"(...)
The work starts with the production of a detailed building programme by an experienced architect on the basis of the questionnaire → pp. 44 and 45.(...)

The sketch scheme is begun by drawing individual rooms of the required areas as simple rectangles, to scale, grouped in the desired relationships to each other (...) and to the compass directions. During this stage, the building commission becomes increasingly clear and a picture forms in the architect's eye. Instead of starting on the drawings, however, on the basis of the previous work establishing the building area, the final position of the structure on the site should be determined. This is often decided by exploring the compass direction, the wind direction, possible access routes, the lie of the land, existing trees and the neighbourhood. Unless the one correct location of the building is obvious in advance, this will require many attempts to exhaust the possibilities (...) and detailed discussions about the pros and cons. These investigations will normally render decision-making fairly quick, and the image of the future building gradually into focus (...).

And now come the birth pains of the actual design stage, first in the architect's imagination out of their deep immersion in the organic and organisational issues raised by the commission and the thoughts behind them. This creates a schematic idea in the mind of the architect of the overall configuration of the building and its spatial atmosphere, from which can be developed the outline of its appearance in plan and elevation.

On the other hand, according to the architect's temperament, for some a rapid sketch or an intricate scribble is the first product of this birth process. The impetus of the first sketch can often be squandered by unskilled helpers, however. The clarity of this image in the mind normally increases with the experience and character of the designer. Older, mature architects are often capable of drawing the final design layout freehand to the precise scale and in full detail. Some refined, mature works are produced in this way, although they mostly lose the verve of earlier designs.

Once the preliminary design is completed (...) a rest period of 3–14 days is advisable, as this allows detachment from it and permits defects to become more obvious, but also offers suggestions for their remedy, because such a waiting time removes many preconceived notions, not least through discussions with employees or the client.

Now the detailed processing of the design starts, the meetings with the structural and services engineers, in short the determination of the construction and the installations. After this (but mostly in advance), the drawings are sent off to the building approval authority, whose examination normally takes 3–6 months.

During this time, the costs are estimated and the works put out to tender using ready-made forms, so that the tenders are available when the building approval is granted, the contracts can be awarded promptly and work can start. All the tasks described here can keep the architect busy for 2–3 months (for a large detached house) or 3–12 months (for a larger project such as a hospital), depending on the circumstances.

It is not advisable to try to save money on design work, as more time spent on careful preparation at this stage can quickly be recouped during the building phase. In addition, the client saves costs and interest."

Quoted from: Ernst Neufert, Architects' Data, 1st ed., p. 34

What is design?
How does design work and what differentiates 'building' from 'architecture'?

Reading the text by Ernst Neufert from the first edition of 'Architect's Data', opposite, it is still clear that he is talking about the essential stages of the design process and describing for the reader the human experience of the working method, which we can understand via his encouraging but pretention-free words.

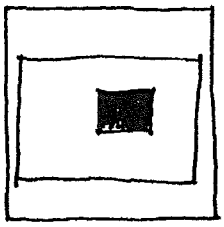
Ernst Neufert's views of the influences driving the creative process in architecture would certainly be different if he wrote them today. In what way and to what purpose, we cannot know, considering the developments in architectural theory in the last 20–30 years. So the current generation is faced with the question, what should be the fundamentals of design, in order to encourage an authentic architectural form?

Design seems to be very easy, and at the same time very difficult, with many influences. But it is always about **space** and its construction through architectural elements: if a single space is formed by its function, then a number of spaces require overall organisation, a **spatial theme**. The architectural elements are in accordance with the theme and mould the specific form and the authenticity of style in its time. History shows that a building commission is only fixed to a certain extent in its spatial style. A building type often changes for reasons which do not always have to do with function. A building can offer many uses, because it more than just a 'glove' for the function – which is demonstrated by the long lives of old buildings.

The essential drivers of change in typological characteristics are more often pictorial ideas about the cultural significance of a building, which result in alterations to the spatial and architectural elements. Buildings with a great influence on architectural history mostly have a very precisely emphasised spatial theme, which determines the overall layout. Excellent and masterful can have two different meanings in this case: **Reduction in the complexity of a commission to a single simple concept or a combination of themes with great variety.**

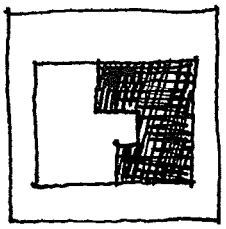
Design is never academic; works are the result of intuitive processes, in which the entire sensual perception of their creator plays a role. Nonetheless, they make use of an architectural grammar, which is organised thematically rather than stylistically.

The architectural considerations determining a building form a complex system of themes, which arise as knowingly staged or work coincidentally to different extents, but at any rate are inseparably intertwined. The basic elements of an architectural language are to be displayed and implemented according to an architectural grammar. The reference planes are **typology**, **topography** and the **architectural elements**. Each building relates to a location and a topographical situation. These create and offer a topos. It is selected for a function and a spatial typology, and architectural elements provide the stylistic form.



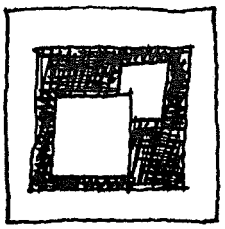
❶ Volumes in the structure

Bodily composed building elements, which take plastic shape inside a structure



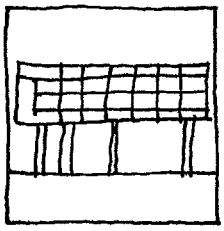
❷ Open and enclosed bodies

Free spaces and volumes are inseparably connected to each other. The spatial theme extends from courtyard concepts to solitary buildings



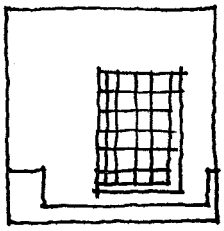
❸ Room plan/cavities in volumes

Single or a composed sequence of interior rooms organise themselves in their specific form within the volume



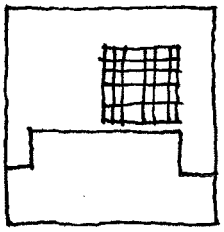
❹ On columns

The volume of the structure frees itself from underground to create an especially impressive space in-between.



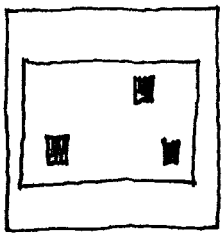
❺ Hollow

The structure creates a place related to itself; the weight of the volume sinks in.



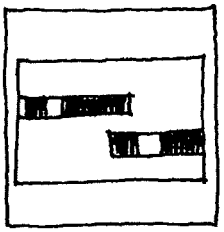
❻ Plateau

The plinth zone separates the rising façade from the street; the topographical elevation liberates the structure and creates a special place.



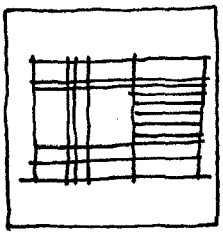
❼ Point on a surface

Point-type openings in a wall



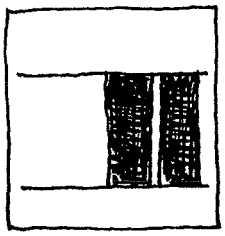
❽ Line on a surface

Horizontal or vertical ribbon windows



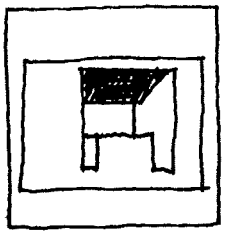
❾ Structuring on a surface

Glass division and construction form a network of lines, an independent design element.



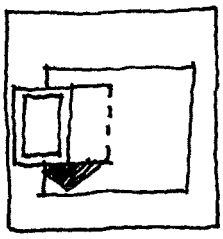
❿ Wall panel and columns

Punctiform – striped – flat wall element



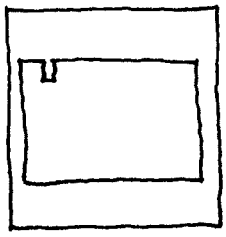
⓫ Cut-outs

Cut-outs and deepened cavities in the volume



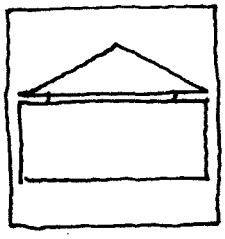
⓬ Projections

Plastic elements projecting from the volume



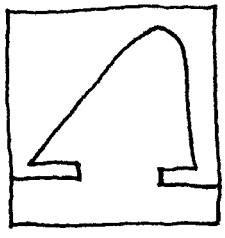
⓭ Flat roof

Horizontal upper edge emphasises the body of the building



⓮ Roof as body

Pitched roof surfaces form a geometrical body



⓯ All over

Equal treatment of roof and wall

Typology

The typological structure of a building grows out of the function and also from the construction and town planning situation. It is three-dimensional and therefore to be understood as a spatial theme.

Topography

The theme of topography refers to the unique location of the building and develops from this a town planning or landscape-related statement. This statement has a major influence on the quality of the public space.

Architectural elements

The structural elements composing a building are always to be designed in keeping with the overall appearance and follow design principles just as much as technical requirements and utility criteria.

Façades/openings → ❼ – ❾
All opening elements form a graphical structure on the surface of the wall. A mixture and combination of various structural principles can lead to an over-loaded façade.

Plastic elements → ❿ – ⓬
Functional components like balconies and loggias, but also columns, form three-dimensional structures which model the wall surface. The formation of structuring for the entire wall surface should not interfere with these.

Roof → ❿ – ⓯ The closure of the roof makes the building a complete sculpture. Town planning context and architectural concepts are decisive for the selection of a type of roof.

The design process is often rushed; projects are tendered and started with insufficient documents. So it has to be understood that the 'final' drawings and costs are available only when the building is almost complete. Explanations to clients will not help this situation; the only answer is faster and better organised work by the architect, with adequate preparation in the office and on the site.

Every project demands similar information; detailed questionnaires and forms, which should already be to hand when the project is commissioned, can help speed up progress. Variations will of course always be necessary but a long list of decisions is so generally applicable that questionnaires can assist every building professional, even if only as an encouragement.

The following questionnaire forms just a part of the work-saving forms which an efficient architect's office should have available, along with forms for cost estimates etc.

Briefing questionnaire

Commission no.:
Client:
Project:
Information collected by:
Copies to:

I. Information about the client

1. Company's outlook? Financial situation? Level of employment? Total capital? Where was this information obtained? Confidential!
2. How does the business seem to be conducted?
3. Who is our main contact? Who is their deputy? Who has the final authority?
4. Has the client any special wishes regarding design?
5. What attitude do they have to art? Particularly with regard to our way of working?
6. Which personal views/characteristics of the client should be taken into account?
7. Who is likely to cause us difficulties? Why? With what potential effects?
8. Is the client interested in later publication of their building?
9. Do the drawings have to be understandable by non-experts?
10. Who was the client's previous architect?
11. For what reason did the former architect not receive this commission?
12. Is the client planning further buildings? Which? How large? When? Have designs already been produced for these? Is there a chance that we could obtain the commission? What steps have been taken in this direction? With what success?

II. Agreements on fees

1. On what agreement is the calculation of the fees based?
2. What approximate degree of finishing is to be assumed?
3. Should the project cost be estimated, is this the basis for the fee calculation?
4. What is the estimated project cost?
5. Will we also be responsible for the finishing works?
6. Has a contract been signed or a written confirmation of agreement?

III. People and firms involved in the project

1. With whom do we conduct preliminary discussions?
2. Who is responsible for what special areas of activity?
3. Who is responsible for checking the invoices?
4. What ordering and checking procedure will be used?
5. Will we have authority to award contracts directly in the name of the client? Up to what value? Has the authorisation been issued to us in writing?
6. Which contractors are recommended by the client? (Trade, address, telephone, etc.)
7. Is a site manager required? Desired? Experienced or junior? When? Permanent or temporary? For how long?
8. Is the client in agreement with our decisions about the legal situation of the site manager?
9. Will the client make space available for the site office? Equipment (telephone, computer, etc.)?

IV. General

1. If there is no enclosure, must a fence or hoarding be installed? Can this be let for advertising? Should a signboard be erected? What lettering should be on it?
2. Precise address of the project? Its later name?
3. Address of nearest railway station?
4. Address of nearest post office?
5. Is there a telephone connection at the site?
6. Working time on the site?

V. Construction

1. Who has drawn up the building schedule? Is it sufficiently detailed? Will it have to be added to by us or others? Does it have to be approved by the client before the start of design work?
2. To which existing or future buildings does the building have to relate? → VIII, 9.
3. Which local or statutory regulations are applicable? Local planning responsibility?
4. What has been written about this building in the specialist press? What is in our collection of cuttings?
5. Where has a similar commission been carried out, with excellent results?
6. Via whom is it possible to view it? Already notified?

VI. Basic design factors

1. What do the surroundings look like? Landscape? Existing trees? Climate? Compass direction? Wind direction?
2. What is the form of the existing buildings? Of what building materials are they? → *VIII*, 9.
3. Are photographs available of the surroundings of the new project (stating where taken from)? Ordered?
4. What must the design also take into consideration?
5. Existing storey and building heights? Street frontages? Building lines? Later streets? Trees (type, size)?
6. What later construction has to be taken into account now?
7. Is a general development plan desirable?
8. Are there local rules for the external appearance of new buildings on this site?
9. Who will check the building application with regard to aesthetic matters? What is their attitude? Is it advisable to present a preliminary design for discussion?
10. What office is responsible for complaints at a higher level? What is the procedure? The duration of a complaint? What is the attitude of this office?

