere conducive to wellbeing.
In new buildings, this experience leads to more value being placed on reversibility, in order to be able to react better to the ever-shorter innovation cycles of office technology. This leads to buildings which can be divided into user units of varying sizes without great inconvenience (**rented offices**) →❸ – ❹, or even permit a combination of production and administration (**start-up centres**) → ❸. The changed values regarding the workplace, plus high energy prices, are leading to new architectural forms with building elements intended to provide temperature regulation and natural ventilation (conservatories, halls, double façades).



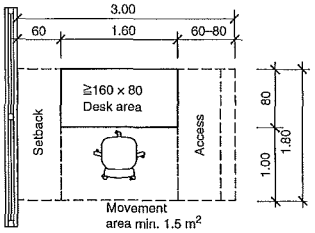
❹ Scheme of a building with variable areas for rent. The central building zone can be opened to the various rental units as required. Kennedyhaus, Düsseldorf
Arch.: Kister Scheithauer Gross, Prof. U. Coersmeier, Cologne



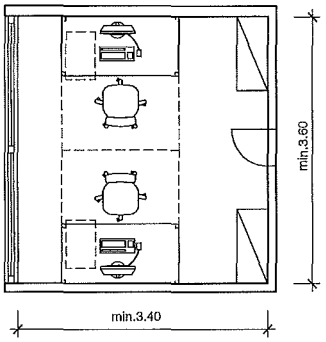
❻ Possible arrangements of various office depths in a 15 m wide plan



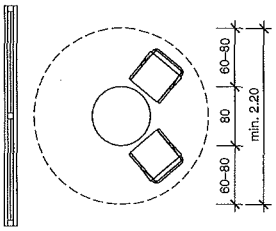
1 Example: single office



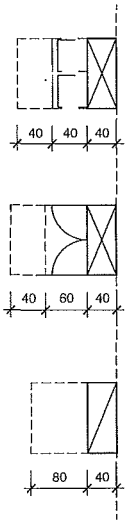
2 Minimum space requirement for a single workstation



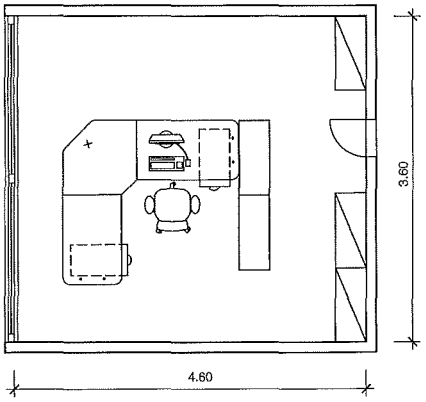
3 Example: double office with wall-oriented workstations



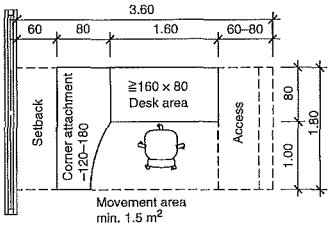
4 Space required for meeting zone



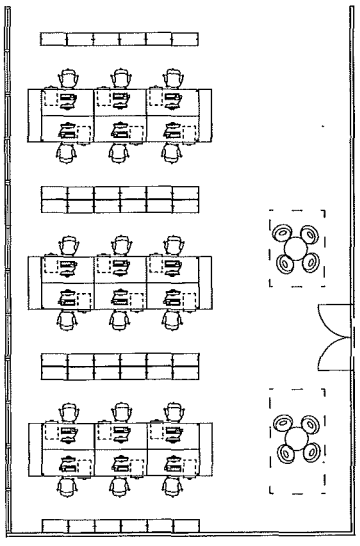
5 Space required for files



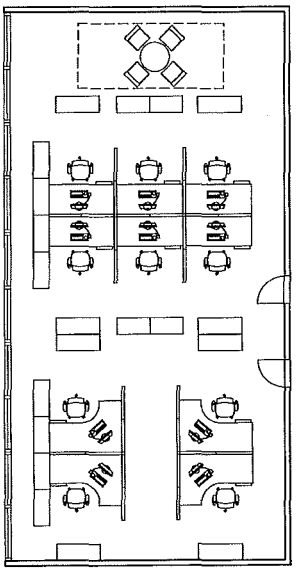
6 Example: office management



7 Space required for single workstation with additional shelf space



8 Example: workstation layout in a large group office



9 Example: workstation layout in a small group office

Workplace

According to the new Workplace Regulations, there are no longer any fixed minimum dimensions for workplaces. But the requirements of the accident insurers and the fact that all workplaces today have computer screens means that the minimum dimensions in the relevant DIN EN standards and regulations apply.

Furniture areas

The standard no longer prescribes fixed dimensions for workplaces, but requires sufficient working and movement areas for changing positions at work and for the individually adaptable placing of work equipment.

The assignments of various areas are differentiated by the standard; however, they can overlap if this results in no limitation of the function.

The areas are:
- work area: table
- shelf area: plan area of the furniture
- furniture function area: space required for doors and drawers
- movement area at the workstation
- traffic and through-passages

Forms of office and work

The office's form and thus its room layout are part of a system influenced by activity, procedural organisation, IT technology and company culture. The building structure and design of rooms can have a significant influence on the use. Efficiency gains can result from factors like reduction of the area per workstation, rooms designed to support procedures and improve motivation, for which emotional factors above all are decisive, like material and colour ideas, but also the provision of quiet and communication areas for formal and informal meetings. The analysis of requirements can produce valuable pointers to possible forms of office.

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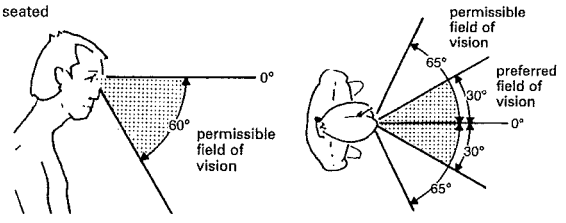
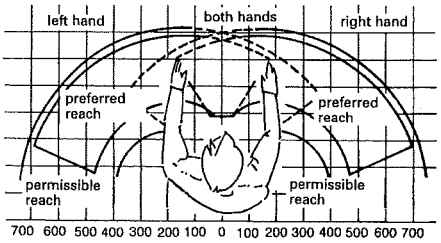
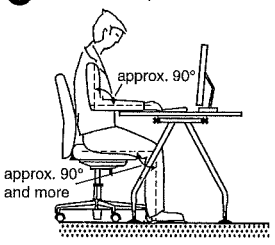
DIN 4543-1



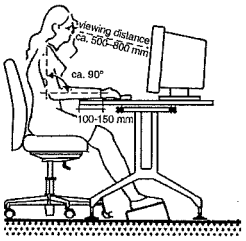
❶ Vertical field of view ❷ Horizontal field of view



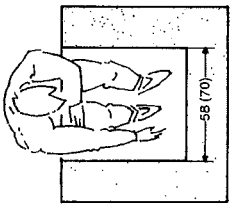
❸ Preferred and permissible reach areas

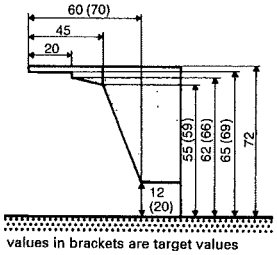


❹ Ergonomically correct basic posture at computer workstation



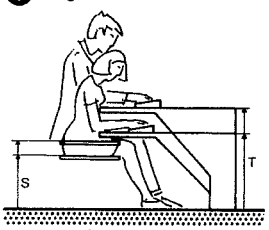
❺ Ergonomically designed computer workstation with fixed desk

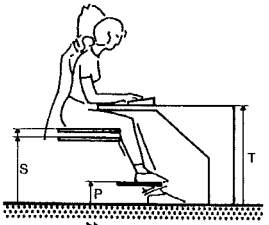


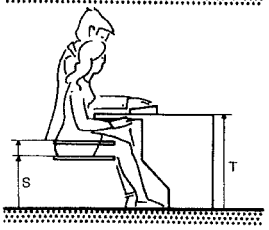


values in brackets are target values

❻ Legroom







Job type 1 table adjustable in height chair adjustable in height	Women	Women and Men
T (Table height)*	(630-t) – (730-t)	(630-t) – (780-t)
S (Chair height)	420-460	420-500
Job type 2 not height-adjustable table not height-adjustable chair not height-adjustable footrest		
	Women	Women and Men
T (Table height)*	(700-t) – (730-t)	(750-t) – (780-t)
S (Chair height)	420-460	500-550
P (Height footrests)	0-100	0-150
Job type 2 not height-adjustable table not height-adjustable chair		
	Women	Women and Men
T (Table height)*	(630-t) – (730-t)	(630-t) – (780-t)
S (Chair height)	420-460	420-500

* t means keyboard height above the table top

❼ Dimensions for workstation furniture

OFFICE BUILDINGS

Computer Workstations

Workstations are where elements such as computer screen, alphanumeric keyboard and document or sound recording device are decisive for dealing with the work. Computer workstations are not based on one standard solution but according to the specific work procedure (e.g. information point, data entry point etc.).
The regulations are laid down in ZH 1/618, 'Safety rules for visual display workstations in office areas', issued by the Association of Commercial Accident Insurance Companies. They include:
- Workplace Guidelines and Workplace Regulations
- more than 40 DIN regulations, particularly:
- DIN EN ISO 9241 T1–T7, 'Ergonomic requirements for office work with visual display terminals'
- ZH 1/535 'Safety rules for office workstations'
- VDI and VDE (German engineering and electrical associations) standards for technical services (heating, ventilation, electricity). Computer workstations should be designed to comply with these regulations and the generally recognised rules of the technology or in accordance with the relevant state of occupational health and ergonomic knowledge.

Workplace layout

Items which are frequently used during the working day should be put in the preferred places where they are visible and reachable → ❶ – ❸. There should be a free movement area of at least 1.5 m^2 at the workstation.
Furniture: This should enable the correctly defined working posture – upper arm and elbow vertical at an angle of approx. 90° and thigh and lower leg vertical at an angle of 90° → ❹. To achieve the correct posture for people of different heights, table and chair sizes must be adjustable. Two ergonomically equally valuable possibilities are:

A: workstation type 1, desk at variable height	60–78 cm
chair at variable height	42–54 cm
B: workstation type 2, type 3, desk of fixed height	72 cm
chair of variable height	42–50 cm
footstool of variable height	00–15 cm

There should be sufficient legroom → ❻.
The desktop working area should be at least 120 × 80 cm (few documents, predominantly screen work; for specialist employees, at least 200 × 80 cm)
Environment: All furniture in the immediate vicinity (desktop etc.) should have a coefficient of reflection of 20–50%.
Lighting intensity should be 300–500 lx, and lamps have limited glare, e.g. through recessed ceiling grid luminaires or 2-K lighting → p. 501–510. Light bands should be arranged parallel to the window. Matt surfaces in the room with recommended coefficients of reflection (approx: ceiling 70%, walls 50%, partitions 20–50%).
The view to the screen should be parallel to the window façade and to light bands, with the screen if possible in-between. Install computer workstations in windowless zones.
Recommendations for climatic conditions and sound reduction should be complied with. The increased use of equipment in offices will more probably result in a cooling load rather than a heating load (→ p. 466).

Psychology of the computer workstation

Negative effects can arise for the management that determines computer work if a strategy of rationalisation is pursued which excludes the employees from the working process as much as possible and attempts to restrict them to residual activities. Prof. Walter Volpert (→ refs) formulated nine criteria for the design of workstations, which define contrasting (machine–person) work tasks with the following features:
- wide scope for action and decision
- reasonable amount of time allowed
- possibility of personal structuring of demands
- performing tasks free of hindrance
- sufficient physical activity
- stimulation of varied senses
- concrete handling with real objects (or direct social relations)
- possibility of variations
- encouragement and enabling of social cooperation and immediate contact between people

(→ **Changes at the workplace**, p. 232)

Filing

Despite the application of new office technologies, the use of paper as the main information storage medium has increased. Until 1980, paper consumption doubled every four years. Computer-aided storage is increasingly used as information depository in office communication systems. Letters, texts and newspapers, which are described as uncoded information, will continue to be part of the paper volume.

Purpose: Clearly arranged ordering and storage of files within short walking distance and efficient exploitation of the space. Space requirements for filing systems (according to Ladner → ❶). Increasing depth of shelves also increases the distance to walk between them.

L × W (filing furniture) = space for furniture
+ ½ L × W + 0.5 m = passage space
total space required = space for furniture + passage space

Deep filing cabinets are more economical. The relationship between furniture floor space and passage space for a vertical filing system using large archive shelves (Velox system) and for a horizontal filing system is made clear in → ⓫. Furniture floor space needed with vertical storage is 5.2 m^2, passage space 4.6 m^2 (100:90). With horizontal storage, furniture floor space 3.2 m^2, passage space 3.6 m^2 (90:100, ratio inverted). A horizontal filing system offers less storage space and the high shelves are hard to organise. **Vertical storage** offers a personnel saving of over 40%. Suspended files make about 87% better use of wall area than files on shelves → ⓯. Files can be transported with a paternoster lift. Workstations should include sorting shelves, small desk, chairs on castors.

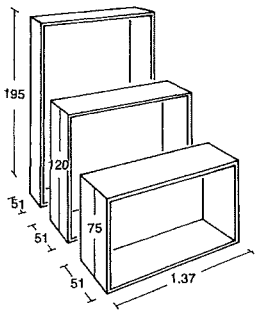
The filing system should be centrally located. A favourable window centre-line is 2.25–2.50 m, ceiling clearance height 2.10 m (2 storeys of normal office space = 3 storeys of filing). The rooms must be dry, so attic and cellar are inadvisable. Continuous table → ⓰ + ⓱ with suspended files and writing surfaces combines workstations effectively. Trolleys can be used as writing surfaces, or for card index boxes. Mobile filing systems (Soenneken Compaktus system) enable a space saving of 100–120%) by eliminating intermediate passages → ⓲B Systems are not standardised and are adapted to the relevant requirements of filing systems, archives, libraries, stores. Take note of the higher loading per m^2 of floor area (→ Libraries, pp. 247 ff.). Movement of the filing system is manual or by a drive. The entire filing system or just parts of it can be closed with one hand.