Questionnaire *(continued)*

VII. Technical basics

1. What type of subsoil is found in the area?
2. Have site investigations been undertaken at the site? At what locations? With what results?
3. What ground pressure can be assumed?
4. Normal groundwater level? High groundwater level? Exceptionally high groundwater level?
5. Has the plot been built on previously? With what? How many storeys? How deep was the cellar?
6. What type of foundations seem sensible?
7. What method of construction should be used for the building?
   Cellar floor: Construction? Loading? From what? Coverings? Protective coating? Measures to resist groundwater?
   Slab over cellar: Construction? Loading? From what? Protective coating?
   Ground floor slab: Material? Loading? From what? Coverings?
   Roof slab: Construction? Loading? From what? Coverings? Protective coating?
   What roof covering? Gutters? Downpipes inside or outside?
8. What insulation types should be provided? Against noise? Horizontal? Vertical? Against vibration? Against heat? Horizontal? Vertical?
9. How should the columns be detailed? External walls? Internal walls?
10. What type of stairs? Loading?
11. What windows? Steel? Timber? Aluminium? Type of glass? Sound insulation or sun protection glass? Opening inward or outward? Single-glazed, combined, double-glazed windows? Sound insulation windows?
12. What doors? Steel linings? Plywood? Steel? With rubber seals? Fire-resisting or fireproof? With door closers?
13. What type of heating? Fuel? Storage for what duration? Oil heating? Electric heating?
14. What domestic water heating? What quantities are required? When? At which locations? What is the chemical composition of the drinking water? Provide water softener?
15. What type of ventilation? Air changes? In which rooms? Smoke extraction?
16. What cooling? Ice supply?
17. What water supply? Diameter of the supply pipe? Diameter of the hoses of the local fire brigade? Water supply pressure? Does this vary widely? Details? Water price per m^3? Outside taps?
18. What drainage? Connection to sewers? Where? What diameter does the main sewer have? Depth? Where does drain water go to? Is percolation possible? Sensible? Allowed? Own treatment plant? Will mechanical cleaning suffice or is biological cleaning required? Rainwater collection?
19. What diameter gas supply? Efficiency? Price per m^3? Discount for large consumers? Are there special regulations about laying pipes? Venting?
20. What lighting? Electricity supply? Voltage? Possible connections? Consumer limit? Price per kW for lighting? Power? Off-peak price from, to? Discount for large consumers? Transformer? High-voltage station? Own power generation? Diesel, steam turbine, wind generator?
21. What telephone system?
22. What intercom? Entry phone? Light? Command system?
23. What type of lift? Special loadings? Floor or parapet access? Speed? Machine room at top or bottom?
24. What other transport systems? Extent? Route? Performance? Pneumatic tube?
25. Waste chutes and waste disposal units? Where? How large? For what waste? Waste incineration? Paper press?
26. Other.

VIII. Design documents

1. Has the land registry been viewed? Copy obtained? What significance for the design?
2. Is there a plan of the town? Ordered? With details of transport systems?
3. Is there a layout plan? Ordered? Officially approved?
4. Is there a level plan? Ordered?
5. Has the water supply plan been clarified?
6. Has the drainage plan been clarified?
7. Has the gas supply connection been determined on plan?
8. Has the electrical supply connection been determined on plan? Confirmed by the utility supplier? Cable or masts?
9. Has the front of the neighbouring houses been surveyed? Has the type of building been determined (general development plan).
10. Has a benchmark been determined without problems and fixed?
11. Is a building site set-up plan required?
12. Where does the building application have to be handed in? How many copies? In what form? Paper size? Prints? Blue? Red? On linen? How do the drawings have to be coloured (plan regulations)?
13. What are the requirements for handing in structural calculations? Who is accredited as a checking engineer? Who could be considered? (Who is named by the building authority?)

IX. Tender documents

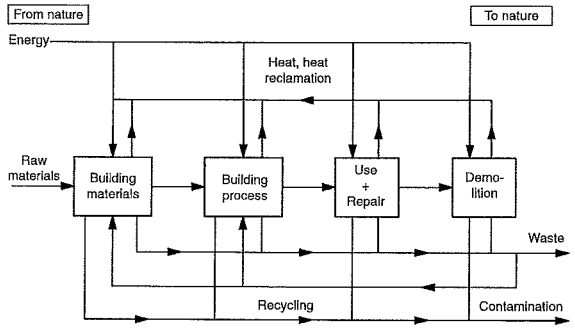
1. What is the distance of the site from a goods station?
2. Is there a siding to the building site? Normal gauge, narrow gauge? What are the unloading possibilities?
3. How are the access routes? Site roads required?
4. What storage space is available for building materials? Flat open spaces? Flat-roofed spaces? What height relationship to the building? Can a number of contractors work next to each other without problems?
5. Will any deliveries or works be undertaken by the client? What? Building cleaning? Security? Gardening?
6. Is there a prospect of advance payment, cash payment? Or what payment terms and financial distribution are to be observed?
7. What building materials are usual locally? Particularly cheap? Particularly expensive?

X. Production deadlines for

1. Sketches for meetings with the employees?
2. Sketches for meetings with the client?
3. Preliminary design (scale) with estimate?
4. Design (scale)?
5. Cost estimate?
6. Handing in the building approval drawings with structural calculations and any other verifications?
7. Forecast duration of the building approval procedure? Appeal route? Possibilities of acceleration?
8. Construction drawings?
9. Start of tender period?
10. Tender deadline?
11. Contract award procedure? Construction schedule?
12. Start of construction?
13. Completion of structure?
14. Final completion (ready for moving in)?
15. Final invoice?

investigation of the need for the planned building	is a new building necessary or could an existing building be suitable?
optimisation of the space allocation programme	layout of the space allocation programme for actual needs optimisation of route relationships
checking and optimisation of the plot situation	plot suitable for the building project? supply situation, vehicle flows etc.
optimisation of the building design	optimum usability and possible conversion (building depths, structural system, access cores etc.) design: typology, relationship of plan to façade, contemporary and original appearance etc. thermal comfort for the users
long, useful service life	durability, conversion possibilities, simple to renew
use of durable building materials	longer life cycle, reduction of maintenance and renewal cost suitability and ageing characteristics of the materials used
optimisation of building element geometries	to increase the usefulness, greater scope of use, better continued use and reuse
avoidance of composite materials and parts, which can only be separated with difficulty	better suitability for recycling and reuse, continued use or reuse of used materials and parts
low content of damaging substances in building components and materials	simpler continued use or reuse, simple disposal of waste, protection of soil and groundwater
controlled demolition when no further use is possible	separation of materials and mostly continued use or reuse of building materials and parts

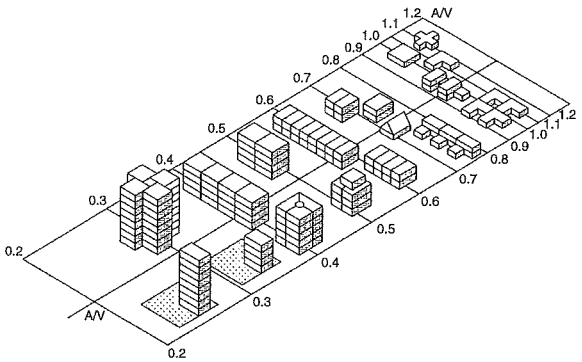
1 Cascade of design principles (Federal Office for Building and Planning → refs)



2 Energy and raw material circulation in buildings' phases of existence

ecological dimension	use on area use, scattering and mixing of mineral and energy raw materials emissions in the form of undesirable release of solid, liquid or gaseous substances, which could damage the biosphere or environment waste products, which release pollutants and remove valuable resources from the natural cycles noise, dust and vibration
economic dimension	lifecycle costs of buildings rebuilding and maintenance costs in relation to initial investment
social dimension	creation and maintenance of jobs preservation of living space in accordance with needs, by age and size of household creation of a suitable residential environment creation of cheap residential space, increasing the owner-occupier percentage networking of work, living and leisure in residential areas, 'healthy living' inside and outside the home

3 Evaluation of aspects of sustainability



4 Comparison of the relationship of area of building envelope to usable building area per m² (Schema Solarbüro, Dr. Peter Goretzki)

Sustainability

Since the agreement of Agenda 21 at the Rio de Janeiro Conference for Environment and Development in 1992, sustainability has been a central theme of national and international environmental policy. Sustainable development has for years been considered the best model for mankind to meet the challenges of the future. 'Sustainable development describes development in accord with the needs of the current generation without endangering opportunities for future generations to satisfy their own needs and choose their own lifestyle...' (Brundtland Report, 1987). The Federal Ministry of the Environment introduced management rules for sustainable development in 1998 – Regeneration: renewable natural resources may only be exploited in the long term within their capability of regeneration; Substitution: non-renewable resources may only be used to the extent that their use cannot be replaced by other materials or energy sources; Adaptability: the release of substances or energy may not be greater than the adaptability of ecological systems.

Sustainable building

Building and the built environment can play a key role in our future development. The construction and operation of buildings is a basic strain on the environment which should be reduced as far as possible. The construction and use of buildings consume a considerable share of natural resources, energy and water but construction according to sustainable principles works within an economic, ecological and social context.

Sustainable building consists of a multitude of concepts and measures, which have to be appropriate to the particular project. The social and cultural effects of the project (function, design and aesthetics, listed status etc.) are to be considered with equal weighting.

Buildings are normally operated over a long time period, i.e. savings or extra costs can be effective in the long term. The intention is a minimisation of the use of resources and energy and the least possible impairment of the natural ecological system for all phases of the life cycle of a building (design, construction, use, refurbishment, demolition). Instruments have been developed with which the various materials, construction methods etc. can be compared with each other and balanced according to differentiated criteria.

Sustainable architecture

The quality of architecture, design and the planning of buildings play a decisive role in the sustainability of a building. The cost of constructing a building is always to be related to the (forecast) duration of its use, and a longer service life often justifies more expensive design and construction.

The average service life of a building is 50–100 years (2–3 generations), although many buildings which are still in use today are much older. The cycles of renewal and modernisation are therefore much longer term than for the building services. As a result, a typologically flexibly usable structure is worth much more for sustainability than ever could be the case with the building services installation. The attention of the architect should therefore concentrate on the design of the building as a composition of structure and design.

BS EN ISO 13370
BS ISO 15686-5
DIN EN 15232
ASTM E917-05
DIN 276
DIN 4108-2
DIN EN ISO 13791
DIN EN ISO 13792
DIN EN 15232
DIN 18386

Heating	Domestic hot water
– optimum design of control and regulation – consideration of incoming solar radiation through façade-related zoning of the heating system in the control process. – different regulation circuits for parts of the building with different requirements – extended regulation concepts for flexible room layouts – setting of the temperature per room and prescription of time programme	– checking if hot water is necessary – for the remaining hot water supply: observation of the requirements for the maintenance of hygiene regulations concerning drinking water, rational energy and water consumption, optimisation of the system and operating costs – investigate the possibilities of solar-assisted domestic water heating

1 Potential savings of heating energy

Lighting	Heating, cooling	Air conditioning	Electrical devices
fullest exploitation of daylight efficient lamps electronic ballast for fluorescent lights lighting controls economical lighting outlay for external areas	energy-saving, independently regulating circulation pumps constructional measures for summer thermal protection cooling load calculation for necessary air-conditioning systems	reduction of air flows to the absolute minimum low pressure loss ductwork fans and motors of high efficiency	energy-saving devices (normal operation and stand-by) devices with off-switch at the mains (if operationally possible)

2 Potential savings of electrical energy

ecological criteria	environmental impact through treatment of building waste transport impact emission of health-impairing substances emissions with global effects (ozone hole, acid rain, greenhouse effect) noise, dust emissions use of land use of new material energy required for waste disposal recognition and separation of polluted batches waste materials and their disposal
saving of environmental impact through substitution of new production processes	transport required for new production emissions of hazardous substances use of land area use of regenerative and non-regenerative resources minimisation of energy consumption for building material production waste materials from building materials production and their disposal
effects of thermal exploitation	calorific value of the building waste
economic criteria	regulations, their application and tightening acceptance of products from the recycling of building waste materials necessary capacities costs
technical criteria	high-quality recycling technical feasibility

3 Evaluation of the waste disposal process

1.	avoidance reuse (e.g. steel joists, bricks etc.) further use (e.g. pre-cast elements with new function)
2.	exploitation recycling e.g. crushing of concrete for aggregate downcycling, e.g. calcium silicate blocks as fill material thermal exploitation, e.g. timber
3.	disposal composting landfill

4 Disposal routes (basics of recycling)

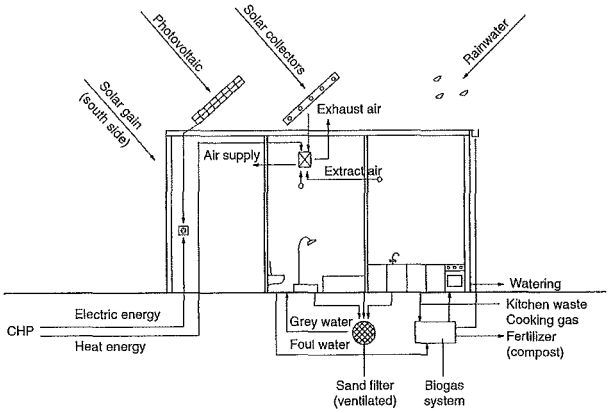
Many factors are decisive for the sustainability of architecture:
- relationship of the design to the location and the building purpose
- contemporary and original appearance of the design
- easily usable and effective structures
- durability of construction and materials
- suitability and ageing characteristics of the materials used
- flexibility for changes of use
- possibility of conversion if required

The intensive use of raw materials and energy in the erection of buildings is normally connected with a long period of usefulness. This phase of the life cycle of a building is therefore very significant.

A significant part of the use of energy and raw materials takes place during the use of the building through the operation of technical devices and installations. New buildings should always be designed in accordance with the current state of technology and existing buildings should be regularly checked to investigate whether any updating (thermal insulation, building services etc.) is possible or necessary in order to ensure energy-saving operation. In addition to the durability and long life of the services installation, mechanisms and methods of saving resources should be the highest priority. Ideally, cycles should be set up to enable the reuse of water and energy.

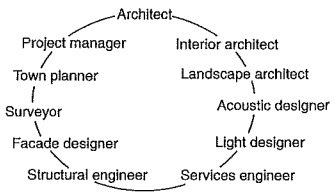
The aims are:
- health and thermal comfort in the use phase
- minimisation of the energy, operating and maintenance costs, reduction of cleaning costs (partially self-cleaning: e.g. façades, roofs etc.)
- minimisation of the servicing and maintenance cost

Rules and regulations:
- Energy Saving Regulations (EnEV)
- SIA 380/4 Electrical Energy in Building: Swiss Engineers and Architects Association, Recommendations
- 'Verification of sufficient summer thermal protection' standards
- 'Building automation' standards
- Heating systems regulations (HeizAnlV)



5 The application of cycles through the example of a residential building in Freiburg-Vauban

Arch.: Common & Gies

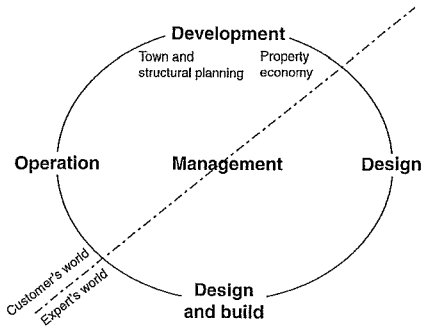


professional client
- CREM (corporate real estate management)
- technical project manager
- facility management

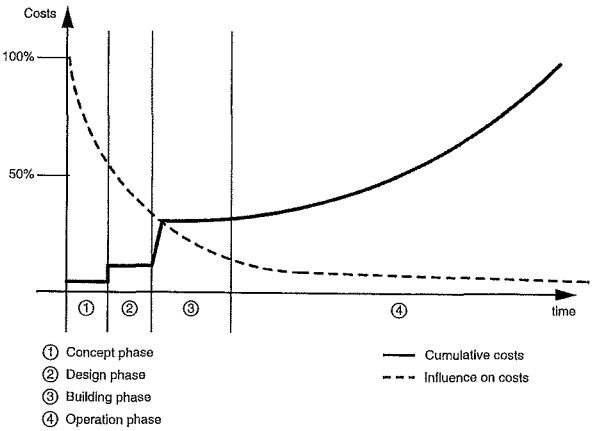
trade and industry
50–100 trades

Client	**Architect**	**Tradesmen** 10 trades
	renaissance	
Client	**Master builder**	**Site hut** 3 trades
	middle ages	
User	**Man builds**	**Self-build**
	early times	

❶ Product and producers – development since the beginning of culture



❷ The life-cycle assessment of a building



❸ Possibilities for project development to influence building costs

Client – responsibility and duties

The client, or commissioner, as the actual decision-maker about its characteristics, bears an essential part of the responsibility for the quality and sustainability of a planned building.

The architect has a central role as the consulting expert, who directs and coordinates all the specialists involved in the design and construction process in a single-minded intention to meet the formulated project aims. In relation to the client, the architect has a role which combines typical expert duties, like exercising their power of persuasion regarding innovative design and construction solutions, with the disciplines of a modern service provider, for example transparency and ensuring the reliability of completion dates and cost estimate.

Considering the oversupply of property since the start of the 21st century and the resulting aggressive competition for building purchasers and tenants, it seems advisable to look in detail into the economic requirements of the typical client.

Clients may be owner-occupiers or investors:
- The owner-occupier or owner-operator is mainly concerned with a reasonable relationship between function and an appropriate image for their company, on the one hand, and cost, on the other.
- The investor is, in contrast, interested in letting or selling with the greatest possible success under current market conditions.

These demand different development, design and construction processes, which, especially in the US and UK, have achieved a high degree of professionalism and success that has motivated investment.

Complex requirements for buildings

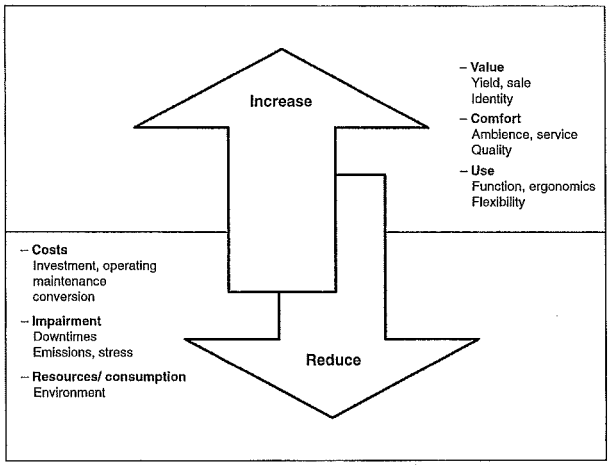
The expression 'added value' comes from the field of production and has increasingly been adopted in the property management field. It includes a complex combination of quantitative and qualitative parameters:
- actually achievable rents, disregarding tax or political effects
- complete and comprehensible costs over the entire life cycle of the building
- practical conversion possibilities laid out in use scenarios planned long term, with all relevant consequences, particularly disturbance-free operation.

Life-cycle assessment

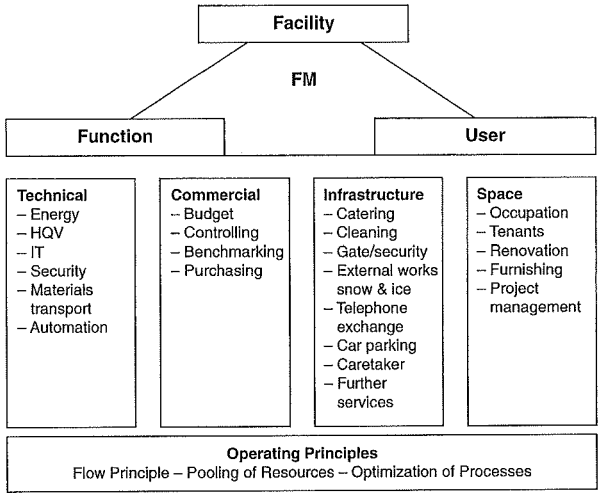
The modern approach in architectural design is typified by the holistic consideration of all phases of the lifetime of a building, called the life-cycle or whole life assessment → ❷. This means that all relevant functional, aesthetic, cost, scheduling and organisational features are systematically categorised for each phase. Of particular importance is the transfer of experience gained during the operation phase to the start of the life cycle of later projects. The result is to transform the planned building into an asset supported by comprehensive responsibility, which can normally continue to be used and maintained after its original purpose has expired.

Project development and programme production

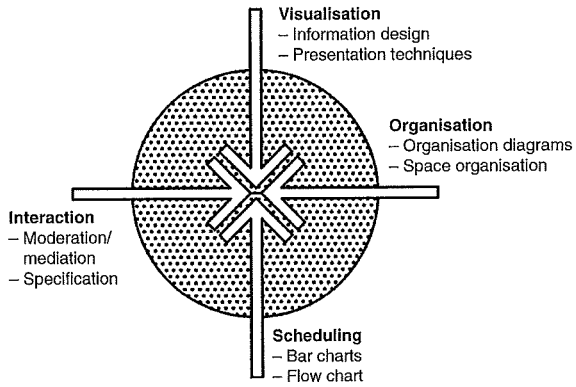
The initial work phase, in which the room and function programmes are developed for an owner-operator, is of course of great significance in the architectural life cycle. When the client is an investor, typical tenant scenarios will be developed → ❸. Careful programming of rooms and functions can result in a considerable increase in the value of a building project:
- functional improvement of typical working and communication processes (the primary or core processes) in the building
- reduction of the space consumed to fulfil functions through appropriate compression of use



❶ Factors which can be influenced and controlled by facility management



❷ The four columns of facility management



❸ Methods of facility management

A new professional discipline

A facility manager is the description for the professional manager of an entire building operation. They undertake all the tasks of the client which can be delegated to specialists. This profession arrived from the USA at the end of the 20th century and has developed very positively in recent years, against the trend for most property-related professions. Its origins were in the planning of the occupation of space (property management). Facility management (FM) developed from related professions like those of architects, building services engineers or infrastructure service providers.

The consistent implementation of FM can save up to 30% in comparison with traditional forms of building management for the same user requirements. Because the operating costs amount to about 80% of the total costs for the entire life-cycle, FM is quickly becoming established as the key profession for the sustainable implementation of architecture → ❶. A range of national and international facility management associations, such as GEFMA, IFMA and BIFM, produce guidelines for facility managers.

The main principle of FM is the combination and optimisation of the many services concerned with a building and its users, which normally already exist but are scattered in their organisation. The architect provides the essential roots for successful FM, is thus the most important partner of a facility manager and also has the best qualifications to take over the tasks of this discipline.

Structural and service aspects

FM is based on a four-column model → ❷. These columns list the technical fields involved, ordered according to their qualification background. These are very heterogeneous, which means that the facility manager has to be a generalist, who typically comes from one specialisation and controls the others. Utilising the wide range of thinking skills included in FM, the facility manager has to be able to provide the users and owners of property with an all-round consulting interface, covering complex specialist issues in an understandable fashion and managing decisions under pressure.

A further special feature of the job description is, similar to the architect, the varied extent of functions, from strategic and intellectual to operative and practical, and thus the requirement to be qualified to work with very diverse partners. This places above-average moderating, management and personal capabilities at the top of the requirement list. Ethical and philosophical qualities like authenticity and integrity are also important qualifications for the sustainable control of complex buildings.

Management methods

The working methods relevant in FM do not normally come from the building industry, but from technical sectors such as the car industry and aviation. Only the building databases that form the foundation of all planning and operational processes and the as-built building drawings, which can be activated to illustrate various aspects (CAFM = computer-assisted facility management) are closely derived from modern architectural, drawing, tendering and room schedule tools → ❷.

For the purposes of facility management planning and decision-making, various management methods from the industries named above are used:

- examination of alternatives and scenarios with total-cost assessment
- complex quality and risk management
- psychology-based moderation/mediation
- 'information design', the graphically descriptive illustration of abstract, multi-faceted and complex information.

Average life expectancy of building elements

Up to 10 years
- lime-washed façade
- window paint, external
- wallpaper
- textile flooring
- surface treatment of floors
- pumps

Up to 20 years
- felt roof covering
- mineral paints
- awnings
- plastic external elements
- plastic-based emulsion paint
- double glazing
- silicon seals and joints
- linoleum and PVC floor coverings
- taps and valves
- measurement and control equipment
- electrical devices
- heating boilers
- air-conditioning plant

Up to 40 years
- external render
- pointing to facing brickwork
- plastic windows
- window ironmongery
- fibre cement roof covering
- zinc gutters
- external wall insulation system
- floating screed
- heating pipes and radiators
- water installations
- electrical installations
- lifts

Up to 80 years
- external render
- fair-faced concrete
- roof construction of:
  - nailed trusses
  - laminated timber trusses
- roof tiles
- stairs, indoor, softwood
- doors
- timber, aluminium windows
- external windowsills:
  - concrete
  - natural stone
- unbonded screed
- bonded screed
- stone/ceramic floor coverings
- sanitary appliances, porcelain
- drainpipes

Over 80 years
- massive construction of:
  - brick
  - calcium silicate blocks
  - concrete
- steel construction
- façade cladding of:
  - glass
  - stone
- timber with constructional weather protection
- external stainless steel elements
- roof construction of:
  - solid timber
  - steel
- slate roofing
- internal windowsills:
  - stone
  - hardwood
- external windowsills, hard brick

❶ The life expectancy of building elements can be affected by the quality of construction and maintenance. Maintenance costs can be reduced if elements liable to wear out are easily accessible.

Measure	definition	costs tax deductibility grant eligibility	treatment under HOAI	approval requirement
Maintenance	inspection service maintenance improvement	operating costs	increase of fee for phase 8 up to 50%	no
Modernisation	improvement of serviceability	investment, measures perhaps grant-aided	increase of fee by up to 20–30 %	possibly
Rebuilding	change of use	investment	increase of fee by up to 20–30 %	yes
Extension	new building work connected to existing	investment	increase of fee by up to 20–30 %	yes

❷ Classification of works to existing buildings according to HOAI, and effects

Conservation
– simple preservation and maintenance of the existing material of a historic monument or listed building with its historic defects and traces.

Restoration
– purposeful recreation and making visible of aesthetic and historic assets. The priority is the production of a historic condition; deleterious and concealing additions may be removed. Layers from other periods can be covered or destroyed in favour of a uniform appearance.

Reconstruction
– recreation of a destroyed building. If no existing structure is present, then this is not the care of an old building but new building.
Anastylose = rebuilding of a building from available original elements
Translocation = relocation of an existing building.

❸ Classification of works to existing buildings, in light of listed building issues

Once buildings have been built, they continue to require care and maintenance. Building and finishing elements have differing lifetime expectations according to their function, use and maintenance. The scale of operations from maintenance, repair, replacement or conversion is blurred → ❶.
Projects involving work on existing buildings should be split into measures under the categories listed below. In addition to advice about the need for approvals, this enables the client to clearly divide the required investment into items which can be grant-aided and those which can be forwarded to tenants. It also enables the architect to correctly assign fee supplements → ❷.
Many of the measures for which the term **renovation** is used stem from construction law but are relevant only in the context of municipal building. As the term is not differentiated regarding building costs and contracts, it should not be applied.

The following measures are differentiated in **HOAI**, which governs the fees of German architects:

Maintenance:
– measures for the preservation of the required condition of a building.

Repair:
– measures to recreate the required condition of a building for its intended use, but not including rebuilding or modernisation. The definition in the standard is the "preservation or recreation of the functional condition".

Modernisation:
– building measures which lead to the sustainable improvement of the serviceability of a building without altering the function, such as the improvement of lighting, sound insulation, access (lifts, disability access) and the energy exploitation.

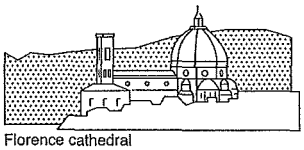
Rebuilding:
– rebuilding works are changes of the design of an existing property with considerable intervention in construction or existing structure.

Extensions:
– additions to an existing building, extending it upwards or sideways.

Recreation:
– new construction of destroyed buildings on existing building or site elements. This counts as a new building if a new design is required.

Conversion:
– describes changes to the type of use of a building. Because this normally leads to different requirements under building regulations, conversion works require building permission like a new building! Conversion includes a change of trade (e.g. from a shop to a restaurant) and also the fitting out of an existing unoccupied attic for residential purposes.

Project preparation
It should be noted for all work on existing buildings that the HOAI is primarily intended for new building and rebuilding, where the requirements are clear in advance. The framework for the determination of fees according to the HOAI is not adequate for the production of a resilient design with varied uses and their effects on cost and listed building protection. The appropriate preliminary investigations (measurement and the surveying of defects), and the ensuing use concepts and variants with cost breakdown, should therefore always be agreed as 'special services' or, better, as the production of an expert report before starting design work, in order to give the client 'design security' before the start of the project. The absence of such design foundations is one of the main reasons for exploding costs in refurbishment work.