Administration and offices

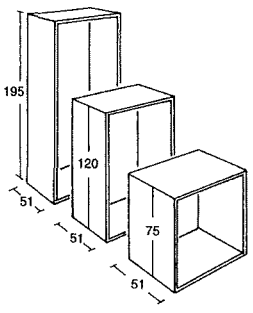
OFFICE BUILDINGS
Structures
Tendencies
Typology
Until 1980
Since 1980
Space requirement
Computer workstations
Archives
Additional areas
Room typology
Grid
Access
Building services
Construction

see also:
Libraries/Archives pp. 247 ff.

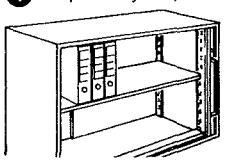
		horizontal storage in loose-leaf binders on open shelves 35 × 200	library storage in letter organisers in roll-front cabinet 40 × 125 × 220	combined vertical and suspended filing cabinet in folders on shelves 65 × 78 × 200
10 000 files approx. 2 mm thick (without folders) approx. 25 sheets	1) continuous cabinet or wall length	7.25 m	11.00 m	2.4 m
	2) basic space requirement including operational but not side passages	5.92 m^2	8.25 m^2	3.6 m^2



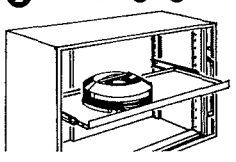
❶ Cupboard system, series A



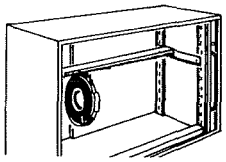
❷ Series B → ❸ – ❿



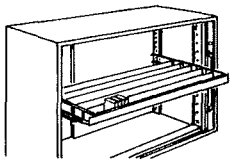
❸ Shelves, usable depth 42 cm; 1.37 m wide



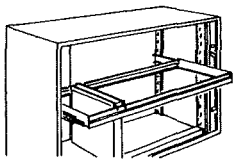
❹ Slide-out shelf with telescopic runners



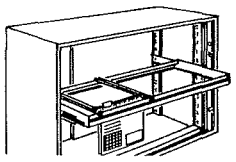
❺ Hanging rail for magnetic tapes, 49 single positions



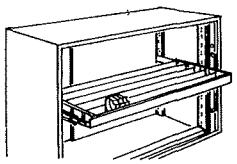
❻ Slide-out shelf for microfilm cassettes, holds up to 164



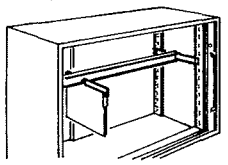
❼ Slide-out unit for suspended files



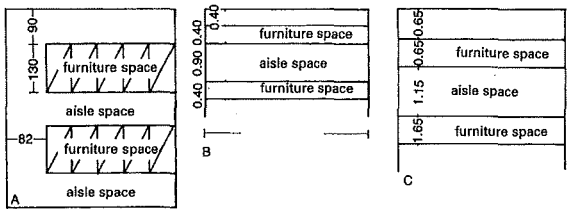
❽ Rails with suspended files parallel to the front



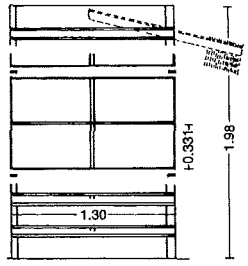
❾ Pull-out shelf for diskettes, holding up to 190



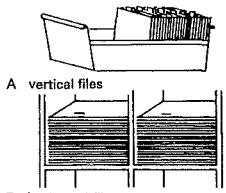
❿ Rail for centre-mounted suspended files



⓫ Relationship of passage/aisle to furniture floor space for various filing systems



⓬ Large Velox archive shelf, section and plan

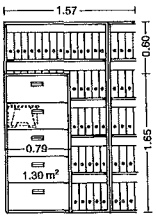


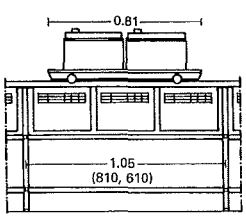
Handling times:
Comparison of flat and vertical files

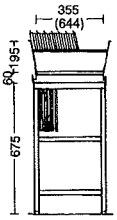
	flat	vertical
remove file	29%	14%
sort files	41%	66%
replace files	30%	20%
	100%	100%

⓭ Filing systems

⓮ Space comparison for various filing systems



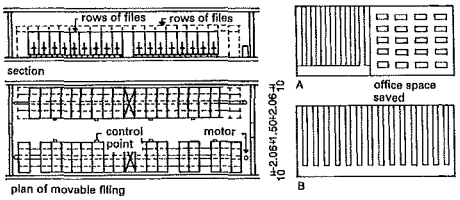




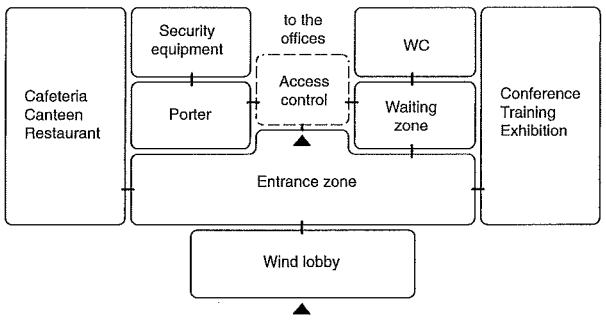
⓯ Wall space comparison between suspended filing and box files for the same file content

⓰ Narrow shelf with trolley

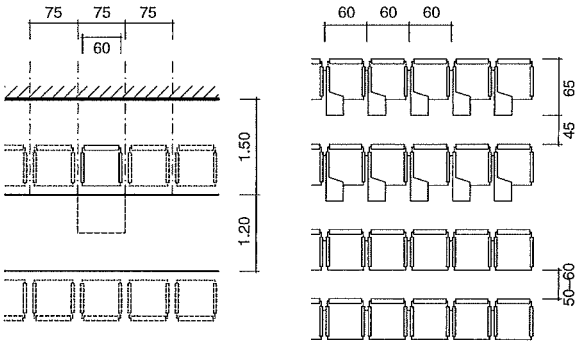
⓱ Section → ⓰



⓲ A = mobile filing system B = space comparison with normal filing cabinet



1 Relationships of publicly accessible rooms to the entrance area and access control



2 Space requirement for seating in conference and training rooms

Area (m^2)		Range	Average	Total
Workstation	Immediate workstation	11–15	13	15.5
	Additional area (consulting, storage)	1.5–4.2	2.5	
Subsidiary areas	Sanitary facilities	0.6–0.8	0.7	9.0
	Conference/training	0.3–1.0	0.6	
	Archive	0.4–1.0	0.6	
	Stores	0.4–1.5	0.6	
	Canteen, cafeteria, tea kitchen	0.6–1.6	1.1	
	Entrance area	0.2–0.7	0.4	
	Supply and disposal	0.5–1.5	1.0	
	Post room	0.3–0.5	0.4	
	Server room	0.5–1.5	1.0	
	Garage parking	0–13	2.6	
Building	Construction area	1.9–3.8	3.0	10.5
	Building services	2.4–4.6	3.0	
	Traffic area	2.2–6.0	4.5	

3 Average gross space requirement for a workstation

OFFICE BUILDINGS

Additional Areas

Subsidiary and additional areas

The total space requirement per workstation varies between 23 and 45 m^2, depending on organisational and status requirements. This includes 2.6 m^2 car parking area in the basement, which is not included in the floor to space ratio. The tendency has been increasing since the 1970s.

Entrance area

Connection between public and working areas. The important functions are lobby, access control, information, visitor registration and waiting zone. Important area for the company's corporate identity – the first impression is decisive!

Conferences, training

Conference areas should be directly accessible from the entrance area. Provide sliding partitions (which can divide large rooms), tables, seating, presentation media, and also store rooms and a pantry for catering (these subsidiary rooms require about ⅓ of the conference area). Good noise reduction is important. A conference area requires about 2.5 m^2 per seat (without subsidiary areas). Space requirement ~ 0.3–1.0 m^2 per workstation.

Post room

Undertakes the distribution of all incoming and outgoing post and goods. Work positions (packing and sorting tables) should be sufficiently large so that distribution can be rapid at peak times. Space requirement ~ 0.3-0.5 m^2 per work position.

Archive rooms

Files and written documents, which are seldom needed but have to be kept (statutory storage requirements), are stored here to take up as little space as possible (purely paper archives rapidly take up 10–20 m per workstation). For this reason, microfilming and some electronic archiving are worth looking into at an early stage. Archive rooms should be designed for an increased floor loading of 7.5–12.5 kN/m^2 (for mobile units) → Archives, p. 252.

IT technology

Early planning of network technology is important. This will determine whether data centres or server rooms with or without constantly manned workstations are necessary and whether these should be placed centrally or decentralised in the building. These rooms should have a 70 cm raised floor on account of the large amount of installation, and should be air-conditioned. Access control is particularly important. Back-up systems should if possible be separated from the data centre in fire-protected areas.

Social areas

Canteens or cafeterias (→ Catering, p. 174 ff.) are mostly operated as units by outside companies. Location near the reception and outside the access control allows outside visitors in.
Tea kitchens should be as near to the workstations as possible and connected with communication zones. For every approx. 50–100 workplaces, one ~10 m^2 kitchen.

Toilets

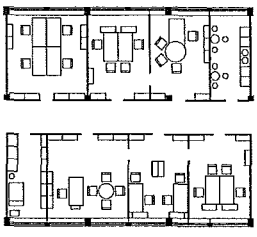
Sanitary facilities are to be provided in accordance with the Workplace Regulations (→ p. 270) and separation between the anteroom with washbasins and the actual toilets is important. A good ratio is one toilet unit per 50–80 workstations. Space requirement ~0.6–0.8 m^2 per workstation.

Cleaning services

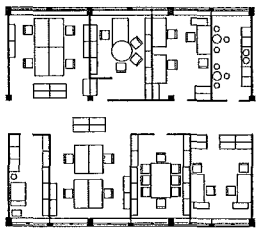
A cleaner's room should be provided on every floor, as a store for cleaning equipment and ideally with water supply and bucket sink. A central waste room, possibly enclosed waste collection rooms with separate collection containers and shredders. The caretaker should have a rest room, store and workshop in a central location.

Further special areas

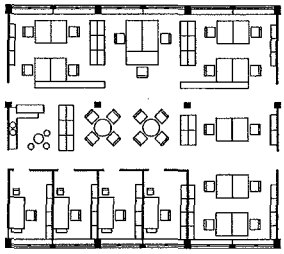
Garage areas with maintenance and parking facilities for company vehicles; company sports facilities, swimming pool, sauna and kindergarten should be considered as required.



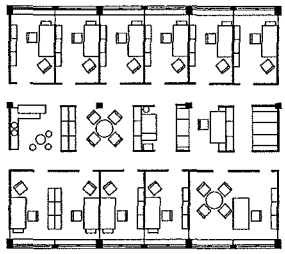
❶ Single-room office



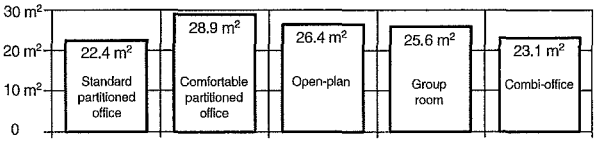
❷ Group office



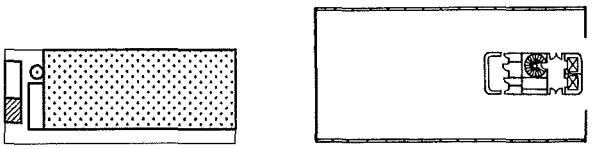
❸ Open-plan office



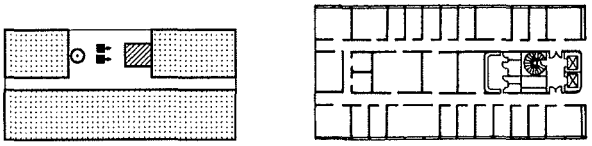
❹ Combi-office



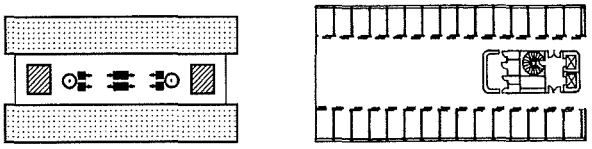
❺ In an investigation on cost-saving (by Prof. H. Sommer), five alternative room arrangements were set up, in order to obtain quantitative data about space requirements.



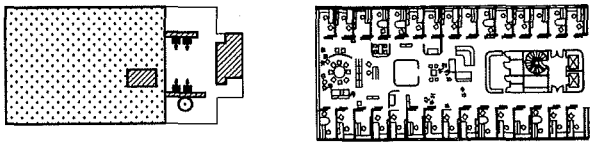
❻ Single-row layout, economical as very deep offices



❼ Two-row layout



❽ Three-row layout



❾ Layout without corridor

❿ First design for a combi-office: ESAB Head Office., Stockholm, 1976. Layout variants: open-plan, group room, single rooms, combi-office Tenbom Architektur AB

Legend:

Lift · Main stairs · Side stairs · Core area · Group room · Small room

Types of offices

Offices can be categorised according to size and occupation into two types: single rooms and open-plan offices. All further types are variations and different arrangements of these basic types.

Room types

Single-room offices: Single and double rooms are arranged in rows along a mostly artificially lit corridor. Jointly used infrastructure occupies expensive window space in occupied rooms, because no furniture is allowed in escape routes. The most economical occupation, by two or three people, disturbs concentrated work. Single rooms hinder internal communication. This is still the most common form of office layout → ❶.

Open-plan office: A form of office developed in the 1960s and 1970s of the last century. Large-scale office landscapes with 100 or more workstations are made possible by artificial lighting and ventilation; they stand for free communication and openness. Economical cubic structures, however, have the disadvantage of high maintenance costs. This form is not very popular among users → ❸.