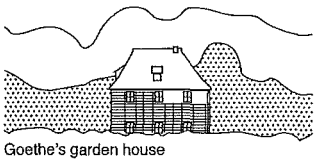


Florence cathedral

Artistic significance
Building as
– individual work of art
– typical example of a style

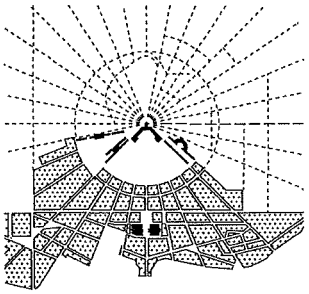
Mine

Technical/scientific significance
Building as example
– of special construction, or first use
– particular craftsmanship
– unaltered original condition of typical construction



Goethe's garden house

Historic significance
Building as site of
– important historic event
– the career of important personalities (birth, residence, death)



Town plan of Karlsruhe

Urban planning significance
Building as part of:
– a planned layout
– a historically developed town plan
– a typical village structure

❶ Criteria for the evaluation of historic building substance

	Conservation	Restoration
Point of view	historical, documentation, structure-related	artistic, aesthetic, related to form and function
What to be protected	**structure** – original structure with all historic alterations as a medium of the historic and building quality	**impression** – visual impression / artistic idea as a medium of the building quality
Aim of historic monument protection	preservation of the structure in the condition in which it has survived. History remains visible.	making the original condition clear and visible, including its recreation
Types of measures	**preservation through conservation** – continual building checks. Immediate repair of any damage by the original methods	**recreation** – repair and if necessary demolition to recreate the original condition
Recreation of destroyed buildings	not allowed, or at most in the form of anastylose (rebuilding using original material)	rebuilding as a recreation of the original condition according to archive sources
Contemporary extensions and alterations	... problematic, because the continuation of history is included in the conservation approach, but is scarcely possible without the destruction of historic building structure.	... problematic, because this would make statements in competition with the original structure.
Criticism	only understandable by experts. Disfigured buildings will be preserved. Changes of use, rebuilding and modernisation are permissible as part of the historical development, under stringent conditions (no destruction of historic building structure) but scarcely practical.	obscuration of the historical development. Destruction of later historically valuable additions. If the sources are insufficient, there is a danger of historical invention. Frequent conflict: which historical state should be chosen for preservation and made visible?

❷ Restoration and conservation principles: various positions and consequences

The care of historic monuments encompasses all measures to preserve such cultural assets in their original substance. The purpose is the preservation, for the benefit of present and future generations, of historic structure that is considered valuable, in order to preserve cultural memory, which can bestow identity and also sustainability in the form of a cultural resource. An important principle was formulated in the Venice Charter of 1964. Listed historic buildings can normally be preserved only in connection with a practical use. This makes it necessary to find a compromise between conservation and alteration.

Statutory protection of historic monuments

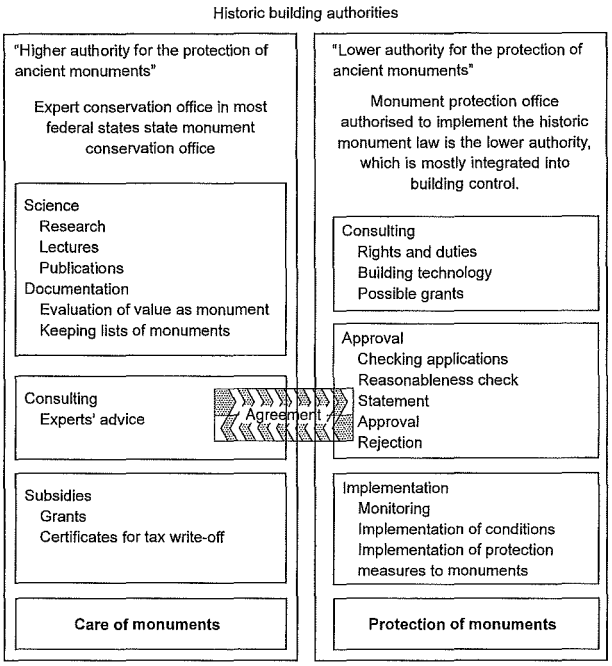
The purposes of the statutory protection of historic monuments include their recognition, recording (drawing up inventories), preservation and publicising. Scientific background research, the preservation and furthering of traditional craft skills, expert consulting for clients and contractors, and public relations work in the form of publications, exhibitions and conferences are further tasks of authorities responsible for the care of historic monuments. All historic buildings and monuments which are placed under protection are entered in the official lists. An individual justification for the listed status must be produced for every building. The evaluation criteria are based on the cultural, historical, town planning, scientific, technical or ethnological significance of a historic building → ❶. According to locally applicable law, lists of historic monuments can be constitutive or declarative → p. 52 ❸ The determination as to which aspects of the value as a monument are most important leads to the contrasting approaches of the preservation of the current state or the recreation of the original state of a historic monument. → ❷

The **restoration approach** has the aim of the recreation of a certain historical condition of the building (e.g. the Bauhausmeisterhäuser in Dessau). This can, however, remove the traces of history. When building elements are reconstructed, there is a danger that, if the documentation is insufficient, the original is falsely interpreted. The preservation of the current state (**conservation approach**) leaves the course of history visible, but takes into account that this may obscure the original appearance (e.g. the Rathaus, Esslingen).

Both approaches have their justification but tend to be put forward dogmatically. They should, however, always be discussed and decided for each individual case, because they have important consequences for the treatment of the historic building. It can be argued that the conservation approach will permit modern additions and rebuilding as the continuation of historical development, but this produces the dilemma that any work involves the destruction of historic building structure.

Historic monuments in the ground

Archaeological monuments serve to protect the signs of human history in the ground (archaeological sites). In contrast to historic buildings, not only known but also unknown sites are placed under protection. They should if possible remain in the ground as an 'archive', because any investigation or excavation would mean their destruction and they would be denied improved methods of investigation in the future. If preservation is not possible, then the responsible party has to pay for recovery and documentation (archaeological excavation). This duty also covers remains discovered in the course of building work.



❶ Principles of the division of responsibilities regarding listed building protection and the care of historic buildings. The individual tasks can vary according to state.

	Basis of protection	Effects
Single listed building	historic buildings protection law	structure and appearance are protected and a permit is required for any alterations or interventions.
Conservation area Protection of an ensemble	situation directly next to a listed building, or location in a conservation area laid down in a by-law (based on the historic buildings protection law)	only the external appearance is protected, not the structure. Alterations to the appearance may have to be discussed and approved.
Preservation by-law	location in an area defined in a by-law (based on planning law)	protection is based on planning concerns, but not the character or appearance.

❷ Difference and effects of various legal protection measures

	Constitutive Hamburg, Nordrhein-Westfalen, Rheinland-Pfalz, Schleswig-Holstein	**Declarative** all other German states
Historic building property	entered in an official document, which leads to listing.	dwells in the building as property and is dependent on an entry in a list.
Incorporation into historic buildings list	formal process, which serves as the basis for the application of the historic buildings law. Owner must be informed of entry.	has no legal consequences and only serves for scientific information. Owner does not have to be informed.
Result	legal security for the owner but higher expense for authorities and citizens	listing status can be obtained on enquiry to the responsible authority.

❸ Legal consequences of the types of statutory lists of historic buildings

The listing of buildings is the legal basis for the state to influence the treatment of historic structures. In Germany, the listing of buildings is part of the cultural sovereignty of the states and is regulated by state laws for the protection of historic buildings. These laws have equal status alongside the other laws governing building. If a conflict arises, then each individual case is balanced against the other(s). Conflicts often derive from fire safety requirements and between the free market exploitation of property and the duty of the owner to preserve a building. Because legally all interests have equal weight, the state requires decisions in accordance with the aims of historic building preservation through information, advice and financial support (grants, depreciation schemes and tax reductions).

Types of listed building protection

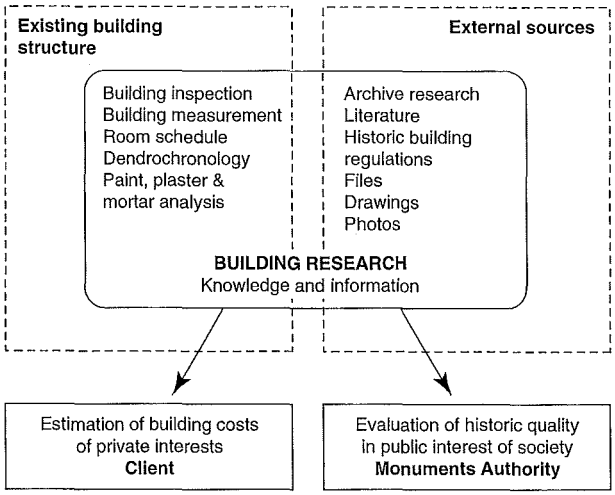
For a single building, the material condition and the direct surroundings are protected. Any alterations to the structure, appearance or use require approval. Because the surroundings are also protected, alterations to neighbouring buildings which impair the impression of the historic building can also require an approval.

The protection of historic buildings in Germany does not differentiate value or categories. There is only an indirect grading of the character of protection through the protection applied to the surroundings of historic buildings and the intention of preserving entire areas or parts of a town in their particular character. The protection of buildings in this case applies only to the external appearance. Conservation areas, the protection of ensembles or local preservation orders are decided by towns and councils as by-laws. The procedure can be very different according to the origin, whether from historic building protection or planning laws. When work is to be undertaken in such areas, this should be discussed and a permit may have to be obtained before starting any alteration to the external appearance of a building or also to the landscape, even if the intended work itself does not require a building permit. → ❷

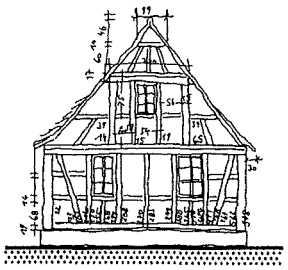
Because of the scope of discretion and the different attitudes of the various authorities, discussions should be opened with the people responsible as soon as possible before undertaking work to listed buildings, in order to work out a reasonable and tolerable solution.

Protection of existing use

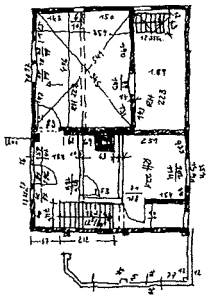
The principle of existing use is intended to prevent new regulations or laws making existing uses impermissible. This applies to buildings, or their use, which would not obtain approval under current regulations, but formerly would have been approved or suitable for approval. Buildings which were never in need of approval are not protected under this principle! The age of a building in this case is immaterial. Buildings with protected existing use may be maintained and also modernised, but the work must preserve their identity. In the case of a change of use, replacement of building structure or other alterations in need of approval, this protection no longer applies, in which case the building must be adapted to modern standards. If this is not done, the authorities can order its demolition. It is important to open discussions at the earliest feasible stage with the responsible authority for historic buildings or the building controller in order to clarify whether and to what extent the protection of existing use applies. Exemptions can be applied for as part of the approval process under listed building legislation, but in order to provide certainty for design work this should be applied for and agreed in advance.



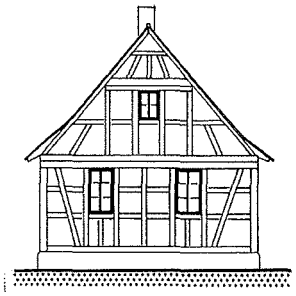
❶ Building research and documentation give the client a sound basis for design and costs and the evaluation criteria for protection and grant aid under historic building legislation



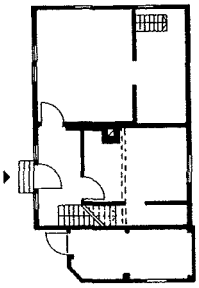
❷ Survey of an existing building: measurement sheet



❸ Survey of an existing building: as-built plan, sketch



❹ Survey of an existing building: as-built elevation



❺ Survey of an existing building: as-built floor plan, structure

	Scale	
I	1:100	schematic recording of the building type and the plan structure for layout plans, approximate calculation of floor areas, analysis of use – sufficient for works which do not alter the structure
II	1:50 precision ± 10 cm	almost precise survey of the geometry, relation of the vertical position of the floors, illustration of the load-bearing structure
III	1:50 precision ± 2.5 cm	exact measurement, including historical deformation, as basis for restoration, construction drawings and scientific investigations
IV	1:25–1:10 precision ± 2–0.5 cm	exact measurement, including historical deformation, for building with stringent scientific and technical construction requirements
V	1:25–1:1 precision ± 2–0.1 cm	exact measurement, including historical deformation, for archaeology and building research for particularly demanding buildings

❻ Measurement precision stages. I and II can be extended up to stage V for difficult historic building projects and scientific investigations.

Surveying an existing building

With the implementation of rebuilding works, documentation of the existing building in the form of drawings and text is an important base for planning. The surveying and investigation of an existing building should ideally be undertaken before decisions are made about construction measures and future use, because only substantiated knowledge about the building structure and potential costs can lead to a sensible solution.

Drawings of the existing building and a room schedule should be produced by the architect on site even if old drawings are available, because this enables an understanding of the defects and the condition of the building at an early stage. The investigations should be carried out with as little damage as possible, but if intrusions into the structure are required, they should be agreed with the client and the historic buildings authority and be performed by experts (restorers, building research consultants).

Drawings of the existing building

The depiction and the precision of the drawings showing the existing building and its condition depend on the aims of the intended work. → ❻ There is a difference between the precision of measurement and the precision of the drawings. The precision of measurement does not depend only on the measuring instruments used but on the system of measurement and any resulting imprecision (out-of-parallel, adding errors). In precision stages I and II → ❻, the measured dimensions are normally more precise than can be shown on the drawing.

The drawings produced in this way serve as the basis for defect mapping, plans of building age and documentation of finds and are then processed further for design, listing of works and construction drawings.

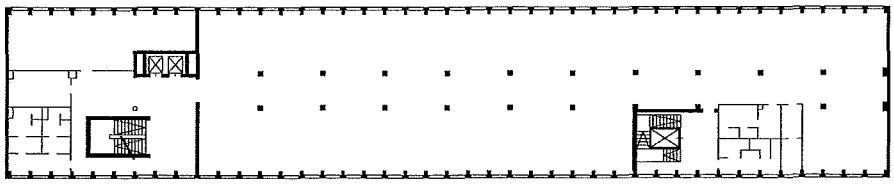
Text description of the existing building

A general building description should contain all the significant information about the building. This includes details about the plot, property relationships, planning conditions, building use, data for financing, tenants and rent income, age of the building, historical building phases, historical design elements, building materials, standards of equipment, building services, structure, constructional properties and other features.

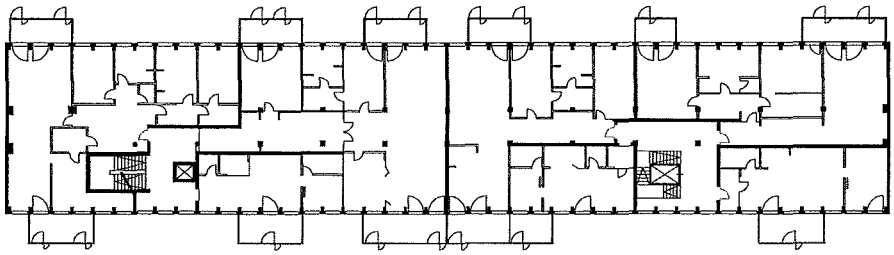
A room schedule should record each room in text and graphics (sketches, drawings and photos), describing necessary measures and work that has already been carried out. The rooms should be numbered on each floor, starting from the entrance hall and proceeding clockwise. The floor number should be legible from the key (e.g. G05 for a room on the ground floor or 1.08 for a room on the first floor).

Building research

Information about each phase of building development, the methods used and later interference with the structure are not only useful for the evaluation of historic quality → p. 51 ❶, but also for sound preliminary design and cost estimation. Some investigations can be undertaken by the architect, e.g. research in the appropriate archives (building authority, town archive etc.), but other tasks will require the appointment of specialists (restorers, conservators, scientific investigations of building materials, colour research, dendrochronology, C14 method, analyses of paint, plaster and mortar). The results can not only give pointers to the age and possible problems arising from earlier rebuilding, but also enable the selection of compatible building materials and enable a precise description of items in the bill of quantities and specification. → ❶

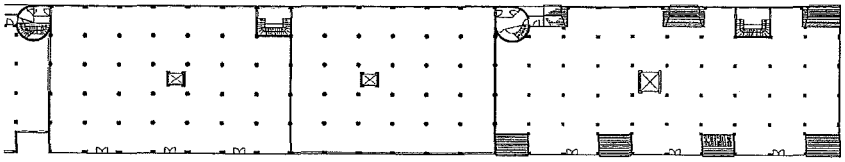


1 As-built plan of an office block from 1965

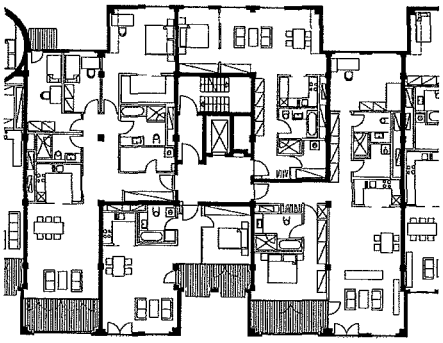


2 Conversion of the office block into flats with a floor area of 60–200 m² each

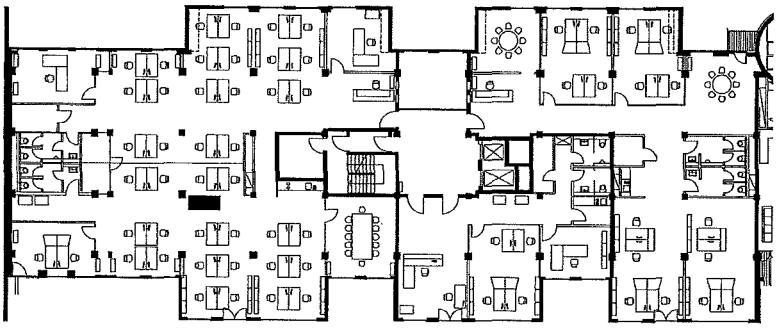
3 Conversion of a former warehouse into a residential and office building. New façade design



4 As-built floor plan



5 Variant with flats



6 Variant with office use

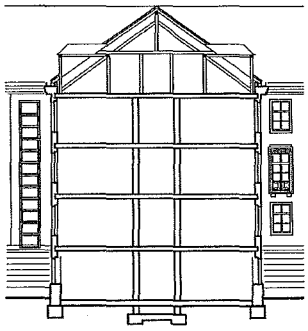
Arch.: Kister Scheithauer Gross

Concrete construction

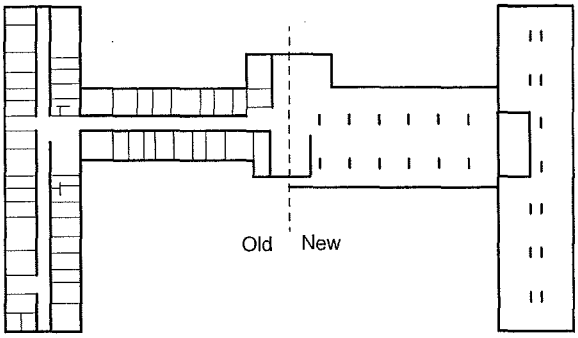
The preservation of historically valuable building structure is only one aspect of work with old buildings. The conversion and further use of existing buildings is also a contribution to sustainability. A large proportion of the office and industrial buildings of the last hundred years no longer meet current requirements. The most important foundation for the decision as to whether these buildings, mostly constructed in reinforced concrete, are suitable for use is the analysis and checking of the structural system. This should ideally be undertaken by an experienced engineer before the design work starts, because it is an important factor in determining whether the building structure is appropriate for further use.

Building archives and knowledge of historic building regulations are helpful in addition to investigation on site, because non-destructive testing of concrete construction is hardly possible.

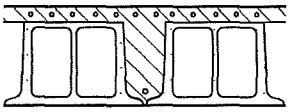
Together with the structural requirements, building physics stipulations also have to be complied with. Updating work is made necessary by the increased concrete covering required for fire protection and the more stringent regulations about thermal insulation (EnEV). The necessary cost of this can be more easily estimated.



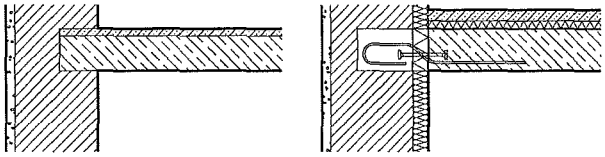
❶ The existing structural system with slabs as continuous beams on the internal and external walls.



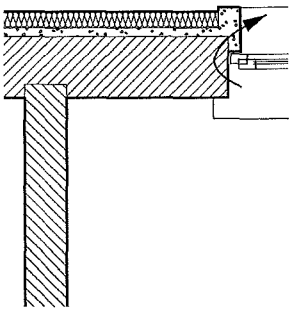
❷ Conversion of an office building to flats. The main wing was extended to the garden side, and new slabs and a new load-bearing structure enable varied floor layouts.



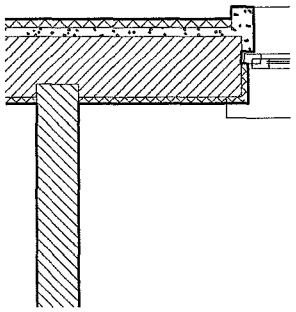
❸ Upgrading of the existing hollow pot floor would have been possible only at great expense.



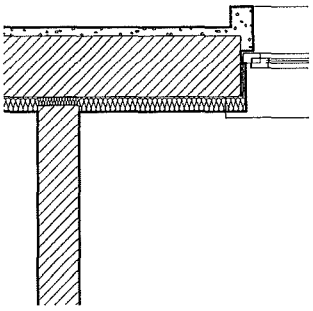
❹ The original hollow pot floor was replaced with a reinforced concrete slab, supported on thermally insulating bearings on the external wall to avoid cold bridging.



❺ External façade insulation system: façade structuring is lost and cold bridging is hard to avoid.



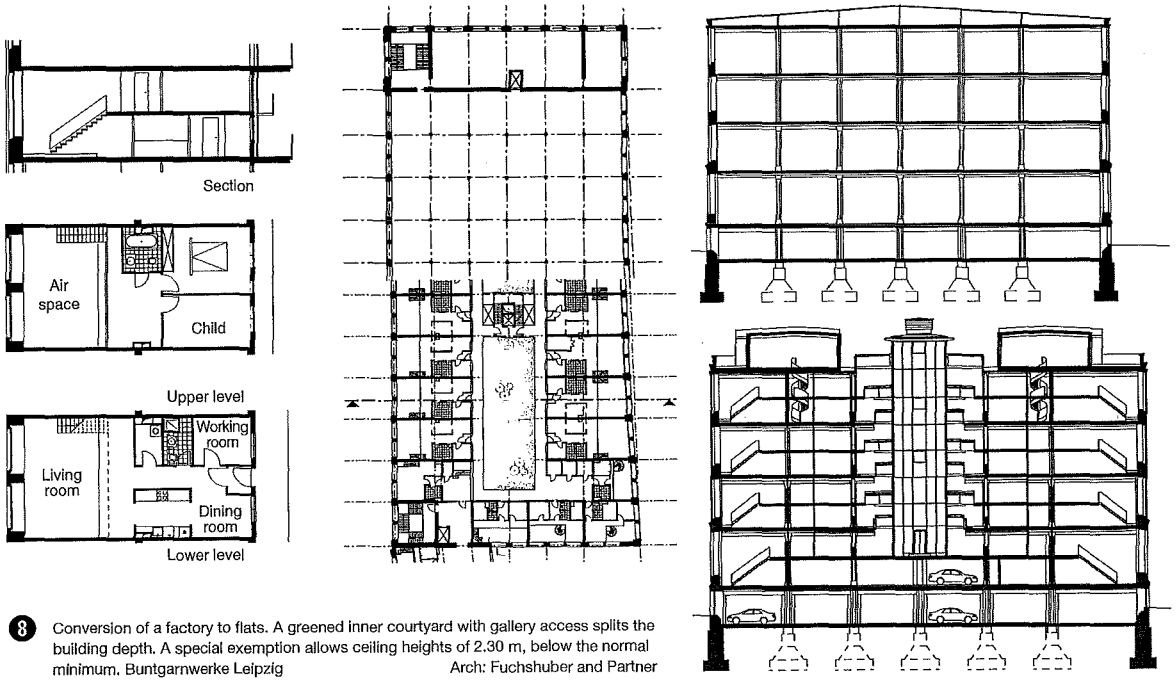
❻ Thermal insulation: external render, calcium silicate boards inside. The optical effect of the structuring elements is weakened.



❼ Thermal insulation: internal plaster, façade remains unaltered, internal walls are tied with insulation cages in order to avoid cold bridge.

Upgrading of masonry buildings

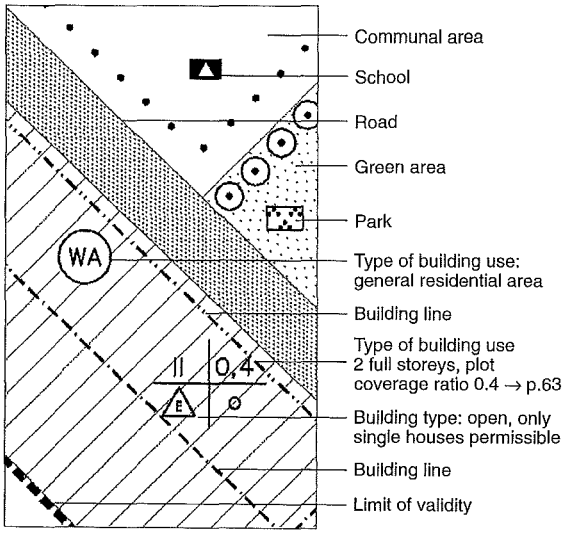
Conversions count as new building and require building permission. The floor slabs cannot normally comply with the requirements for sound, thermal and fire insulation and thus have to be upgraded. Impact sound insulation, fire protection construction and the structural strengthening required for additional loading reduce the clear ceiling height considerably. In an example of the conversion of an office building to high-quality apartments, the slabs were designed as continuous beams over the internal walls. The only solution in this case was the complete exchange of the internal slabs. The use of thermally separated bearings enables internal thermal insulation without cold bridges and does not impair the external elevation → ❶ – ❼. Conversions require compromise. For a listed factory hall with a large building depth and a 5 m ceiling height, the insertion of an internal courtyard and reduction of the height of the less important rooms of the maisonettes was approved → ❽.



❽ Conversion of a factory to flats. A greened inner courtyard with gallery access splits the building depth. A special exemption allows ceiling heights of 2.30 m, below the normal minimum. Buntgarnwerke Leipzig Arch: Fuchshuber and Partner

General provisions	scope of application, terms, general requirements	§ 1–3
The plot and its building development	building on plots	§ 4
	access and exit routes	§ 5
	setback areas, spacings	§ 6
	division of plots	§ 7
	non-built areas, play areas	§ 8
Buildings	design	§ 9
	advertising, vending machines	§ 10
	general requirements for construction	§ 11–16
	building products, types	§ 17–25
	walls, floor slabs, roofs	§ 26–32
	escape routes, openings, fencing	§ 33–38
	building services	§ 39–46
	use-related requirements	§ 47–51
Parties involved in building	basic duties	§ 52
	client	§ 53
	designer	§ 54
	contractor	§ 55
	site manager	§ 56
Building control authorities, administrative procedures	structure, responsibilities, tasks	§ 57–58
	approval requirement, exemption	§ 59–62
	approval procedure	§ 63–77
	building supervision measures	§ 78–80
	official supervision	§ 81–82
	easements	§ 83
Summary offences	summary offences, legal regulations, transitional and final provisions	§ 84–87

1 Structure of the MBO (model building regulations, at state level), general provisions (overview)



2 Decisions in development plans according to the building law code and the land use regulation (example)

Building law code
This federal law contains the most important regulations about **public building law** and **planning law**. It provides local councils in particular with the instruments and procedure for controlling land use in their areas by applying their statutory planning authority. The most important instrument is **town planning.** It regulates the permissibility of new building in unzoned urban areas and outside built-up areas and the organisation of land use (reallocation). The 'special town planning law' includes mainly provisions concerning refurbishment and development projects and town remodelling.

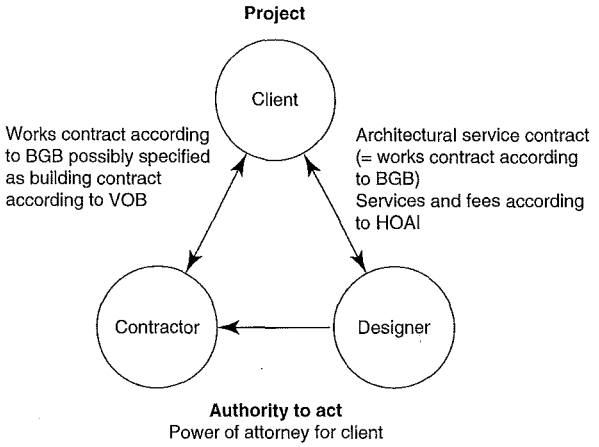
Land use regulation
This controls the land use to be laid down in **zoning plans**. It is divided into the sections **nature** of building use (e.g. general residential area, industrial area), **measures** of building use (e.g. floor area ratio, plot coverage ratio, full storeys → p. 63), **type** of building (e.g. open, closed) and **buildable plot area** (e.g. boundaries, building lines).

Planning drawings regulation
This lays down the uniform illustration of decisions on zoning plans.

Regional planning law
This federal law contains provisions about the basics and problems of regional planning and the regional planning responsibilities of the federal states. The basics of the law are put into practice through the state development plans, development programmes and regional plans. Aims laid down at this level have to be complied with at all lower levels. The law prescribes regional planning procedures.