Group office: The experience with the open-plan layout led to the development of group offices with approx. 4–16 workstations; each office is used by a single team or department. This arrangement is preferred above all for creative, design or coordination and development activities with high internal communication needs. → ❷

Room systems

Combi-office: Very small single offices are separated by glass walls from the deep connection zone, in which communally used infrastructure is located. The combi-office was developed in the 1980s as an attempt to combine the advantages of single-room and open-plan offices. Each employee is provided with an individual workstation for concentrated work and a jointly used room in the central zone, with its glass partitions, encourage communication → ❿.

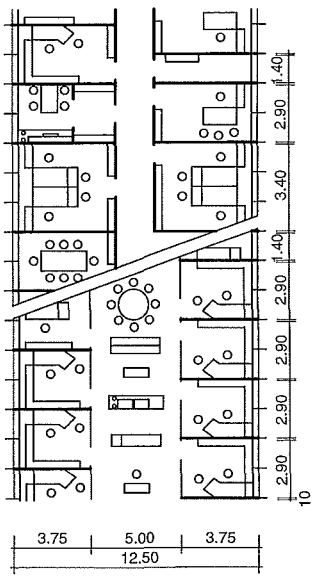
'Hot desk' office, 'business club': Certain functions are assigned to workstations. The users choose the suitable working location for the current activity (non-territorial offices). The personal area of the employee is limited to a mobile desk/cupboard unit. This type of office is only made possible by new forms of business organisation and technical equipment like mobile phones and laptops. Combined with teleworking or with a high proportion of travelling representatives, savings of 20–50% are possible compared with personalised offices → p. 234 → ❶.

Satellite office: Office space is located in decentralised locations, for example in residential areas near the employee. In the form of rented office space, satellite offices provide 'service stations', not only as branch offices of large companies but also varied sizes of office and infrastructure for small firms or self-employed people. The intention is to relieve rush-hour traffic and offer seldom-used office space like meeting, conference or training rooms when required.

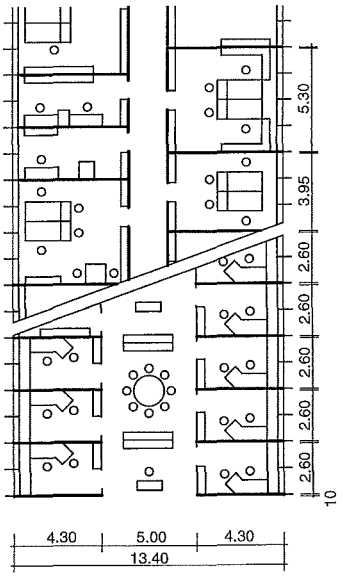
Reversible office (Revibüro): This is actually not a type of office but rather a form of building which hosts functions of different office companies at more or less expense. The cost of equipment rises with increasing adaptability and compromises have to be accepted concerning office sizes and organisation. This type of building is mainly suitable for offices for renting to tenants who are not yet known → pp. 234, 235.

OFFICE BUILDINGS

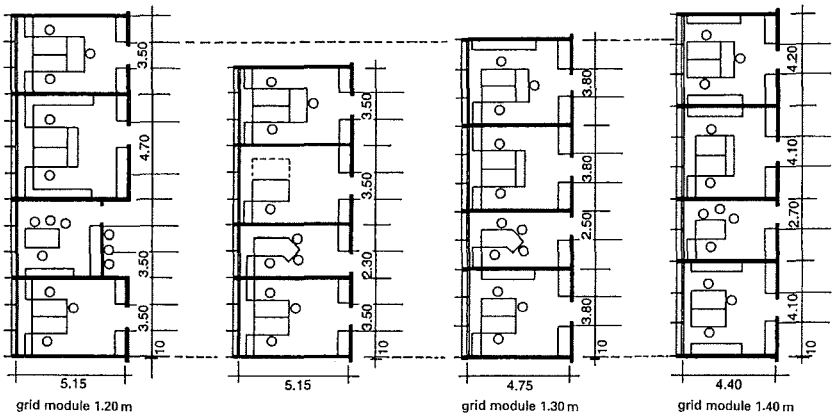
Grid



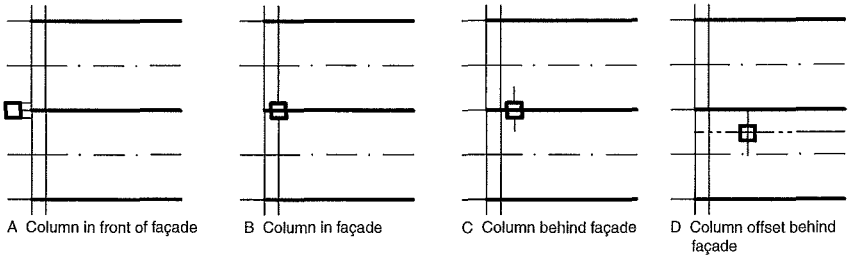
❶ Grid module 1.50 m, building depth 12.50 m, an economical form of building for single offices or for combi-offices; this provides a narrow communal zone and 10% fewer workstations at the window than with ❷.



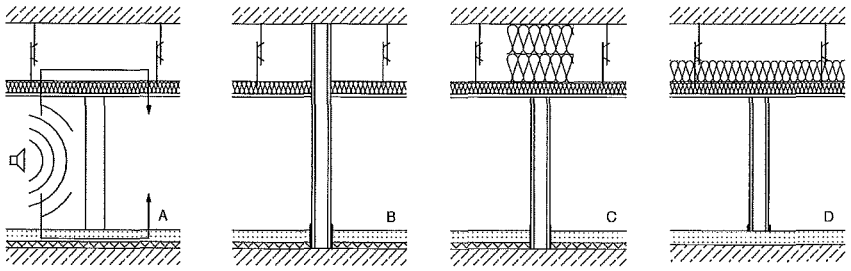
❷ Grid module 1.35 m, building depth 13.40 m, an economical form of building for combi-offices, but for single offices this produces deep and badly proportioned rooms.



❸ Possible uses for various window axis dimensions



❹ Various possibilities of placing the columns in relation to the grid module. With A and D, the partition–façade junctions are always the same. With B and C, there are different partition junctions with columns and façade.



❺ Avoidance of sound transfer through junction elements above and below light partitions (Schulz → refs)

Grid module spacings define possible room sizes through the resulting spacing of columns and façades. The fitting out and façade grids must be the same in order to enable the partitions to connect to the windows. The structural grid can be offset against the fitting out grid. This reduces the problem of connecting the partitions to columns, but loses space in the rooms, which contain columns. Because of the different lifecycles of the building elements, an adaptable module dimension should be chosen. The modular dimensions, which have proved successful in recent years, are 1.50 m for single-room offices and 1.35 m for office types based on the combi principle.

Modular dimension 1.50 m

This is the economical module dimension for single-room offices consisting mainly of double workstations. Workstation depth 2.20 m (80 cm desk, 1 m movement area, 40 cm shelf behind). With 10 cm wall thickness, this gives 4.40 m clear room space.
The usual depth of buildings with central corridors is 12–13 m. This dimension is only of limited practicality for combi-offices.

Modular dimension 1.35 m

Room widths of 3.80 m (~18 m^2 usable area) enable:
- additional filing storage; two computer workstations with a depth of 0.90 m, as recommended by accident insurance companies; one drawing board or drawing machine and one desk; one desk and meeting table for four people. All usual office workstations are possible, offering high flexibility of use without moving the partitions.

Partitions

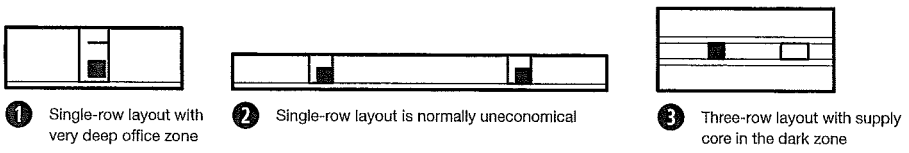
The junctions of light partitions demand particular attention to noise reduction. When glass partitions are specified, the required degree of sound proofing should be discussed with the user!

Façade

Vertical profiles in the façade, which lie on the modular grid, should be wide enough to connect a partition. A better solution is with sound-insulated profiles running along the façade. Take care with the opening lights of the windows.

Ceiling and floor

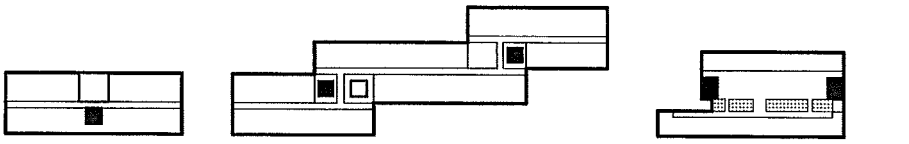
Screed bonded to the slab is good for sound insulation →❺, D with integrated cable ducts, because airborne sound is transmitted only to a slight degree.
With raised access floors and suspended ceilings, either vertical continuation of any possible partitions is to be provided or these elements are to be sound-insulating in themselves → ❺ B + C



❶ Single-row layout with very deep office zone

❷ Single-row layout is normally uneconomical

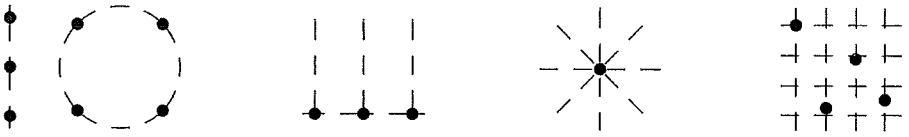
❸ Three-row layout with supply core in the dark zone



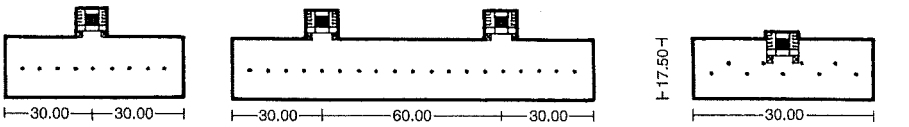
❹ Two-row layout, standard solution for single-room office blocks

❺ Offset two-row layout, overlapping zone with supply core forms three-row layout

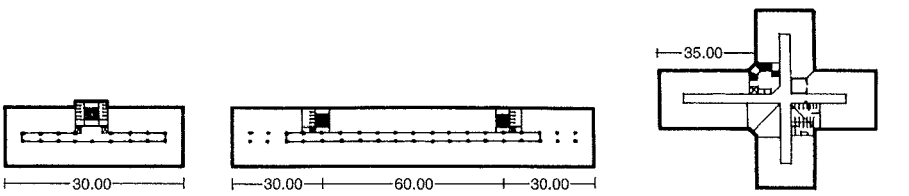
❻ Three-row layout; lightwells in the core can light these naturally



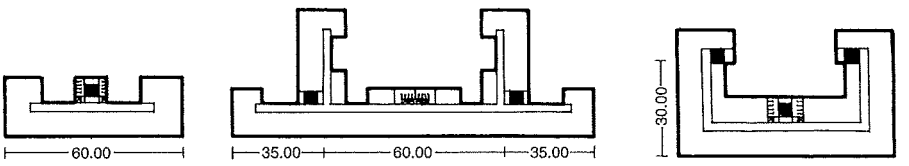
❼ Building forms and arrangements of supply cores (Hascher → refs)



❽ ❾ ❿

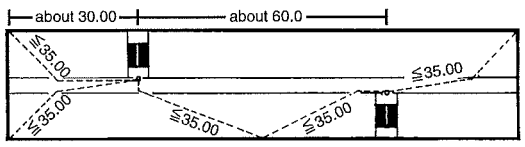


⓫ ⓬ ⓭



⓮ ⓯ ⓰

⓱ Building with lightwell



⓲ According to MBO 2002, every point in an occupied room must be ≦35 m from a staircase. This in practice leads to a spacing of the staircases from the end of the building of 30 m and from each other of 60 m → ❶ – ⓲. Take note of deviating stipulations in the current LBO!

Building concepts

Single-row layouts are uneconomical, and only acceptable with deep office rooms (daylight?) → ❶ – ❷.

Two-row layouts have mostly been used for administration buildings until now; single rooms and small offices are possible with daylight → ❹. The supply cores are situated in well-lit zones. The transitional form, three-row, is produced by offsetting the two-row layout in the supply area → ❺.

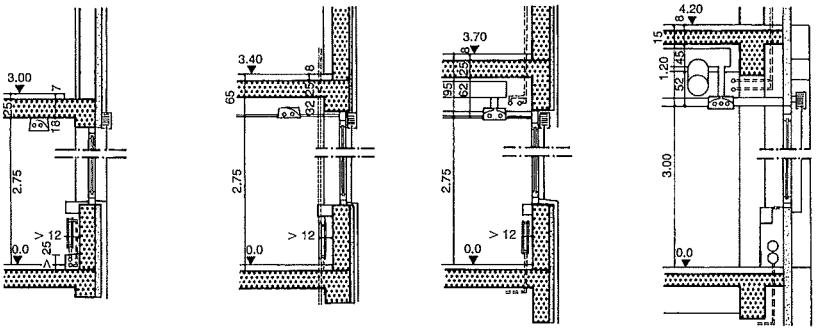
Three-row layouts (typical of office high-rise) → ❸ + ❻
A large supply zone at the centre of the building is normally practical only for high-rise buildings (greater proportion of vertical transport). Daylight can mostly be exploited into a room depth of about 7.00 m. New daylight systems for the deflection and transport of light (prisms, reflectors → p. 499), exploit the available daylight still better. Lightwells can illuminate the centre of three-row buildings naturally → ❻.

Building alignment

Compass orientation is variously estimated. According to Rosenauer, 90% of all office buildings in the USA have a main axis E/W, because the deeply penetrating morning and evening sun is a disturbance. Sun from the south can be shaded more easily with sun blinds. According to Joedicke (→ refs), the main axis in the N/S alignment is to ensure sunlight through all rooms. North-facing rooms are acceptable only for layouts without a corridor.