State building regulations
This legislation, passed by the states, controls building regulations. These cover requirements for building and properties, and serve to reduce risk. They include, for example, provisions about setback areas, fire protection, rescue routes and building approval procedures.

Land-use planning
The building law code differentiates between preparatory land-use planning (**land use plan**) and binding zoning plans (**development plan** and **project development plan**). All zoning plans are produced under a fixed procedure, including the participation of the public, and public agencies and authorities. With the **land use plan,** the intended land use is displayed for an entire council area. The plan is binding on authorities, which means that it has to be complied with at lower levels. The **development plan** is then produced from the land use plan and regulates as an ordinance the control of building for an entire council area, with a catalogue of possible provisions. The **project development plan** is a special form for a defined project. The promoter of the project undertakes in an implementation contract to complete the building commission within a certain time frame and, partially or completely, to bear the design and development costs.



❶ Principal legal relationships between the parties involved in a building contract

	% fee	Work phase	No.
Design	3	collection basic information	1
	7	preliminary design	2
	11	design	3
	6	building permit application	4
Construction	25	detailed design	5
	10	preparation for tendering	6
	4	collaboration in tendering	7
	31	supervision of works	8
	3	supervision of snagging and documentation	9

❷ Services performed in each work phase, HOAI (→ refs)

BGB works contract		VOB/B	
§ 632	payment	§ 2	payment
		§ 14	invoicing
		§ 15	day works
§ 632a	stage payments	§ 16	payment (No. 1)
§ 633	defects	§ 4	construction (No. 7)
		§ 13	defect claims (No. 3, 5, 6)
		§ 17	security
§ 634	rights of the employer in case of defect	§ 13	defect claims
§ 634a	limitation of defect claims	§ 13	defect claims (No. 4, 5)
§ 635	supplementary performance (with § 634 No. 1)	§ 13	defect claims (No. 5 section 1)
§ 636	particular provisions for damages (with § § 634 No. 4, 280, 281, 283, 311a) particular provisions for termination (with § § 634 No. 3, 323, 326 Section 5)	§ 4 § 8 § 13	construction (No. 7) termination by the employer (No. 5) defect rights (No. 7) – not included
§ 637	self-remedy of defects (with § 634 No. 2)	§ 13	defect rights (No. 5 section 2)
§ 638	price reduction (with § 634 No. 3)	§ 13	defect rights (No. 6)
§ 639	exclusion of liability	§ 13	defect rights (No. 3)
§ 640	acceptance	§ 12	acceptance
§ 641	payment due date	§ 16	payment – not included
§ 641a	certificate of completion	§ 4	construction
§ 642	duties of the employer	§ 9	termination by contractor
§ 643	termination by contractor	§	– note § 12 No. 6
§ 644	transfer of risk	§ 7	sharing of risk
§ 645	responsibilities of the employer	§ 12	acceptance – not included
§ 646	completion instead of acceptance		– not included
§ 647	contractor's lien rights		– not included
§ 648	building works security mortgage		
§ 648a	collateral of the employer (tradesman collateral)		
§ 649	right of termination by employer	§ 8	termination by the employer – note in § 2 – not part of VOB
§ 650	cost estimate		
§ 651	application of commercial law		

❸ Comparison of BGB works contract law and the corresponding provisions in the VOB (according to: Boisserée, Mantscheff, Baubetriebslehre 1, p. 53 → refs)

Legal relationships

The legal relationships between parties involved in a building project are normally classified as **works contracts** under the German civil code (BGB), or as **building contracts** under the contract award procedure and contract regulations for building works (VOB) → ❶.

The essence of a building contract is to produce a contractually determined result, in this case the construction of a building. In contrast to this, the subject of a service contract (BGB) is the work as such or working.

HOAI

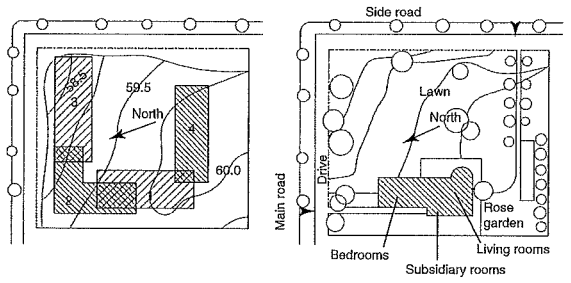
HOAI (Fee Regulations for Architects and Engineers – Germany) controls the invoicing of fees for the services of architects and engineers. The fee is based on the **fee zone** to which a building project has been assigned, the **chargeable costs** (according to the fee table) and the **work phases** undertaken by the architect or engineer, to each of which a percentage of the total fee is assigned (services performed in each phase → ❷). In each of the work phases, there is a differentiation between **basic services**, which are always performed as part of the proper performance of the service, and **special services**, which are separately ordered and invoiced to fulfil particular requirements (e.g. building remeasurement) → p. 58 ff.

HOAI is undergoing revision at the moment. Its scope of application is to be restricted to smaller projects through the lowering of the final values in the fee table, and the removal of work phases 6–9 and the consulting services. Furthermore, the fees should in the future be determined on the basis of building costs agreed in advance.

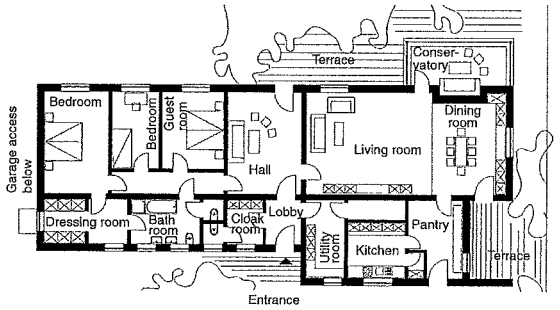
VOB

The VOB (contract award procedure and contract regulations for building works) is neither law nor legal regulation but represents **freely agreed contract rights**, which amend or add to the provisions of the BGB, from whose provisions it varies in essential areas (practical completion, defect claims, payment) → ❸. Federal authorities and many public clients are obliged to apply the VOB in the tendering and contract award procedure of building works.

The VOB is laid out as follows:
Part A contains guidelines for the layout and composition of tender documents, contract award procedures and building contracts.
Part B contains the general conditions of contract for the construction of building works, as laid out → ❸.
Part C contains, categorised according to trades, general technical contract conditions, according to the following uniform system:
0. Notes for the production of bills of quantities and specifications
(an aid for clear and exhaustive tendering)
1. Scope of application (terms, definition of trades, differentiation from other trades)
2. Materials / building elements (definition of the quality conditions for the materials and building elements to be used according to DIN standards
3. Construction (definition of the standards for construction with reference to current DIN standards)
4. Ancillary work / extra work (differentiation of ancillary work (without extra payment) and extra work)
5. Invoicing (invoicing regulations, units, remeasurement, deductions etc.)



1 Consideration of the location of the house on the plot: building development proposal



2 Development of the design from the building development proposal

Architectural services and fees are contained in the respective guidelines for each country / professional body, e.g. in Germany **HOAI** (Fee Regulations for Architects and Engineers), which has broadly the same structure as the Royal Institute of British Architects (**RIBA**) Architects' Plan of Work.

Collection of basic information
(HOAI, work phase 1 → refs)

Basic services:
1. Clarification of the task
2. Consulting concerning extent of services required
3. Assistance with decisions in the selection of specialist engineers
4. Summary of the results

Special services:
- *Recording of the existing condition*
- *Analysis of the location*
- *Production of a room or function schedule*
- *Investigation of the environmental impact or relevance*

Preliminary design
(HOAI, work phase 2 → refs)

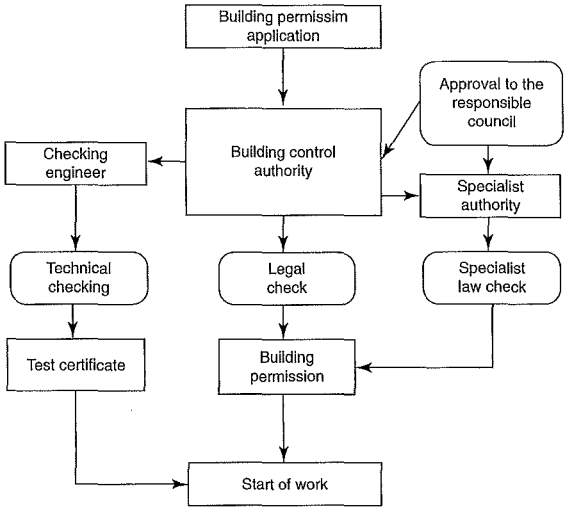
Basic services:
1. Basic analysis
2. Discussion of the aims (constraints, conflicts)
3. Production of a design-related catalogue of aims
4. Production of a design concept with alternatives (for the same requirements) in the form of drawings and descriptions
5. Integration of the services of other involved experts
6. Clarification and explanation of the essential interactions and conditions (e.g. town planning, construction, building services)
7. Preliminary negotiations with authorities and other technical experts about the suitability for approval
8. Cost estimate according to DIN 276 or the local calculation regulation
9. Summary of all results

Special services:
- *Collaboration in obtaining credit*
- *Preliminary inquiry about building permission*
- *Preparation of diagrams on special techniques*
- *Preparation of a time and organisation schedule*
- *Additional design work for building optimisation (e.g. reduction of energy consumption) to a greater extent than the requirements of legal regulations and standards*

Design
(HOAI, work phase 3 → refs)

Basic services:
1. Working through the design concept from work phase 2, using the contributions of the other specialist parties
2. Description of the building work
3. Drawings showing the overall design in the form of fully worked-through design drawings
4. Negotiation with authorities and other specialist parties about the suitability for approval
5. Cost calculation according to DIN 276 or the local calculation regulation
6. Cost control through the comparison of cost estimate and cost calculation
7. Summary of all results

Special services:
- *Investigation of concept variants and their (cost-related) evaluation*
- *Calculation of cost-effectiveness*
- *Cost calculation with quantity framework or building element catalogue*
- *Processing particular measures for the optimisation of the building from work phase 2*



1 Building permit process (outline)

Building permission (MBO)
The construction, alteration or change of use of buildings always requires approval from the building supervision authorities.

There are, however, **exemptions** for certain buildings. These are essentially:

Approval-free building projects (e.g. single-storey building with a gross floor area up to 10 m^2 and garages up to 30 m^2 with average wall heights of up to 3 m (except outside built-up areas → p. 55); **retaining walls and fencing** up to 2 m high, the alteration of load-bearing and bracing building elements in buildings of classes 1 and 2; **cladding of external walls** (except to high-rise buildings); pergolas, entrance porches and **facilities which require approval under other regulations**, such as power stations and traffic-related buildings, in which case the authority responsible for the appropriate legal regulations undertakes the role of building control.

In connection with a **building notification procedure**, approval is also not required for the construction and alteration of buildings of low height which fully correspond to the decisions of a legally binding building development plan, whose utility supply and access is ensured. This applies unless the council demands an application under the simplified building permission procedure within a certain deadline or applies for an interim prohibition.

The **simplified building approval process** is applicable for the construction and alteration of buildings of classes 1–3 within the scope of validity of a legally binding building development plan, if the proposed building corresponds to the decisions in the building development plan to the full extent and the utility supply and access are ensured. In this case, the building control authority only checks the compliance with the regulations of the German building law code concerning general permissibility.

Outline building permission
In advance of the building approval application, a preliminary decision can be obtained from the building control authority about individual (critical) questions concerning the building approval application by making a preliminary enquiry, in order to simplify further processing of the building approval application. Outline building permission is legally binding and valid for one year; the period can be prolonged on application.

Building permit application
(HOAI, work phase 4 → refs)

Basic services:
1. Production of the application documents required for permission or approval in accordance with official regulations, including any application for exceptions and exemptions, making use of the contributions of other specialists involved in the design and including any negotiations necessary with the authorities.
2. Handing in these documents.
3. Completion and adaptation of design documents, descriptions and calculations making use of the contributions of other specialists involved in the design.
4. (For external works and extensions forming rooms) checking whether permits are necessary, obtaining of permissions and approvals.

Special services:
- *Collaboration in the obtaining of approval from neighbours, production of documents for special testing procedures, expert and organisational support of the client in protest procedures, legal actions etc.*
- *Alteration of the application documents resulting from circumstances for which the appointed party is not responsible.*

Building permit application and application documents
The building approval application contains the following details:
1. Name and address of the client
2. Name and address of the architect
3. Description of the proposed building measure
4. Description of the plot (street, house number, plot number etc.)
5. Utility supply and access
6. Details of already granted permits
7. All documents required for evaluation

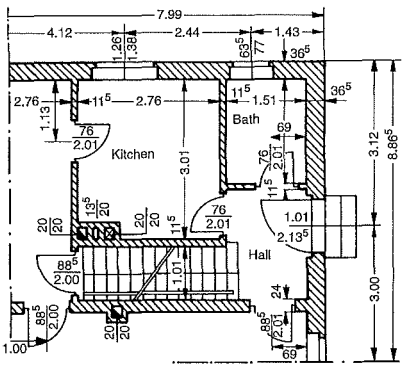
(layout plan, building drawings, building description, verification of structural safety and other technical verifications)
All appended documents must be signed by the client, the architect and other specialist parties.
The building approval application is to be handed in to the responsible council in writing, which will then forward it with their comments to the responsible building control authority. This authority will request comments from all further responsible authorities (fire service, care of historic buildings, etc.) and the owners of neighbouring properties.

Building permit issue
After the completion of checking, the applicant receives the written building permit together with copies of the approved documents (possibly with conditions).
A partial building permit can be issued for single building elements or stages (e.g. excavation) before the issue of the final building permit.
The building permit and partial building permit lapse if building work is not started within one year of their issue or the works are interrupted for more than one year. This period can be prolonged on application.

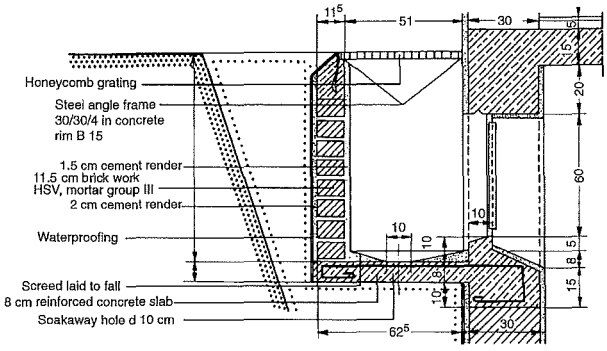
Building supervision by the authorities
The MBO provides for supervision during the building phase. This can be limited to spot checks and essentially consists of the acceptance of the structure (testing of the construction for structural safety, sound and thermal insulation, fire safety) and final acceptance. After the final acceptance certificate has been issued, the building can be used.