Access systems

Fixed points are sanitary facilities, stairwells, lift shafts etc., situated at maximum spacings defined in the building regulations → ❽ – ⓬. The arrangement of these determines urban development's building structure → ❼ – ⓰. For combined use units of less than 400 m², the corridors are not subject to the requirements for escape routes.



Storey height 3.00/3.10 m
Building with a low degree of installation. No suspended ceilings. Heating pipes in external wall. Electrical supply through windowsill or floor duct. Ceiling lighting supplied through ducts or standing partitions. Corridor areas for installation.

Storey height 3.40 m
Building with installation requirements, without ventilation system. In the ceiling void (h = 32 cm): electric cables and heating and water pipework. Installation ducts in the corridor.

Storey height 3.70 m
Building with air-conditioning system. A ceiling void of min. 50 cm is recommended for air-conditioned offices. Ducts along the corridor.

Storey height 4.20 m
Office with 3.00 m ceiling height. Crossing ventilation ducts require a storey height of approx. 4.20 m. All height-dependent building elements influence the ratio of building costs to usable office space.

❶ Storey heights according to the degree of installation (installed zone can either be in the ceiling void or above the bare floor slab)

Air conditioning

Two fifths of the operating costs of an administrative building are energy costs. The energy required for cooling in the summer is considerably higher than for heating in the winter.

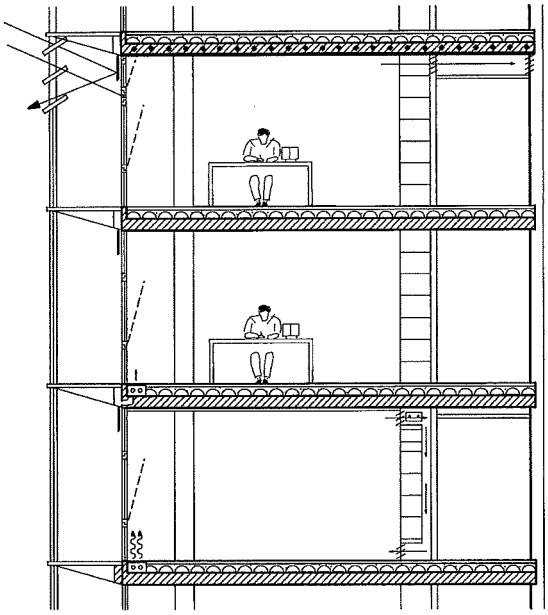
The room temperature should be min. 19°C and max. 26°C (legal interpretation of the Workplace Regulations). The construction and alignment of the building are decisive for the energy consumption to provide air conditioning and light. Building elements which store heat, double façades and light deflection systems reduce energy consumption.

Fully air-conditioned rooms

The gross built volume and the total construction costs for air-conditioned buildings are 1.3–1.5 times higher than for buildings without air conditioning → ❶.

Gentle cooling → ❷ – ❸

In order to reduce peaks of energy consumption, large areas of solid building elements should be in direct contact with rooms as heat buffers. Ceilings are particularly suitable for this purpose because the partitions should normally be easy to relocate. A further development is building element cooling, e.g. capillary tube mats with refrigerant flowing through. Radiant ceilings work without the buffer effect of heavy building elements. Further savings of energy can be achieved with geothermal heat exchangers, which can pre-warm or cool the air supply to ventilation plant or passively heated halls by making use of the constant temperature underground. In order to achieve better regulation capability, there are suitable systems which regulate the temperature of the air supply with convectors. The radiant heating capacity of a building element in connection with temperature-regulated air supply can provide sufficient heating (usable area can be gained through less floor or ceiling construction). The cost of air-conditioning systems with building element cooling are not more than conventional air-conditioning systems. Advantages: no draughts, no noise, reduction of the investment and operating costs (water has 1000 × less pumped volume than air for the same performance, closed circuit, heat reclamation), reduction of the supply cross-sections (water instead of air) and size of the building's energy control room.



Bare ceiling slab serves as heat buffer. Transverse ventilation through tilted windows and ventilation ducts over the corridor zone enable night-time cooling of the storage mass. If building elements are additionally temperature-regulated through heating or cooling pipework, then it is called building element activation. The system saves energy but reacts sluggishly and is not individually controllable.

Bare ceiling slab serves as heat buffer. Underfloor convector with air supply from outside serves to heat or cool (for which a fan is required). The system is individually controllable only to a limited degree because the heating and cooling medium flows in the same circuit.

Bare ceiling slab serves as heat buffer. Underfloor convector serves for heating. Cooling convectors in the cupboards cool warm air under the ceiling and lead it back to the floor area of the room (without fans). The system can be well controlled individually but requires a double system of pipework.

❷ Alternatives to air conditioning of offices: saving of storey height through reduction of the supply cross-sections (water instead of air)

Floor construction	Floor construction thickness above slab (mm)	Duct type
bonded screed	30	open duct with distribution above floor
	55	duct under the screed with distribution above floor
	70	open duct with underfloor distribution
		duct under screed with underfloor distribution
	70	raised floor with underfloor distribution
	70–1000	cavity floor with underfloor distribution

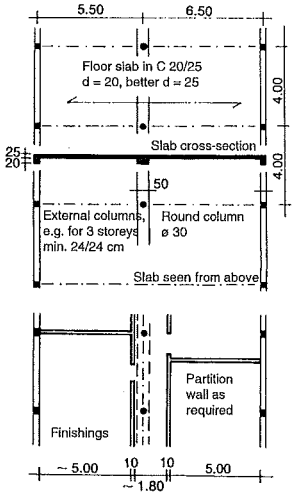
❸ Floor installation dependent on floor construction

Fresh air m^3/h per person	According to VDI ventilation rule	According to US ASRE guideline
10	non-smoker with air heating, under 0°C outside temperature	
10–27		office
20–30	non-smoker	
26–34		
30–40	smoker	
34–51		
51–68		directors' room (smokers)

❹ Ventilation requirement for office rooms

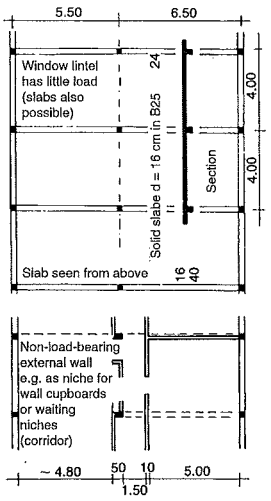
element	lifetime
structure	50 years
building envelope	20 years
building services	7–15 years
finishings	5–7 years
technical devices, furniture and communications technology	Constant

❺ Lifetime of building elements



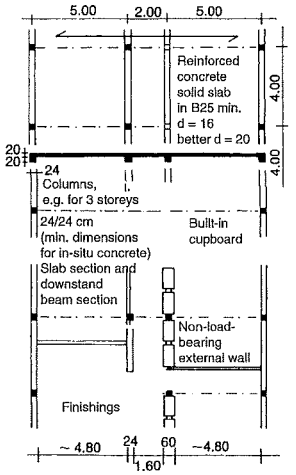
Floor spanning across building. Supporting beams running along the building. Central support beam and columns at the side of the corridor separate from corridor wall.
- flexibility and reversibility unlimited
- sufficient corridor width for clear passage between column and wall
- highly suitable if no suspended ceiling or for enclosed car parking with access route along the building

❶ Structural system, asymmetrical two-span beam



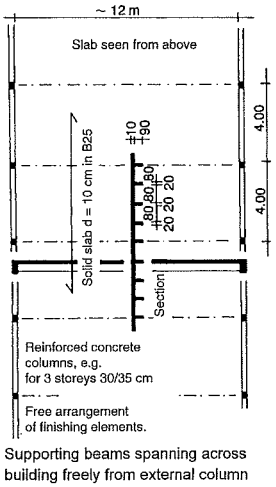
Floor spanning along the building. Supporting beams running across the building from external column to centre column to external column.
- flexibility and reversibility unlimited
- additional sound insulation measures required on account of insufficient density of floor (suspended ceiling, floating screed
- highly suitable for enclosed car parking with access route along the building.

❷ Structural system, multi-span beam



Floor spanning across the building. Supporting beams running along the building on both sides of the corridor in the middle span. The corridor wall can also be constructed as a load-bearing/ bracing wall to increase longitudinal rigidity.
- masonry corridor wall cannot be altered, so limited flexibility in room depth
- floor thickness min. 20 cm (impact sound insulation) if no suspended ceiling or floating screed
- not suitable above enclosed car parking
- construction of corridor wall as load-bearing is cost-effective
- construction increasingly cost-effective with greater building depth and longer spacing of columns along building

❸ Structural system, three-span beam



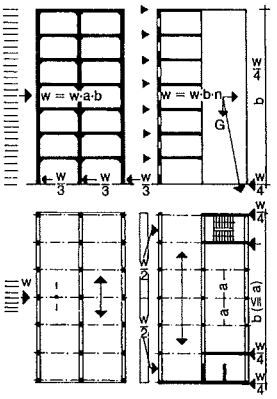
Supporting beams spanning across building freely from external column to external column.
- flexibility and reversibility unlimited
- suspended ceiling is required – services run across the building between webs, longitudinal arrangement in holes in beams (cut-outs) is not practical
- construction uneconomical overall, high supporting beams (also in steel), large building volume, only for column-free superstructures. Reduced supporting beam height of 60 cm, structure susceptible to vibration and high degree of deflection.

❹ Structural system, slab acting as beam

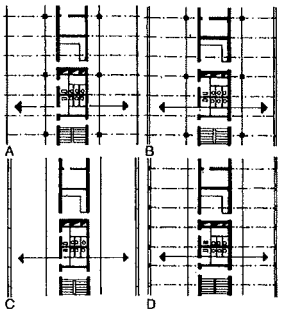
OFFICE BUILDINGS

Construction

Structure – influence of construction on the layout of offices → ❶ – ❹. Construction proposals for the cross-sections of two-row office buildings with the following loading assumptions: normal 5 KN/m², additional 2 KN/m² for screed (8 cm for floor duct and supply connections).
Ceiling height 2.75 m according to Vst regulation (enables the later installation of raised floor and deeper suspended ceilings). For predominantly sedentary activities, the reduction of the ceiling height by 25 cm is possible, but min. 2.50 m clear. Corridors and sanitary facilities are permitted to be 2.30 m high (this can be exploited for installation runs). According to Kahl (→ refs), the cost-effectiveness of a structure is less dependent on the optimisation of the individual components (e.g. pre-cast elements), and much more on their integration into a functional building. Differentiation between longitudinal and transverse spanning systems → ❶ – ❹. Constructive scope for decision-making via the example of a reinforced concrete slab with 6.50 m span. Criteria: almost identical costs; higher weight has influence on costs for load transfer and foundations; thicker slab has advantages through greater stiffness under differing loading (box-outs, spreader beams, point loads, various spans, various floor constructions).
Ribbed slabs: Only economical over longer spans (less self-weight, higher labour costs for formwork). Cutting through the ribs is not possible, due to lack of space. Supporting beams have the same soffit level.
Slab beams (double T or Pi-slabs): These are structurally advantageous for long spans. Installation should run parallel to the web; crossing runs should be carried out in the corridor → ❶ – ❹. The façade plane can lie behind, between or in front of the structural plane. Greatest variability with separation of construction and external envelope. Layout of columns, front face of façade, back face of façade, in front or behind, have no influence on the compartmentalisation of the façade or the division arrangement (grid, corner detail).
Internal columns → p. 240 ❹ A–D: If the slab cantilevers with a cantilever of c = 1/5 L–1/3 L, the span is economical. Bracing through walls acting as deep beams, storey frames and the provision of solid access cores and end-fixed side zones.
Building the walls: Solid partition walls can replace columns and supporting beams, or can be considered as deep beams to provide rigidity → ❺ – ❼. Not reversible, openings should be specified in advance. The use of lightweight (non-load-bearing) partitions has the advantage of potential relocation, but also delays decisions about room layout, even during construction (construction, studding – both sides 2 × 12.5 mm plasterboards approximately correspond to the sound reduction value of a 24 cm block wall of density 1.2 kg/dm³, plastered both sides).

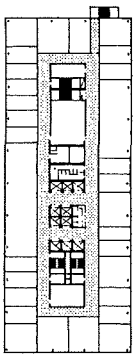


❺ Frame bracing, which transfers wind load into the foundations

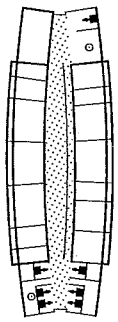


❻ Bracing using wall panels

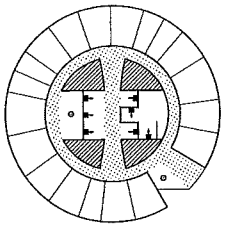
❼ Four ways of distributing the floor loading onto columns and core zone in three-row layouts



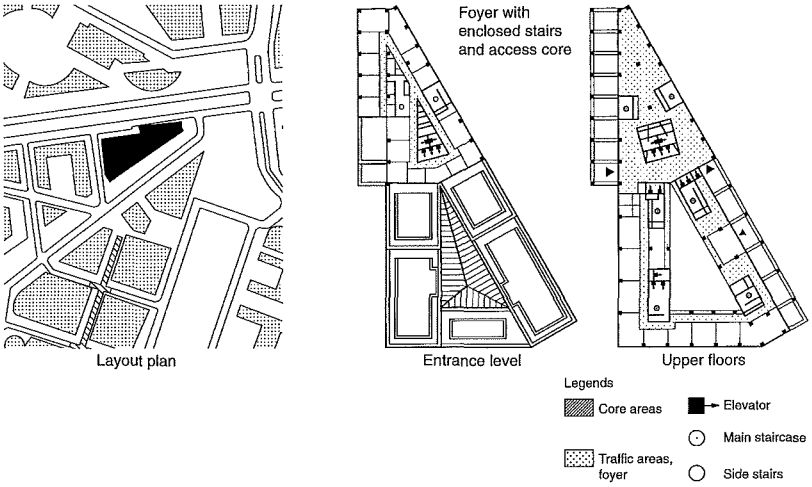
❶ Internal traffic areas and subsidiary rooms are purely artificially lit and ventilated
Arch.: Rosskotten



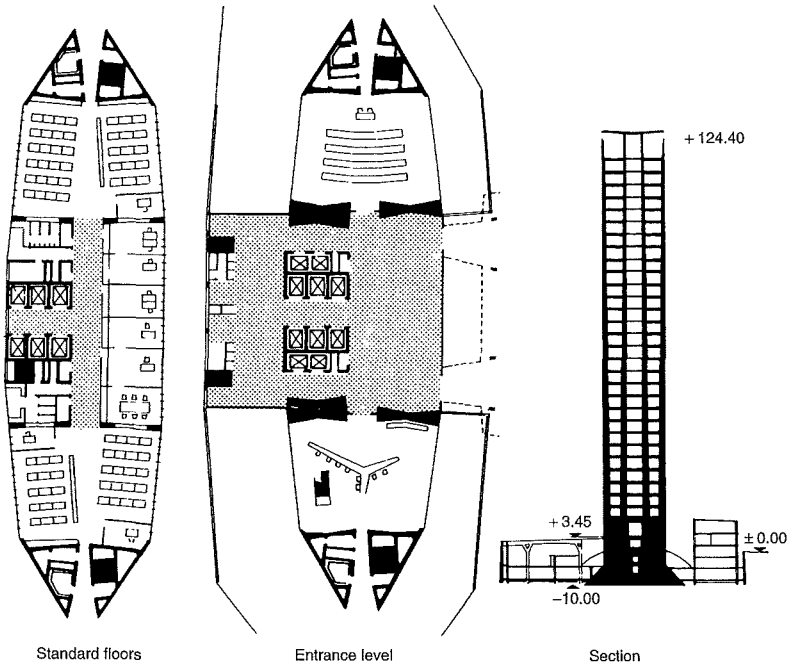
❷ Two-row floor plan with access at the external façade



❸ Cruciform floor plan with bracing core and external emergency stairs



❹ High-rise building developed from the ground plan of the block, Daimler Chrysler Building, Berlin
Arch.: Kollhoff



❺ The load-bearing construction forms the towers, between which pre-stressed floors are ≤24 m wide, but only 0.75 m deep
Arch.: Ponti-Nervi

HIGH-RISE BUILDINGS

Basics

Definition of high-rise buildings

High-rise buildings are those intended for long-term human occupation whose uppermost floor on one side of the building is more than 22 m above ground level.

Typology

There are two basic types of high-rise building:

1. The **block**, which has been designed as a high-rise building for economic reasons, and whose form has been developed from urban structure and planning, and from building regulations. Predominantly found in densely built cities, e.g. New York → ❹.
2. The **tower**, erected as a solitary building and mainly intended to provide a symbolic and prestige effect to keep the client and the city at the forefront of attention → ❺.

Use

High-rise buildings are a sign of extreme urban density and can also be seen as a town within the town. Use is therefore correspondingly varied: on the lower floors, public establishments (plaza, hall); and, above, offices, hotels and apartments.

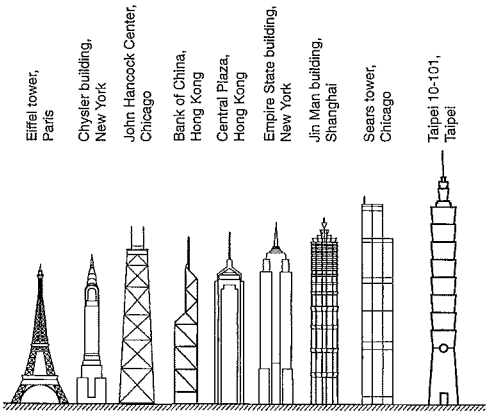
Because high-rise buildings in Europe are mainly built as prestige projects, these are often company headquarters / office buildings with additional uses like hotels or apartments. In Germany, use as schools, hospitals or homes for elderly people is ruled out by the applicable regulations.

Location

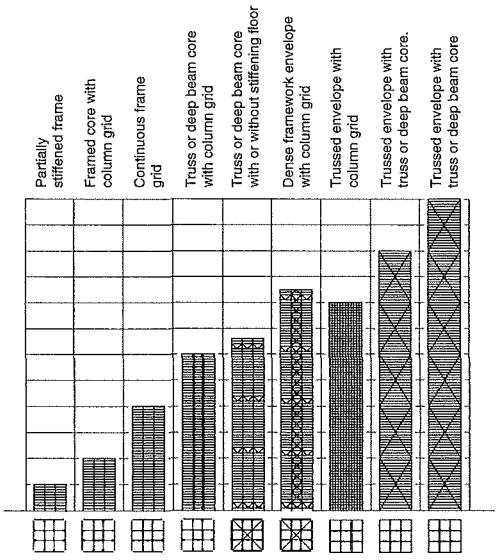
In Europe, the construction of high-rise buildings is mainly determined by political decisions. Because their effect is decisive for a city's character, the city normally decides where and what type of high-rises. The integration of a high-rise building into the urban landscape poses many questions for urban development planning. The preservation of street spaces, extension of public access areas, connection to public transport, pedestrian circulation, the needs of neighbouring buildings to receive natural light and alteration of the urban microclimate all have to be considered.

Approval

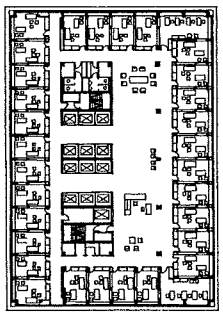
In addition to the normal authorities, further specialised bodies are also involved in the approval of high-rise buildings according to location and federal state, e.g. the requirements of air-traffic control (Radar damping → p. 112), broadcasting authorities, state criminal offices and water protection boards have to be considered and their approval gained.



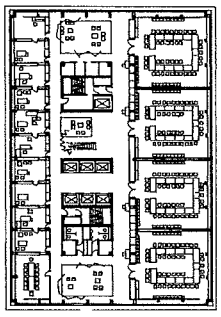
❶ Some of the world's highest buildings



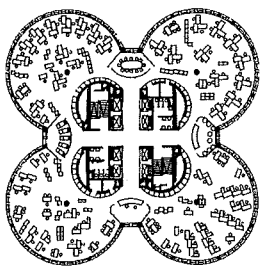
❷ Range of cost-effectiveness for structural systems



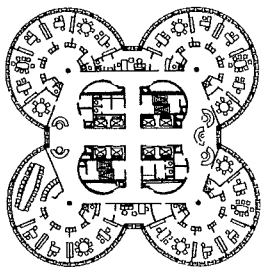
❸ House of Representatives, Bonn, 1969
Arch.: E. Eiermann with BBD



❹ Eccentric placement of the core zone enables different room configurations



❺ BMW headquarters, Munich, 1972, standard open-plan floor
Arch. Karl Schwanzer



❻ Different fitting out with single offices

Frame construction in steel or reinforced concrete is the standard solution. Spans vary according to material and type of construction. Solid reinforced concrete slabs span 2.5–5.5 m, ribbed slabs 5.0–7.5 m, both with a maximum 12.5 m between main beams. Pre-stressed concrete can span up to 25 m with only 0.75 m structural depth → p. 244 ❺. The exterior wall should be a curtain wall in front of set-back external columns (take note of fire protection → p. 246 ❼). There are a multitude of mixed forms of construction such as steel frame with concrete floors. In areas at risk of earthquakes, special construction is necessary to prevent oscillation of the building.

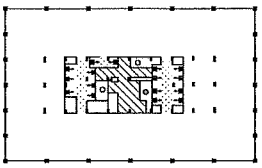
The design of high-rise buildings is determined by the construction system and the vertical access elements. The ratio of usable floor area to building cost becomes ever less favourable with the increasing height of the building. Construction and access areas take up a large part of the plan area. The division of high-rise buildings into sections with transport to 'sky lobbies' by express lift, where the passengers can transfer to normal lifts, reduces the space required for lifts and the travel time → p. 246 ❻.

Cost-effectiveness depends on the 'sway factor', the ratio of maximum permissible horizontal deformation at the top to the total height of a building (max. 1:600).

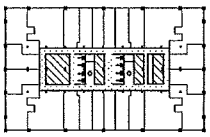
The decisive factor for the design of very high buildings is the horizontal forces (wind) and not the vertical loads. 90% of horizontal deformation comes from the shifting of the frame, or 'shear sway', and 10% comes from the slant of the entire building. Frame structures without special wind bracing are economic only up to about 10 storeys. Conventional frame systems lead to uneconomic dimensions for more than 20 floors. Reinforced concrete frames are practical up to 10 storeys without, and for 20–30 storeys with, bracing walls, and higher than that for concrete tube and double tube structures. The cost-effectiveness of a building is determined by material used, suitable type of construction and application of rational construction technology → ❷.

An example of a structurally economical solution is the John Hancock Center, Chicago, 1965, by Skidmore, Owings & Merrill. The visible structural elements form the design concept. The tube principle considerably reduced the amount of steel required and the operational economics are improved by layered usage:

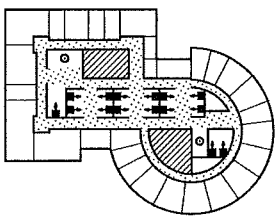
Floors 1–5 shops, 6–12 parking, 13–41 offices with flexible use, 42–45 services and 'sky lobby', 46–93 apartments, 94–96 visitors and restaurants, 97–98 TV transmitter → ❼ – ❽.



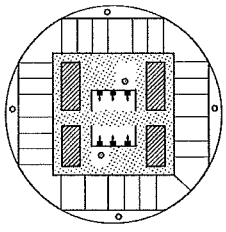
❼ John Hancock Center, Chicago, floors 13–14, offices with flexible use



❽ John Hancock Center, Chicago, floors 46–93, apartments
Arch. Skidmore, Owings & Merrill



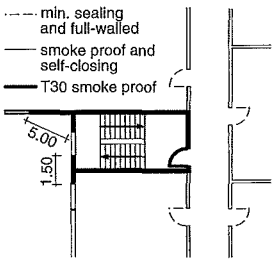
❾ Additive basic form



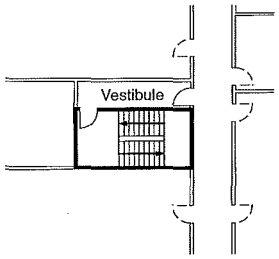
❿ Compact basic form

High-rise group	Height above fire service parking area	Special requirements
I	22– 30 m	high-rise regulations apply
II	30– 60 m	at least 1 fire service lift
III	60–200 m	elements of structural significance must be F 120 and many fire service lifts can be required
IV	over 200 m	the approval authority can place further requirements

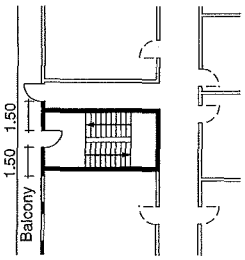
❶ Approval requirements for high-rise building groups



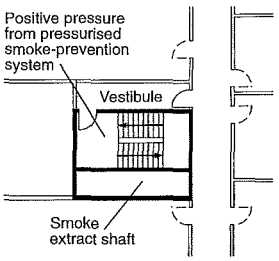
❷ Emergency stairs on the external wall with minimum distance to windows



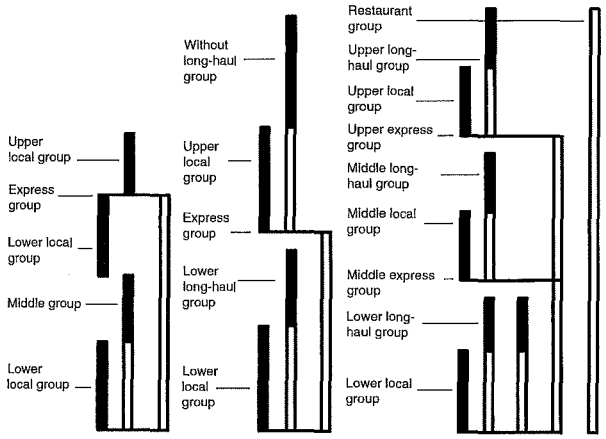
❸ Emergency stairs inside the building with ventilation system



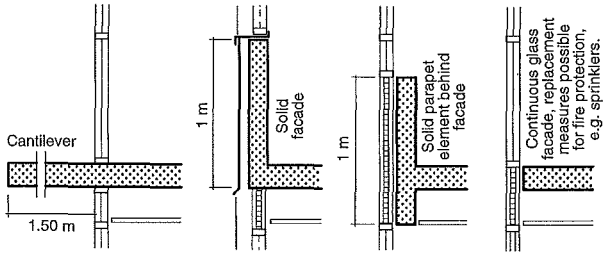
❹ External safety stairwell



❺ Internal safety stairwell with smoke protection pressure system



❻ Running a number of lift groups in the same shaft by arranging express groups ('sky lobbies')



❼ Requirements for the parapet area in high-rise buildings to prevent fire spreading from one storey to the next

The requirements of the high-rise building guideline are mostly derived from the need for fire protection. Described here are mostly those relevant to the structural layout of a design. The exact requirements for particular building elements should be taken from the relevant state building regulations and the high-rise building guideline. Specific local regulations should be clarified at an early stage.

Escape routes

Escape routes are min. 1.25 m wide and should if possible lead in two directions, to each staircase. The maximum walking distance from each point of an occupied room may not exceed 25 m. Corridors with two escape directions may be max. 40 m long. After 20 m, a smoke-proof self-closing door must be installed. Branch corridors with only one escape direction may be max. 10 m long. If a second escape route (e.g. an escape balcony) is available, max. 20 m.

Stairs

High-rise buildings up to 60 m high: at least two emergency stairs must be available, which must be located opposite in two separate fire compartments. Their walking width must be at least 1.25 m. The wellhole must be min. 0.80 m wide in order to avoid having to lay hoses on the stairs. Smoke outlets must be provided at their highest point (5% of the floor area but min. 1 m^2). The exit must be directly into the open air or through a lobby without any fire load. In exceptional cases, one staircase can be approved for high-rise buildings up to 60 m in height, if it is a safety staircase. Requirements for the location of stairs → ❷ – ❺.