DESIGN AND CONSTRUCTION MANAGEMENT

Work Phases



❶ Dimensioned drawing for construction, scale 1:50 (reduced excerpt)



❷ Detail drawing of cellar light shaft, scale 1:20 (reduced)

Means / instruments for construction design

Construction drawings → ❶, with all the details and dimensions required for construction (scale 1:50).

Detailed drawings → ❷ supplement construction drawings for certain sections of the building works (scale 1:20/10/5/1).

Special drawings are intended for the requirements of particular specialist areas (e.g. reinforced concrete, steel or timber construction etc.) and only if necessary show building elements not directly relevant to this specialist area (scale 1:50, depending on subject).

Room schedules → ❸ contain complete details about dimensions (length, height, floor area, volume) of the room or part of the building, materials (e.g. wall finishes, floor finishes etc.), equipment (e.g. heating, sanitary, ventilation, electrical installations etc.) in the form of tables. These are in some cases the basis for a performance specification. **Room schedules and construction drawings can be linked with appropriate software for tendering, contract award procedure and invoicing.**

Detailed design
(HOAI, work phase 5 → refs)

Basic services:

1. Working through the results of work phases 3 and 4 (staged processing of information and presenting solutions) – taking into account town planning, design, functional, technical, building physics, economical, energy-related (e.g. rational consumption of energy), biological and ecological requirements – and making use of the contributions of other specialist parties, until the design is ready for construction.
2. Drawings showing the building with all details required for construction, i.e. the final, complete working drawings, details and construction drawings.
3. For extensions which form rooms: detailed drawings of the rooms and sequence of rooms at scale 1:25 to 1:1, with the required textual details and material descriptions.
4. Development of the basis for the other specialist parties involved in the design and integration of their contributions until the design is ready for construction.
5. Continuation of the detailed design during the construction of the building.

Special services:

- *Setting up a detailed description of the proposed works as a building schedule, to be the basis of a works specification with a performance specification.*)*
- *Setting up a detailed description of the proposed works as a room schedule, to be the basis of a works specification with a performance specification.*)*
- *Checking the working drawings produced by contracting companies on the basis of the works specification with performance specification for compliance with the design.*)*
- *Setting up detailed models. Checking and approving the drawings of third parties who are not specialists in the design team for compliance with the construction drawings (for example workshop drawings from companies, location and foundation drawings from machine suppliers), as long as the services apply to facilities which are not included in the chargeable costs.*

*)This special service becomes wholly or partly a basic service if the works are specified through a performance specification. In this case, the corresponding basic services in this work phase are omitted.

A2 room description					B2 room dimensions						B4 service connections for				B5 values						
1			2	3		1		2		3	1	2	3	4	5	6	1	3	6	
Prov. room no.			Use	User	Type	Area	Type	Height	Type	Volume	Heating	Ventilation	Sanitary	Elec.	Comms.	Transport	Temp.	Vent.	Light	Remarks
A	B	C		(dept)		m^2		m		m^3							°C	/h	lx	(addresses)
	W	104	hall		N	6.92	L	2.47	N	14.87	–	–	–	SW	TS		20	1		AS aerial connection socket
														CL	SI					CL ceiling light
														WVT						SSO power socket
	W	204	bathroom/ WC		N	3.47	L	2.475	N	8.588	CH	ZWE	BA	WB	–		24	7		TF potential equalisation
																				SW switch
													WB	SO						SI sink
													WC	TF						IC entry phone
																				SO socket
	W	304	kitchen		N	6.09	L	2.47	N	15.04	CH	MV	SI	SW	–			20	4	TS telephone socket
														SO						BA bathtub
														SWL						WB washbasin
														SSO						WL wall light without SO
														CL						SWL ditto with switch
	W	404	loggia		N	1.69	L	2.363	N	4.000	CH	MV		–	–		–	–		WC WC
	W	504	liv./din.		N	19.77	L	2.47	N	48.63				SW	AS		21	1		FB fuseboard
														SO						CH central heating
														CL						MV mechanical ventilation
	W	604	serv. rm.		F	0.36	L	2.475	N	0.891				–	–		–	–		

❸ Room schedule (short form): A2 room description

<table>
<tr><td colspan="3">Tender documents</td><td rowspan="5">+
award</td></tr>
<tr><td rowspan="4">covering letter
(request to tender)
+
application conditions</td><td colspan="2">contents of tender</td></tr>
<tr><td>technical content</td><td>legal content</td></tr>
<tr><td>(1) bill of quantities
(4) additional technical regulations
(5) general technical regulations</td><td>(2) special contract conditions
(3) additional contract conditions
(6) general contract terms</td></tr>
<tr><td colspan="3">Building contract</td></tr>
</table>

❶ Tender documents required and their collection to form a building contract (VOB)

Tender and contract

The **contract award procedure** aims to create a contract structure which will guarantee that the plans of a project are carried out within the framework of civil law with its accompanying regulations (→ p. 57). The contract can be awarded when tenders have been received for defined tender documents (specifications, contract conditions and letter stating the possibilities of seeing the tender documents, location and date of the opening deadline, additional costs deadline, binding deadline etc.).

The priced tender documents and signature of the bidder or their authorised representative constitute an **offer**, and if these are accepted and the contract awarded, they become, unaltered, the building contract → ❶.

Building contracts (and thus also tender documents) should comprehensively and completely remove any differences of opinion between the contract parties in advance and clearly regulate the duties on each side.

The specification of the works is therefore the basis for the later building contract. This consists either of bill of quantities or performance specification and building specification:

Bills of quantities → ❷ are listings of the individual items (description of a part of the works according to type, quality, quantity, dimensions with an item number) and can be structured by batch (building stage, building phase/production phase) or title (trade-related).

Performance specifications are functional descriptions of the essential design, technical and economic requirements of the completed work. In contrast to bills of quantities, they do not have a detailed listing of individual items.

The bills of quantities are normally supplemented by **preliminaries** in the form of **general and general technical contract conditions** (= VOB/B or VOB/C), **additional and additional technical contract conditions** from clients who regularly award building works (e.g. German Railways, State of Berlin) and **special contract conditions**, which regulate conditions for special cases.

Software is almost always used for the production of bills of quantities today, because this field is ideal for computerisation due to the linking of tender data with detailed design. The **Standard Book of Bill Items (StLB)** for the building industry helps with the production of bills of quantities with standard text building blocks for individual items, which are assigned to the appropriate areas of work (these approximate to trades according to VOB/C). **Model bills of quantities** for the production of bills are similar to standard books. They include possible text blocks (texts are created by deleting) and are generally very extensive. **Manufacturer's model bills of quantities** for the production of bills offer additional information and are useful for particular constructional solutions.

Preparation of / collaboration in tendering

HOAI 15, work phases 6 + 7 → refs)

Basic services:

1. Determination and listing of quantities as a basis for production of the works specification, making use of the contributions of other design specialists.
2. Production of the works specification and bills of quantities, by areas of work.
3. Approval and coordination of the works specifications produced by other design specialists.
4. Collection of tender documents for all areas of work.
5. Obtaining of tenders.
6. Checking and assessment of tenders, including the production of a price comparison list, by work sections.
7. Checking and collation of the services of specialists collaborating in the tendering process.
8. Negotiations with bidders.
9. Cost forecast according to DIN 276 from the unit or lump sum prices of the tenders.
10. Collaboration in the awarding of the contract.

Special services:

- *Production of work specifications with performance specification, making use of building schedules / room schedules.*)*
- *Production of alternative work specifications for distinct areas of work.*
- *Production of comparative cost outlines, with evaluation of the contributions of other specialists.*
- *Checking and assessing the tenders from the works specification with performance specification, including price comparison list.*)*
- *Production, checking and assessment of price comparison lists for special requirements.*

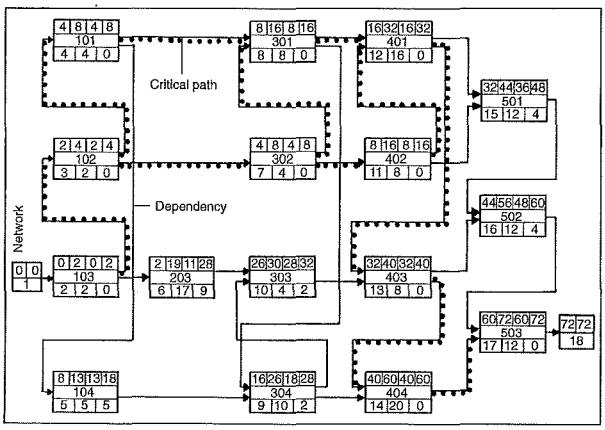
*) see note p. 60

Item	Quantity	Description		Unit price	Total price
Example 1 – quantities and unit prices outside the text					
2.02	105.0	m² construct ground slab of in-situ concrete B 25, d = 15 cm incl. formwork. The surfaces are to be formed with falls to gullies.	for 1 m²	35.70	3748.50
disadvantages:		a) extensive space required for text b) no details about unit price components c) unit price not in words			
Example 2 – unit price inside the text					
2.02	105.0	m² construct ground slab of in-situ concrete B 25, d = 15 cm incl. formwork. The surfaces are to be formed with falls to gullies. wages: € 24.60 material: € 11.10 other: €–.–	for 1 m²	35.70	3748.50
		unit price in words: thirty five 70/100			
disadvantages:		quantity and unit price not on one line			
Example 3 – unit price and quantity inside the text and on one line					
2.02		construct ground slab of in-situ concrete B 25, d = 15 cm incl. formwork. The surfaces are to be formed with falls to gullies. 105 m² W/M/O: € 24.60/€ 11.10/€ –.–			
		unit price in words: thirty five 70/100		35.70	3748.50
advantages:		a) extensive space saving b) quantity × unit price = total price in one line			

❷ Bill of quantities (example)

No.	Activity week	5	10	15	20	25	30	35	40	45
11	Preliminary design									
12	Design									
13	Approvals application									
14	Building permission									
15	Detailed design									
16	Tendering structure									
17	Tendering finishings									
21	Preliminary structural design									
22	Structural design									
23	Working drawings									
31	Work preparation									
32	Structural frame works									
33	Finishing works									

❶ Building schedule as bar chart



❷ Network diagram; example: forward arrow method / Critical Path Method (CPM)

Techniques of work scheduling

Bar charts → ❶ show the work activities vertically and the relevant construction time horizontally in a coordinate system. The duration of each activity is shown by the length of the relevant bar. Following activities are shown below each other. Bar charts are widely used in construction because they are simple and easy to understand. However, the interdependencies of activities (critical paths) and working directions can scarcely be shown.

Line diagrams (time–distance diagrams) show a linear graph of the relationship between work time and distance (or work quantity) in a coordinate system. The speed of work (the slope of the line) and the critical spacings of individual work activities (mutual hindrance) can be made clear. Line diagrams are mainly used for construction processes with a pronounced direction of work (roads, tunnels etc.).

Network diagrams → ❷ are used for the analysis, planning and control of complex construction sequences with consideration of as many parameters as possible. The sequence of work is divided into part activities or events, which are shown as **nodes** (Metra Potential Method (MPM), event node method/ Program Evaluation and Review Technique (PERT)) or **arrows** (Critical Path Method (CPM)), with nodes shown as starting and finishing events. Nodes thus indicates important process or event parameters.

Supervision and support of construction

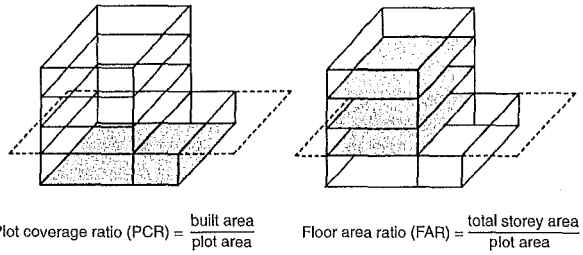
(HOAI, work phases 8 + 9 → refs)

Basic services:

1. Supervision of the construction of the works for compliance with the building permit, the construction drawings and the specifications, as well as the generally recognised qualities of workmanship and applicable regulations.
2. Monitoring of the construction of load-bearing structures with a low degree of difficulty for compliance with the structural safety certificate.
3. Coordination of the parties involved in supervision of the works.
4. Supervision and correction of the details of prefabricated elements.
5. Production and monitoring of a construction time plan (bar chart).
6. Keeping a building site diary.
7. Joint measuring up of work with the contracting firms.
8. Acceptance of building works in collaboration with other design and supervision specialists and identification of defects.
9. Checking invoices.
10. Final cost statement according to DIN 276 or the local calculation regulation.
11. Application to authorities for grants, with follow-up.
12. Handing over the building, including collection and issue of required documents.
13. Listing of guarantee periods.
14. Monitoring of the remediation of defects identified at acceptance.
15. Cost control through the checking of works invoices from contracting firms and comparison with the contract prices and cost estimate.
16. Inspection of the works to identify defects before the expiry of the guarantee periods applicable to the relevant contractors.
17. Monitoring of the remediation of defects occurring within the guarantee period, but at the latest before five years since the acceptance of the building works.
18. Collaboration in the release of securities.
19. Systematic collection of the drawings and calculation results for the building.

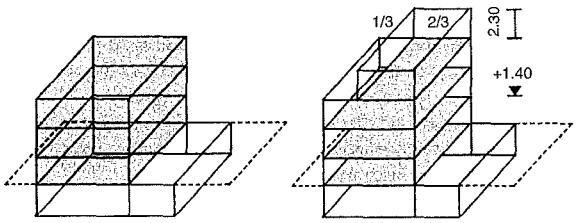
Special services:

- *Set up, monitor and update a payment plan.*
- *Set up, monitor and update comparative progress, cost or capacity schedules.*
- *Activity as responsible construction manager, to the extent that this exceeds the basic services of work phase 8 according to the relevant state regulation.*
- *Production of as-built drawings.*
- *Production of equipment and materials lists.*
- *Production of maintenance and care instructions.*
- *Building security.*
- *Building administration.*
- *Building visits after handover.*
- *Supervision of maintenance and care.*
- *Preparation of payment material for a project file.*
- *Enquiries and cost calculations for standard cost evaluations.*
- *Checking the building and operating cost-use analysis*



Plot coverage ratio (PCR) = $\frac{\text{built area}}{\text{plot area}}$

Floor area ratio (FAR) = $\frac{\text{total storey area}}{\text{plot area}}$



Building mass number (BMN) = $\frac{\text{built volume}}{\text{plot area}}$

Full storey (according to MBO): Ceiling height over 2/3 of the floor area min 2.30 m, slab level min. +1.40 m.