Lifts

Up to about 25 storeys, it is usual to provide one group of lifts with all lifts serving all floors. If more than 6 lifts are necessary, they should be divided into two groups.

In higher buildings, the lifts are split into groups. A group of lifts serves a certain number of floors with priority. When there are more than three groups, this system becomes uneconomic because of the high number of lifts in the lower area. High-rise buildings above about 200 m therefore have 'sky lobbies' reached by an express group (mostly 2–3) and further distribution continues from there. This enables a number of lifts in one shaft to provide the fine distribution → ❻.

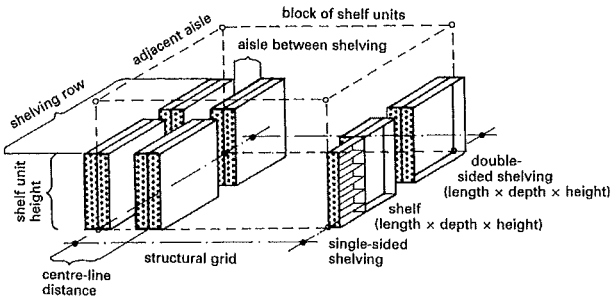
Fire service lift

In high-rise buildings more than 30 m high, there must be at least one fire service lift in its own shaft, from where every point of an occupied room can be reached within a radius of 50 m. It must have an anteroom with a hydrant, which is large enough to enable the transport of stretchers to the lift. Access routes must be at least T 30 fire-retarding.

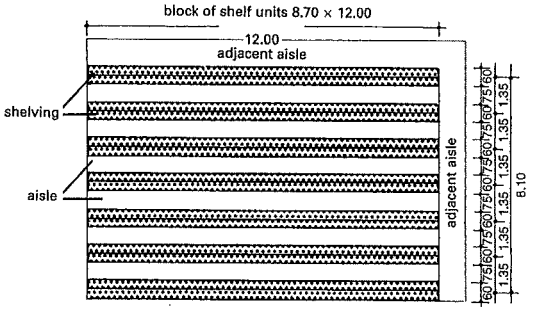
Façade

In order to avoid fire spreading from one storey to the one above, there must be W 90 A fire-resistant parapets at least 1 m high (fire spreading height). Alternatively, a W 90 A horizontal building element projecting at least 1.5 m from the façade can be provided. All-glass façades (also double façades) are permitted only with special approvals if particular protection measures (area sprinklers, mist extinguishing systems) can prevent the spread of fire to the next storey → ❼.

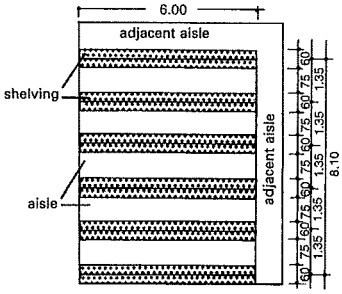
Window areas which cannot be cleaned safely from inside, must be cleaned from the outside by trained personnel using suitable apparatus → p. 101.



1 Unscaled sketch to clarify the terms used in the calculation of areas for stock



2 Floor area for bookshelves in stacks (stores), which are closed to the public



Area	Centreline distance (m)
store	1.35 (1.20) 1.44
self-service area	1.40 1.70
information area and reading room	1.60 2.00

3 Floor area for bookshelves in self-service area, standard block 8.70 × 6.00 m

Library area/floor type	Stacks and self-service store	Compact systems	Reading room and self-service area	Administration
on floors arranged transversely	7.5	12.5	5.0	5.0
on floors not arranged transversely	8.5	15.0	5.0	5.0

4 Load assumptions for floors (kN/m²)

	Structural grid							
	3.60	4.20	4.80	5.40	6.00	6.60	7.20	8.40
Stacks (St)		1.05	1.08		1.10		1.05	
Self-service areas (S1)	1.20	1.20	1.20	1.10	1.20	1.20	1.20	1.12/1.2 1.29
Self-service areas (S2)		1.40	1.37	1.35	1.33	1.32	1.31	1.40
	1.44				1.50	1.47	1.44	
			1.60	1.54			1.60	1.53
		1.68				1.65		1.68
Reading room areas (R)	1.80			1.80	1.71		1.80	
			1.92		2.00			
Workplaces (2.25) (W)	2.40	2.10					2.07	2.10
	2.40	2.10	2.40	2.10	2.40	2.20	2.40	2.10
Group workplaces (G)	3.60	4.20	4.80	3.60	4.00	4.40	3.60	4.20

5 Suitability of common structural grids for essential functions of a library

Types of library

Public lending libraries → p. 250: offer a wide range of literature and other information, preferably on open shelves. The supply of literature covers all population and age groups. In larger cities, the functions of scientific and public libraries are sometimes combined.

Scientific libraries → p. 251: collection, acquisition and provision of literature on specific subjects for education and research, mostly publicly accessible without limitation.

State libraries: federal state and national libraries; collections, for example, of literature produced in the state or a region (legal deposit copies); publicly accessible.

Specialist libraries: scientific libraries for the collection of specialist literature and media on specific subjects, often with very limited group of users.

Components

Three areas in every library: user and reading area, store and administration. The space requirement for these areas differs according to the type of library.

User and reading area: With a good orientation system (signposting of routes, functions and shelves with easily read signs), the reading area with reading and working places should if possible be spread over as few floors as possible, also for ease of book transport; staggered floors should be avoided. Access should if possible be by stairs. All areas of the user and reading room should also be accessible by lift (book transport, disability-friendly). The floor in the user and reading area should be designed for a loading of 5.0 kN/m².

Traffic routes > 1.20 m wide, clear distance between the shelves – in public areas always fixed – up to max. 1.30–1.40 m. Entrance and reading room area separated by access control with book security system. If possible, only one entrance and exit. The access control should ideally be situated near the lending counter/central information.

Outside access-controlled area: cloakrooms or lockers for clothing and bags/cases, toilets, cafeteria, newspaper reading corner, exhibition room, lecture and conference room (which may be open outside library opening hours), central information point, possibly also card index and microfiche catalogue, online catalogue terminals, book return, collection point for ordered books.

Inside access-controlled area: reader information, bibliographies, online catalogue terminals, handing out and return of books only to be used in reading area, issuing of books in educational book collection, copiers (in separate rooms), book stock on open shelves, user workplaces, possibly access to self-service stores.

The provision of user workplaces in **university libraries** depends on the number of students and the distribution of the individual subject groups. Special workplaces for disabled people (wheelchair users, visually impaired), special work tasks (microform reading and enlargement devices, PCs, terminals, CD-ROM and similar: observe the guidelines for computer workplaces p. 236!) and single workplaces (cubicles, carrels, single work rooms). The arrangement of the reading places should be in daylight. Space requirement per single reading/working place 2.5 m², per PC or single working place ≧4.0 m². Traffic routes ≧1.20 m wide, clear distance between the shelves, which in public areas should always be fixed, up to max. 1.30–1.40 m.

	Distance between centreline of double shelves (m)	Volumes/ m standard shelves	Vertical shelves	Volumes/m double shelves	Space needed for 1000 books (m²)	Volumes/ m²
for stores closed to users (additional 20%)	1.20	30	6	360	3.99	250.6
		30	6.5	390	3.68	271.7
		25	6.5	325	4.43	225.7
		30	7	420	3.42	292.3
		25	6	300	4.80	208.3
	1.25	30	6	360	4.16	240.3
		30	6.5	390	3.84	260.4
		25	6.5	325	4.61	216.9
		30	7	420	3.56	280.8
		25	6	300	4.99	200.4
	1.30	30	6	360	4.33	230.9
		30	6.5	390	3.99	250.6
		25	6.5	325	4.80	208.3
		30	7	420	3.70	270.2
		25	6	300	5.19	192.6
	1.35	30	6	360	4.50	222.2
		30	6.5	390	4.15	240.9
		25	6.5	325	4.98	200.8
		30	7	420	3.85	259.7
		25	6	300	5.40	185.1
self-service area (additional 25%)	1.40	30	6	360	4.85	206.1
		30	6.5	390	4.47	223.7
		25	6.5	325	5.17	193.4
		30	7	420	4.16	240.3
		25	6	300	5.82	171.8
		20	5.5	220	7.63	131.0
	1.44	25	6	300	6.00	166.6
		25	5.5	275	6.53	153.1
		20	6	240	7.50	133.3
		20	5.5	220	8.17	122.3
	1.50	25	6	300	6.25	160.0
		25	5.5	275	6.81	146.8
		20	6	240	7.81	128.0
		20	5.5	220	8.51	117.5
reading room area (additional 25%)	1.68	25	6	300	7.00	142.8
		25	5.5	275	7.62	131.2
		20	6	240	8.75	114.2
		20	5.5	220	9.53	104.9
	1.80	20	5.5	220	10.22	97.8
		20	5	200	11.25	88.8
	1.87	20	5.5	220	10.62	94.1
		20	5	200	11.68	85.6
	2.10	20	5.5	220	11.92	83.8
		20	5	200	13.12	76.2
		20	4	160	16.40	60.9

Source: Schweigler

❶ Space calculation

Structural grid	7.20 m × 7.20 m	7.50 m × 7.50 m	7.80 m × 7.80 m	8.40 m × 8.40 m
n × distance between centre-line (m)	6 × 1.20 5 × 1.44 4 × 1.80	6 × 1.25 5 × 1.50 4 × 1.87	6 × 1.30 5 × 1.56 4 × 1.95	6 × 1.20 4 × 1.40 4 × 1.68

❷ Example of standard spacing for usual structural grids

Area	Volumes per shelf
stacks	25–30
self-service area	20–25
information area and reading room	20

❸ Volumes per shelf

No. shelves	Standard distance between centre-line (m)							
	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80
4	3.83	3.72	3.62	3.54	3.46	3.39	3.33	3.27
5	4.38	4.24	4.11	4.00	3.90	3.81	3.73	3.65
6	4.93	4.75	4.60	4.46	4.34	4.23	4.13	4.03
7	5.48	5.27	5.09	4.93	4.78	4.65	4.53	4.42
8	6.03	5.79	5.58	5.39	5.22	5.07	4.93	4.80
9	6.58	6.31	6.07	5.85	5.66	5.49	5.33	5.18

❹ Live floor loads for various number of shelves and centre-line distances

Vertical shelves n	7	6	5	Assuming a format distribution of
Max. book height (cm)	25	30	35	25 cm 65%
Average book depth (cm)	18	20	22	25–30 cm 25%
Load per shelf (kN)	0.38	0.51	0.55	30–35 cm 10% results in a required load assumption of 7.5 kN/m²

❺ Floor load assumption for stacks of 7.5 kN/m²

LIBRARIES

Basics

Lighting in the user area: generally approx. 250–300 lx; reading and working places, card index, information, lending counter 500 lx. **Climate** in the user area: 20° ± 2°C, ~50 ± 5% relative humidity, air changes (flow of outside air) 20 $m^3/h \times$ no. of people; these values can sometimes be exceeded according to the weather. Avoid direct sunshine as UV and heat radiation destroy paper and bindings. Air-conditioning systems should be used sparingly because of the high energy consumption and thus high operation costs. Window ventilation is possible for low building depth.

Safety and security in the user area: **fire protection** is adequately covered in the regulations and requirements of the local building inspectors. **Burglary prevention** through motion detectors and burglary-resistant glazing and **theft protection** through book security systems, optimally **securing** unsupervised emergency doors through electronically controlled automatic locking on alarm. Mechanical securing of **emergency doors**, also with acoustic and/or optical signals, is not very effective.

The stacks (store) should ideally be situated in the basement on account of the more even climate and support of the higher loadings. 'Book towers' are inconvenient on account of the increased cost of air conditioning, transport and staff because of the limited space and flexibility. The largest possible continuous areas without steps are the most practical. Divide into fixed and mobile shelf blocks ('compact systems') depending on the structural grid of the columns (→ DIN specialist report 13). Mobile stacks can increase the capacity by up to ~100%. Floor load-bearing capacity for fixed shelves is min. 7.5 kN/m²; for mobile stacks min. 12.5 kN/m² (→ DIN specialist report 13).

Climate in stacks: 18 ± 2°C, 50 ± 5% rel. humidity, air changes (flow of outside air) ≧3 $m^3/h \times m^2$; filtering of harmful substances (dust, SO_2, NO_x etc.) is required according to location. The use of wall materials with a good capacity to retain moisture and heat can reduce the need for air conditioning. Slight air movement is useful for the avoidance of mould formation, particularly with mobile stacks (use open ends). Special collections and materials (e.g. slides, film or sound and data storage media as well as card, drawings and graphics) require a particular climate.

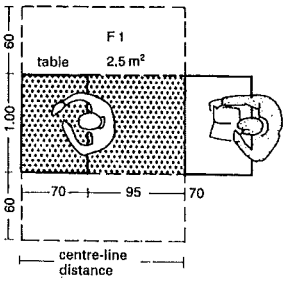
Floor load-bearing capacity in administration and book processing areas >5.0 kN/m²; can be higher in the technical areas (workshops) on account of machinery (individual structural verification required).

Construction: Reinforced concrete or steel frame construction with a grid of >7.20 m × 7.20 m and room heights of ≧3.00 m have proved successful on account of the flexibility of fitting out.

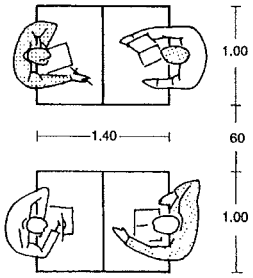
Traffic routes: avoid crossings and overlapping of routes for users, staff and books.

Transport: Book transport carried out **horizontally** with trolleys (no thresholds, differences of level should have ramps for ≦6% or lifting platforms) and conveyor belts; **vertically** in lifts, conveyor belts (plan the route carefully, with sloping upward inclines; very low maintenance costs), container transport systems (mechanically programmable, combination of horizontal stretches and paternoster lifts) or automatic container transport systems (routes can be horizontal or vertical as required, automatic, mostly computer route control; high investment cost, currently very high maintenance costs).

Space requirement for bookshelves depends on the form of organisation, accessibility for users, type of shelves (fixed or mobile), systematic subject categorisation with corresponding display, format separation and construction grid (tables → DIN specialist report 13).



1 Space for a single workplace → 3



2 Minimum spacing between tables

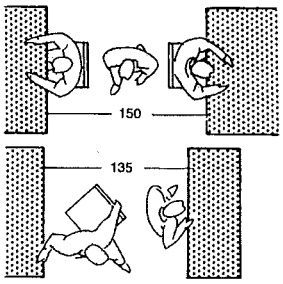
$$F_1 = b \cdot e \cdot (1 + \frac{N\%}{100})$$ formula 1

F1 floor area required for an open workstation for library user
b width of table
e distance between centre-lines of tables arranged one behind the other
N% percentage of area allowed for adjacent aisles providing access to individual workstations

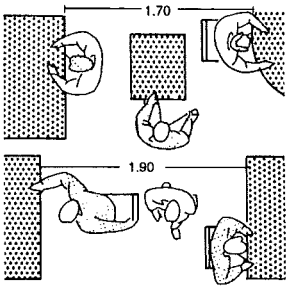
Under the conditions listed above, the floor area required for an individual workstation is approx. 2.50 m². Example:

$F_1 = 1.00 \text{ m} \cdot (0.70 + 0.95) \cdot (1 + \frac{50}{100})$
$F_1 = 2.48 \text{ m}^2$

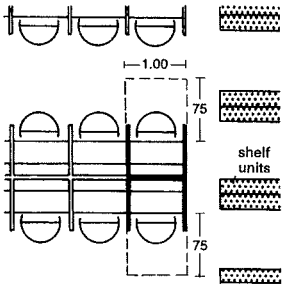
3 Area calculation → 1 m² main usable area



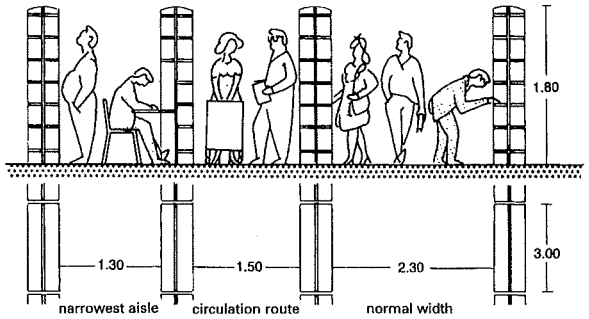
4 Minimum free room in reading area → 5



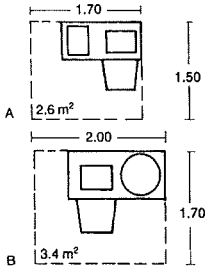
5 Transporting books between sitting and standing library users → 4



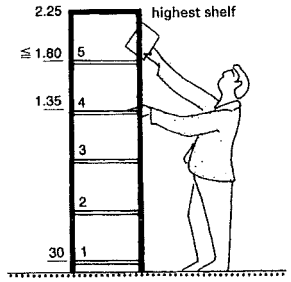
6 Carrels (non-lockable protected workplaces)



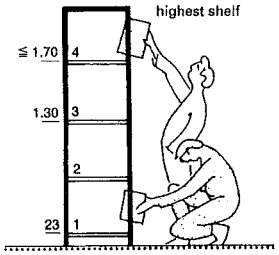
7 Minimum spacing



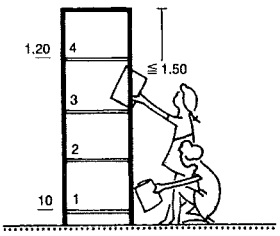
8 Microfiche reader workplace



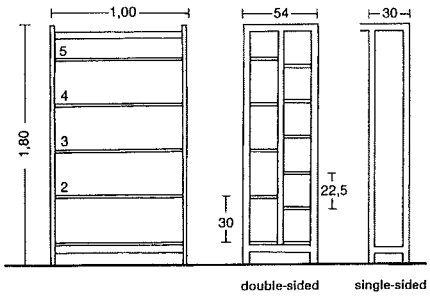
9 Shelf unit, five shelves

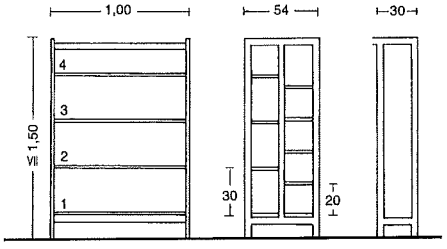


10 Shelf height for schoolchildren

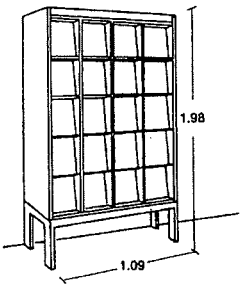


11 Shelf unit, four shelves – small children





12 Bookshelves for adults 5–6 shelves, for children 4–5 shelves → 11



13 Magazine rack

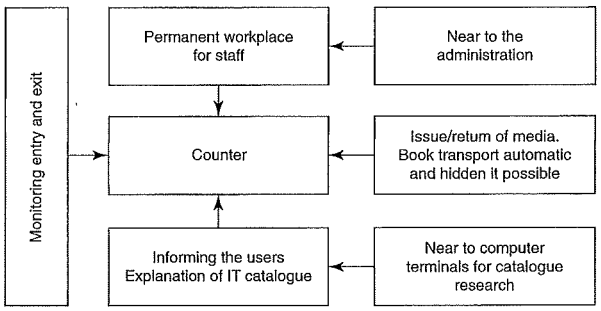
System furniture for reference and lending libraries for all types of devices (telephone, PC, terminals, microfiche readers) and for all required cable ducts for network and communications systems.

Cupboards with special drawers for card catalogues, microfiches, slides, film, audio and videocassettes, compact discs, drawing cabinets for maps, drawings and graphics.

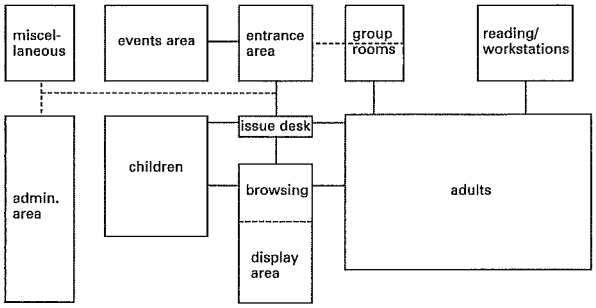
Shelving systems for books, magazines, media; mostly freestanding double shelf units (vertical steel profiles, shelves steel sheet or wood) h = 2.25 m, spacing of verticals = 1.00 m, depth of shelves = 0.25–0.30 m, but also extra depths, e.g. for atlases and newspaper collected editions; shelves adjustable for height min. every 15 mm. Height of the freestanding double shelves max. 5 × depth. Capacity of the shelves depends on the number of shelves per unit, calculated at 25–30 vols/running m (→ DIN specialist report 13). Shelf spacing in stacks > 0.75 m, longer in accessible areas.

Mobile shelf units (only permissible in closed stacks) can, if the column grid is favourable and the shelf blocks fit, result in a capacity increase of up to approx. 100%. Required: floor load-bearing capacity ≧12.5 kN/m² (extra costs compared to the usual 7.5 kN/m²).

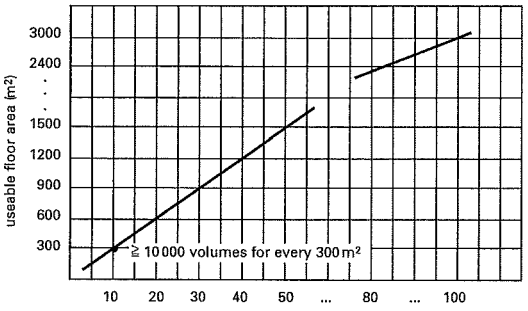
Microfilm reader workplaces will be necessary in the future to make available microfilmed media (predominantly newspapers). The tendency, however, is towards digitalisation because this creates better use and access possibilities.



❶ Demands on the lending counter/issue desk



❷ Functional scheme of a medium-sized library



❸ Scheme: space requirement of a library depending on the amount of stock

Post room goods entrance/ ramp		Technical processing Reception booking Store, sort and distribute Packaging (remote lending)
Administration office workplace		Invoicing
Librarian Office workplace with additional shelf space for media ≦2 m² Parking for book trolley (50 cm × 100 cm)		Stock-taking Title registration Issue of signature Subject assignment Catalogue processing
Technical processing Bookbinding workshop ≦50 m² Restoration workshop ≦200 m² (for 4 employees) Material store ≦15 m²		Binding Labelling Restoration
Distribution Book sorting room ≦14 m²		Sorting Distribution
Stacks / self-service shelves		

❹ Route of book processing from delivery to lending

Lending counter

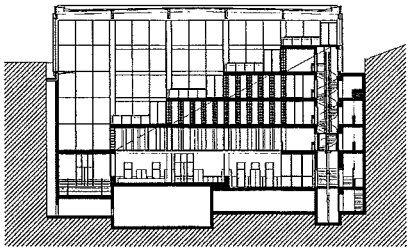
This is the interface between entrance areas and the normally accessible catalogue areas, the reading room with microfilm device, the stacks and the administration. Here the issuing and return of books takes place, information about the library is given and people are checked on entering or leaving the reading room. So there are many demands on the counter.

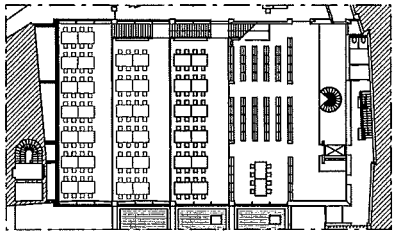
Mobile counters of combined units are mainly suitable for smaller libraries. Larger libraries, especially when the book transport systems are integrated into the counters, tend to prefer permanently installed systems. The height of the counter depends on the main activity undertaken → ❹, 95–105 cm is appropriate. It is better not to have any additional units above the counter in libraries mainly used by young people and children. The surface of the counter is subject to very heavy wear, so suitable materials should be specified, which can still look presentable after a long period of use (e.g. solid wood, linoleum or laminates coloured right through). Provide connections for computer and telephone, adequate lighting and a view into the open air (comply with the requirements of the Workplace Regulations, as the counter is normally a permanent workplace).

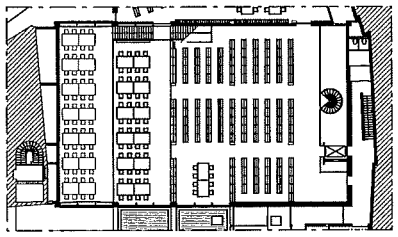
Public libraries

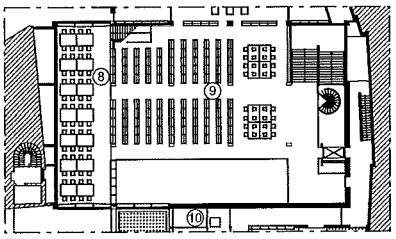
These offer general literature and other media on directly accessible self-service display. Systematic collection and cataloguing by content of printed and other media is restricted to a few large public libraries. Public libraries have no scientific collection duty or archive function, but are lending libraries, which normally have small stores or none at all. The users are children, young people and adults. Public libraries aim their range of stock and services at meeting the needs of the users. As a place of communication ('market place') for the population, they offer, in addition to the traditional lending of books, browsing zones, citizen's advice, information, cafeteria, listening to music, areas for sitting and events, art lending, and/or travelling library.

Stock ('media') can be not only books and newspapers but also magazines, brochures, games or new media (CD, DVD, video, PC games), which can be borrowed or used in the library. Rooms should encourage visitors to stay by being welcoming. Structure the areas into those for adults, children and young people with activity-oriented movement rooms, not separated but in zones with flowing transition. The space requirement is in line with the amount of stock → ❸. The target is two media units per inhabitant, but a minimum size of 300 m² usable area with 10000 media units in stock. They should be large, connected areas, almost square and flexibly usable, and extending horizontally rather than vertically (less staff), capable of extension and with an inviting entrance area. The shelf units in the adult area will have five or six shelves (max. reach height 1.80 m → p. 249 ⓾), and in the children's area four shelves (reach height ~1.20 m → p. 249 ⓫ – ⓬). Passages should not be longer than 3 m, neither niches nor compartments. Books are transported with a book trolley (L × H × W: 92 × 99 × 50 cm). Goods lift at the goods entrance, and in larger libraries also book transport systems. Floor loading in public libraries: 5.0 kN/m², in store-type self-service areas with denser stacking 7.5 kN/m², with compact storage (mobile shelving units) 12.5 or 15.0 kN/m².

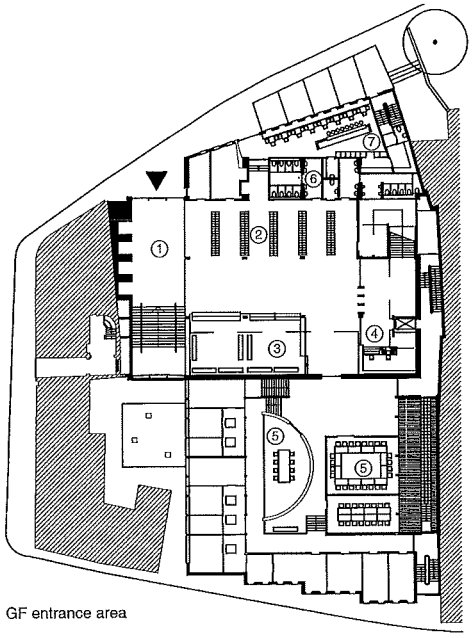

Section reading room


3rd floor reading room


2nd floor reading room



1st floor reading room



GF entrance area

❶ Juridicum Halle: specialist law library, Halle University, Wittenberg

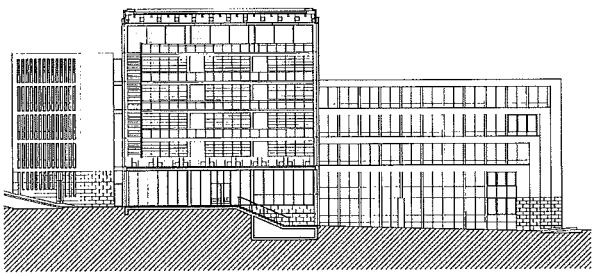
Scientific libraries have always had a key role in the history of science and in the life of universities. They are not only a location for storing books, but places where books can be worked with. An important and decisive part of world literature has been produced in libraries. Their erection is among society's greatest building projects. Important architectural examples from the 19th century show what high prestige has been applied to the task (Biblioteca Laurentiana, Florence; Bibliothèque Nationale, Paris).

They collect and access printed publications and other information media for education and research, and offer it for use in reading rooms (stock which is not lent out) and also for lending from the closed stacks, the self-service shelves and, to select in the reading rooms, separately displayed teaching material or specially gathered collections for one term. As well as books and magazines, most other types of audiovisual media are collected, catalogued and available for use. The number of reading places is related to the number of students in the various subjects. Orientation is provided by systematic classification of stock by subject. The services offered include remote lending (obtaining literature from distant libraries), copying services and enlargement of micro-forms (microfiche and microfilm).

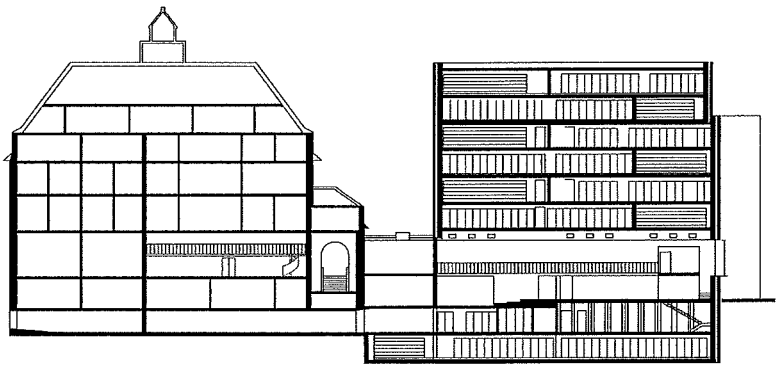
Example: Juridicum Halle → ❶ – ❷.

University libraries
These are single- or two-storey buildings: single-storey systems are centrally administered (book processing and services) and mostly have at least a few separate user areas in branch or specialist libraries. Two-storey libraries include a central library and an (often larger) number of libraries for faculties, specialist areas and institutes. Stock is often freely available in reading rooms, often in self-service stacks (shelving units spaced as in closed stacks) and in closed stacks, the different forms of display being mixed in most university libraries. The ratio of stored to display and lending stock is determined by the structure of the stock, and/or the organisation type or library concept, and often also the space available in existing buildings.

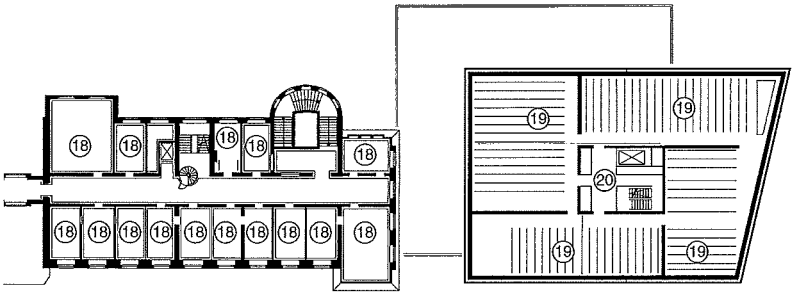
① Main entrance
② Lockers
③ Waiting area
④ Staff/supervision
⑤ Exam room
⑥ WC
⑦ Café, accessible from outside
⑧ Reading places
⑨ Bookshelves
⑩ Computer places



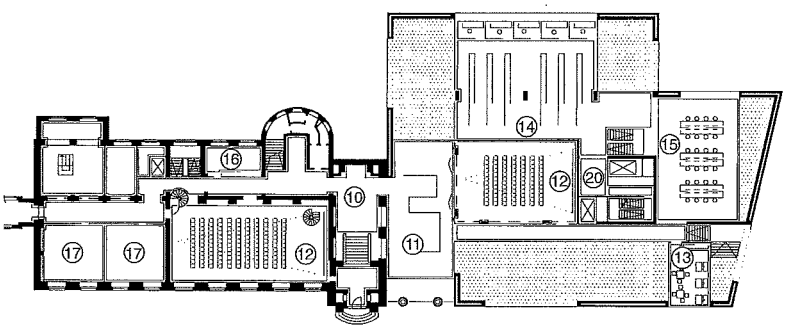
❷ Juridicum Halle, section Arch.: Thomas van den Valentyn, Gernot Schulz



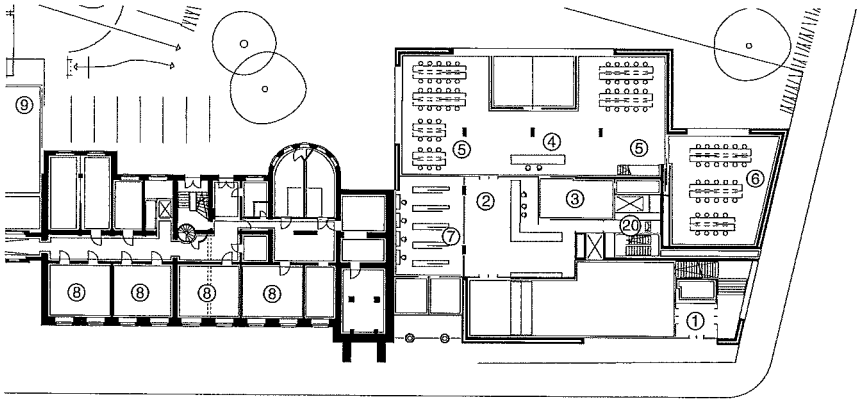
1 Extension of the State Archive in Dresden, section through old building and new archive building
Arch.: Kister Scheithauer Gross



2 The archive storerooms are arranged round the access and ventilation core. The room can be flexibly divided due to the three entrances. Pre-stressed concrete slabs enable thin floor structures with high loadings, so that space-saving rolling storage units can be used.



3 First floor serves to connect to the old building and houses seminar rooms, cafeteria and reading room.



4 Ground floor and first floor serve public functions. The foyer in the new building enables disability-friendly access and connection to the old building.

LIBRARIES

Archives

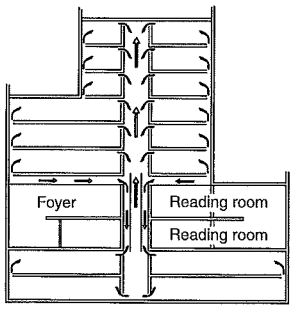
Basics

Archives do not, unlike libraries, serve mainly to make available written, graphic and audio media, but for their systematic cataloguing and long-term preservation.

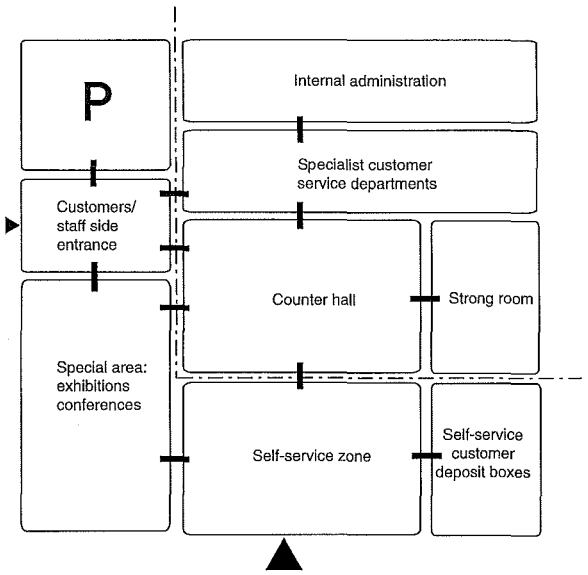
In this function, they are often part of libraries, museums or universities. State archives keep all sorts of files, business records, maps, drawings and documents.

In order to be able to accept the rapidly increasing stock, suitable storage systems such as rolling shelving units or plan chests (→ pp. 237, 248) must be provided. The loading on the floor slab should be paid particular attention (→ p. 248). For the durability of the preserved media, the maintenance of a uniform climate is the most important factor, but full air conditioning has not proved acceptable on account of the high cost. Natural ventilation is the ideal, but also brings the danger of entry by air-borne pollutants. Systems without air conditioning need solid walls with the best possible diffusion values, and the temperature should be maintained by simple wall surface heating (skirting radiators).

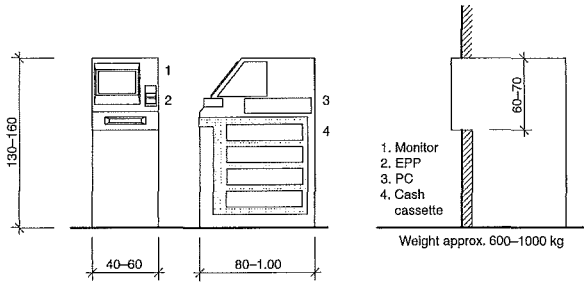
① Controlled access for users
② Information, issue
③ Store
④ Supervision
⑤ Reading room
⑥ Map reading room
⑦ Search aids
⑧ Workshops
⑨ Delivery
⑩ Staff access
⑪ Display
⑫ Seminar/ lecture
⑬ Bistro/café
⑭ Self-service films
⑮ Film reading room
⑯ Post room
⑰ Director
⑱ Administration
⑲ Archive rooms
⑳ Stair and ventilation core



5 Principle of source ventilation: prepared air is blown in through shafts and fed to the floors through ventilation blocks.



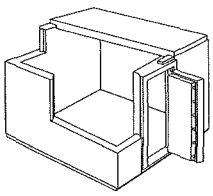
1 Room layout for a branch of a clearing bank with customer business



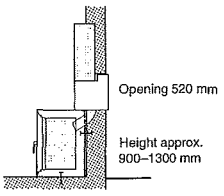
2 Cashpoint

ATM cash dispenser:		Statement printer:	
height:	1.30 – 1.60 m	height:	1.10 – 1.30 m
width:	0.40 – 0.60 m	width:	0.50 – 0.80 m
depth:	0.80 – 1.00 m	depth:	~ 0.60 m
weight:	600 – 1000 kg	weight:	~ 150 kg

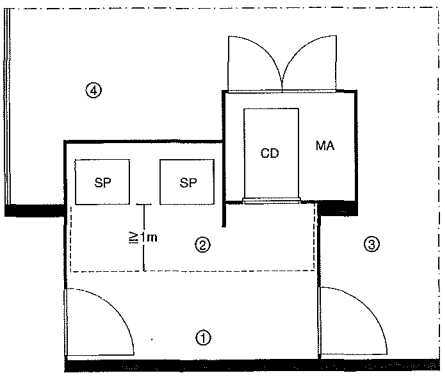
3 Dimensions of cashpoint and statement printer



4 Container strong room



5 Night safe



① Self-service zone
② Discretion area
③ Customer hall
④ Service

CD Cash dispenser
SP Statement printer
MA Maintenance area in accordance with manufacturer's instructions

6 Self-service zone

Bank buildings

There are two basic types of bank buildings: high street clearing bank branches with customer transactions and special or central banks without public access. The latter institutions are large-scale investment and/or corporate buildings.

High street clearing bank branches are a mixture of administration offices and customer service centres. The administrative share is larger for main offices and considerably less in smaller branches, because administration is mostly centrally organised. The main preconditions for the banking business are security, trust and reliability, which should also be visible in the design.

The UK, in addition, has long-established building societies, originally funding house purchase loans from the deposits they accepted, but now most are also functioning as banks. Their operating basis resembles that of a bank, so their building design requirements are similar.

Banks' functional areas are as follows:

Processing zone

Internal office area for administration without public access (→ p. 231 ff.).

Special zones

In addition to the social rooms for staff and the normal subsidiary rooms for administration offices (→ p. 238), there are conference and prestige-promoting areas. These serve training purposes and provide space for exhibitions.

Security area

Safes, today described as bank vaults or strong rooms, are mainly installed in larger bank branches or head offices. In new buildings there is solid and specially reinforced concrete construction and in old buildings a room-in-room structure of pre-cast elements. The ideal location is in the cellar near the entrance, because the shaft from the night safe has to be almost straight. The routes to the customer safe deposit boxes and to the bank strong room should if possible be separate. Delivery of cash and valuables by armoured vehicles also has to be considered. An access gallery with surveillance mirrors can be provided to monitor the strong room. Wall thicknesses are in accordance with the security level, from 80 cm (T10) to 100 cm (T20). For the customer safe deposit boxes, 'fully automated safe deposit systems' open at all times are available. These can be reached from the self-service area through an additional access control vestibule without staff involvement. The design should take into account the recommendations of the Research and Testing Association for safe and strong rooms and above all the requirements of the insurers.

Customer zone

The introduction of automatic teller cash dispensers (cash dispensers operated by bank staff) with restricted and time-locked cash release means that the structural protection of the counter area is no longer necessary. Cash dispensing and simple information is mostly at self-service cash points (ATMs). Cashless transactions can be carried out by home banking. This reduces the space requirement in the customer area, because the activity mostly consists of consultations and reference to specialist departments. For initial information, standing consultation counters are sufficient, but thorough consultations require a separate room for privacy. Expert departments (e.g. credit and investment) are often located on the first floor of the customer area.

The self-service zone is also accessible outside business hours. It is therefore mostly relocated into a lobby outside the customer area → ❻. This zone is equipped with cashpoints, account statement printers, deposit slot for the night safe and possibly the access to the safe deposit system.