❶ Measures of building use

Housing area regulations → p. 136

Housing area regulations apply to calculations of residential area according to the law to promote living space (includes housing subsidies): the living area of a dwelling covers all rooms which belong exclusively to the relevant dwelling, including conservatories, swimming pools (if enclosed on all sides), balconies, loggias, terraces, but not subsidiary rooms (cellars, garages etc:), offices and rooms which do not comply with the building regulations.

The floor area of a room is determined from the clear dimensions between the building elements, from the outer face of the element's cladding (which includes window and door claddings, skirting boards, stoves, ovens, baths, built-in furniture, free-standing installations, movable partitions). The floor area is measured in completed rooms or from a suitable building drawing.

Floor areas are included in the calculation either completely (for rooms and parts of rooms with a clear ceiling height of at least 2 m), or a half (for rooms and parts of rooms with a clear ceiling height of at least 1 m and less than 2 m) or a quarter (balconies, loggias, terraces etc.).

Calculation of commercial letting areas

The guidelines for the calculation of commercial letting areas, issued by the Property Industry Research Company (GIF) creates a uniform standard for the determination of leased commercial and office space. The leased space is calculated from two types of area:

1. Areas with exclusive right of use, individually listed in types of area according to DIN 277: basement garage with number of places (see above), indirectly usable areas (loggias, balconies, atriums, areas with room heights between 1.50 m and 2.30 m.

2. Areas with communal right of use, individually listed as: rooms for communal use (WCs/bathrooms, staff rooms, etc.) and communal traffic areas (entrance halls, corridors, etc.).

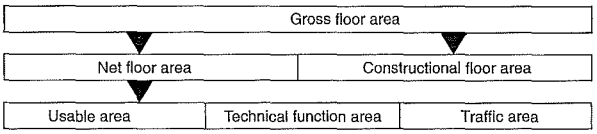
The following do not belong to the letting area: stairs, lifts, emergency exits, escape balconies, services rooms, shafts, protection rooms, areas of columns, pillars and separate walls, areas with a clear ceiling height of 1.50 m or less.

The relevant areas are measured at floor level between solid walls (including skirtings and fittings built in on site (radiators etc.), and room heights are measured between top of finished floor level and underside of the (suspended) ceiling.

Measures of building use → ❶

The land use regulation specifies parameters for the measurement of building use in planning law: the **plot coverage ratio** determines the permissible ratio of built area on the plot (*plan area of building including garages, parking places and their access, subsidiary areas... and underground facilities beneath the plot*) and the **floor-area ratio** (determines the permissible ratio of storey area (*external dimensions of all full floors, without subsidiary areas..., balconies, loggias, terraces and structures which are permissible inside setback areas*) to the plot area.

The **building mass number** represents how many cubic metres of building mass (external dimensions of the building facilities from floor level of the lowest to the ceiling of the highest **full storey**, including occupied rooms in the intermediate floors with their stairwells, surrounding walls and slabs but without subsidiary rooms..., balconies, loggias, terraces and structures which are permissible inside the setback area under state law) are permissible per square metre of plot area.



❷ Breakdown of floor areas (according to DIN 277-1)

Floor areas and volumes

DIN 277 contains parameters for the calculation of floor areas and room volumes of buildings → ❷. All parameters are calculated separately according to whether they belong to the following categories:

a) roofed over and enclosed on all sides
b) roofed over but not enclosed on all sides
c) not roofed over

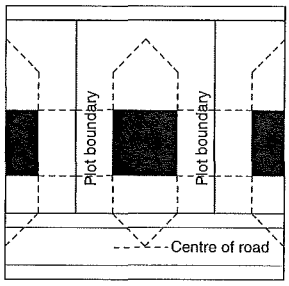
The **gross floor area** is the sum of the plan area of all levels (without usable roof areas), measured between the external dimensions of the surrounding building elements at floor height.

The **constructional floor area** is the sum of the plan area of all surrounding building elements (walls, columns, pillars, chimneys, non-accessible shafts, door openings, niches, apertures) measured between the external dimensions at floor height. The **net floor area** is the usable floor area between the building elements (without door and window openings, cut-outs and niches) measured at floor level. The net floor area is the sum of the **usable area** (area which serves the building's intended purpose), the **technical function area** (rooms for building services, such as utility connection room, accessible shafts, etc.) and the **traffic area** (e.g. stairwells, corridors, lift shafts, escape balconies etc.).

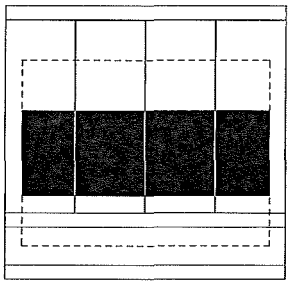
The **gross built volume** is the sum of the floor areas of all levels multiplied by the relevant height (measured between top of floor covering and top of floor covering of the next level, in the basement from the underside of the constructional structural invert in the roof to the top of the roof covering, without external stairs, light wells, roof overhangs, dormer windows, chimneys, etc.). The **net built volume** is the net floor area multiplied by the relevant clear ceiling height.

DESIGN AND CONSTRUCTION MANAGEMENT

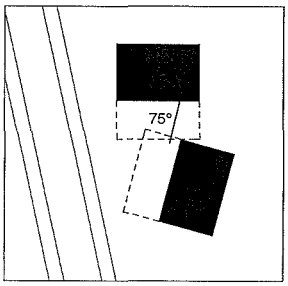
Setback Areas



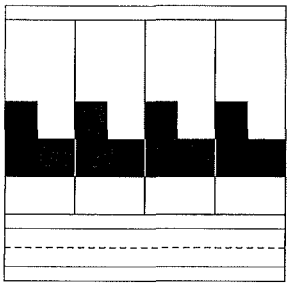
❶ Setback areas



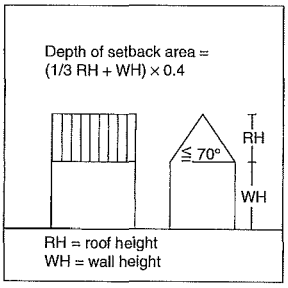
❷ Building on the boundary



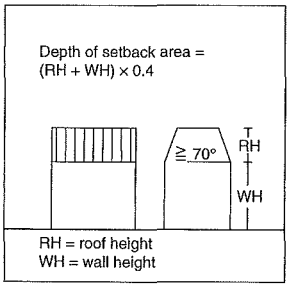
❸ Overlapping of setback areas at more than 75°



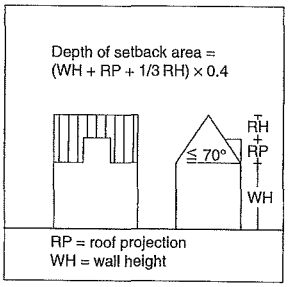
❹ Overlapping of setback areas with a garden courtyard



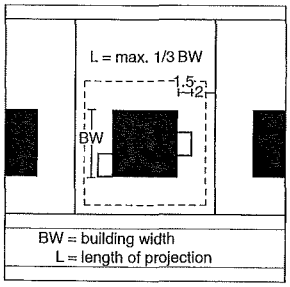
❺ Depth of the setback area



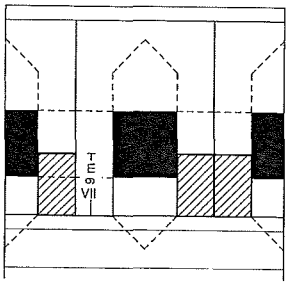
❻ Depth of the setback area with a roof pitch of more than 70°



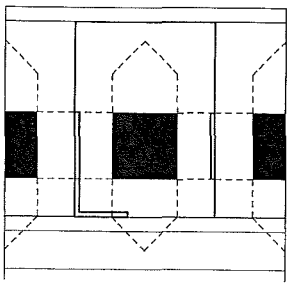
❼ Depth of the setback area with roof projections (roof window)



❽ Projecting building elements



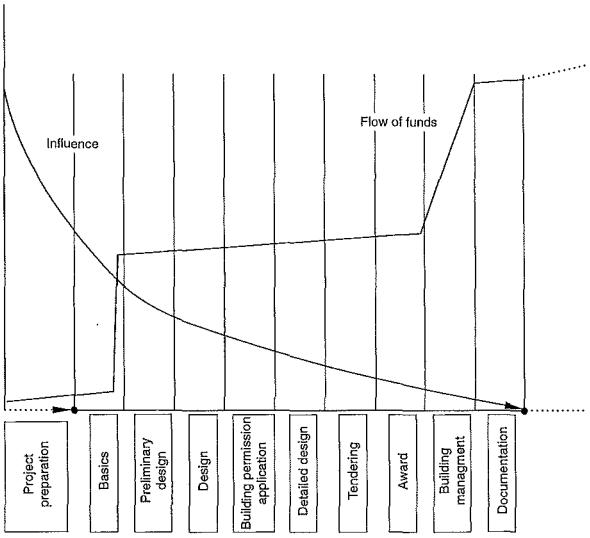
❾ Garages



❿ Walls, fencing

Setback areas are the spaces between buildings and their plot boundaries.

1. Setback areas next to above-ground buildings have to be kept free in front of the external walls of buildings → ❶ – ❷. This also applies to other facilities with effects similar to buildings, which are opposite buildings and plot boundaries. Setback areas are not required in front of external walls which are built on plot boundaries, if they may be or must be built on the boundary according to planning regulations → ❷.
2. Setback areas must be on the plot itself → ❶ – ❷. They may also lie on public traffic, green and water areas, but only to their centre. Setback areas and spaces may wholly or partly extend onto other plots, if it is certain according to public law that they cannot be built on, though they may not be deducted from the other plot's setback areas.
3. Setback areas may not overlap unless:
   - the external walls are at an angle of more than 75° to each other → ❸
   - they are external walls facing a garden courtyard in dwellings of building classes 1 and 2 → ❹
   - buildings and other built facilities are permissible in the setback areas.
4. The depth of the setback area is measured according to wall height → ❹ – ❻.This is measured at right angles to the wall. Wall height means the dimension from ground level to upper extent of the wall or to the intersection of the wall with the roof covering → ❹. The height of roofs with a pitch of ≦70° is included to one third, ≧70° fully with the wall height → ❺.The same applies to roof projections → ❼.
5. The depth of setback areas differs in the various state building regulations (LBO)). According to the model building regulations (MBO), it is 0.4 × H, but at least 3 m (0.2 × H, min. 3 m for commercial and industrial areas). In front of the outside walls of building classes 1 and 2 with not more than three overground storeys, 3 m depth is also sufficient. In some LBOs, there are further exceptions (e.g. narrow side privilege).
6. Building elements projecting from the outside wall (cornices, roof overhang) are not considered in the measurement of setback areas → ❽. Projections remain unconsidered if they:
   - take up altogether less than one third of the width of the outside wall
   - project by a max. 1.50 m in front of the outside wall
   - stay at least 2 m distant from the opposing plot boundary
7. The following are permissible inside the setback area of a building and do not have their own setback areas (even if they are built on the plot boundary or on the building) → ❾ – ❿:
   - garages and buildings without occupied rooms or fireplaces with an average wall height of up to 3 m and a total length per plot boundary of 9 m → ❾
   - solar energy systems independent of the building with a height of up to 3 m and a total length per plot boundary of 9 m
   - retaining walls and closed fencing in commercial and industrial areas, outside these areas with a height of up to 2 m → ❿. The depth of setback areas opposite plot boundaries but not stopping building may not altogether exceed 15 m on the plot.



❶ Influence on the construction costs in the course of design and construction

Cost group			
1st level	2nd level	3rd level	Description
100			plot
200			site preparation and utility connections
300			construction
	→ 012...		– masonry
		→ 012.111	– cored block internal wall block type 12/1.6 mortar group: II wall thickness: 11.5 cm
400			building services
500			external works
600			finishing and artworks
700			ancillary costs, professional fees

❷ Breakdown of costs, DIN 276

Cost estimate

The cost estimate is for the approximate determination of construction costs. It is included in work phase 2 (preliminary design). It is based on:

1. results of the preliminary design (if necessary as a sketch),
2. calculation of the quantities of reference units in the cost groups
3. explanations and building description
4. details of plot, utility supply and access.

The cost estimate should contain the total costs according to cost groups at the 1st level of cost breakdown and thus has at least seven items of cost data. The required description should correspond to the state of information of the preliminary design

Cost calculation

The cost calculation is defined as 'approximate determination' of the construction costs. It is part of work phase 3 (preliminary design). The basis for the cost calculation are:

1. complete design drawings and, if appropriate, details
2. calculation of the quantities of reference units in the cost groups
3. descriptions relevant for the calculation.

The cost calculation should determine the total costs according to cost groups down to the 2nd level of cost breakdown and contain 40 individual items of cost data.

The building description should correspond to the differentiated state of information of the preliminary design.

(Drawings and text from: Neddermann, slightly abbreviated → refs)

Influence over the building costs reduces very rapidly during the course of design and construction. The parties involved in the preparation of the project have the greatest influence over the building costs, because decisions are made at this time about the size, volume etc. of the project. In the further course of construction, costs can be influenced only to a decreasing degree. The flow of money behaves the other way around; it is still very small in the preparation phase and increases in steps → ❶. Efficient cost control should therefore always attempt to apply the brakes during the work phases of a project; control as part of works planning (material selection, etc.) normally has, by way of contrast, no noticeable success.

HOAI requirements

HOAI obliges the architect to produce four determinations of cost during the course of design and construction: **cost estimate, cost calculation, cost forecast, final cost statement).** These cost determinations are basic services → pp. 58–62. They are regarded as basic services with a special weighting, i.e. neglecting a cost determination can have dire legal consequences in the case of a dispute.

Basic rules of cost determination

The basic rules of cost determination are laid down in DIN 276. This classifies the building costs into seven **cost groups** and three **(cost) levels** → ❷. Each cost determination must be structured in the same way and consist of defined building blocks:

1. **Statements about the cost in all cost groups**
2. **Building description**
3. **Cost situation at the time of the determination**
4. **Details of VAT**
5. **Date of the cost determination**
6. **Reference to the relevant design work**

Cost forecast

The cost forecast is the most precise determination of the building costs, taking place in work phase 7 (collaboration in tendering). The cost forecast is based on:

1. complete construction drawings, details, etc.
2. structural verifications, thermal insulation calculations etc.
3. calculations of quantities of reference units in the cost groups or bill items
4. building description with explanations of construction
5. listing of tenders, awards and already accrued costs

As the last cost determination before the start of construction, this has particular significance. The cost forecast should include the total cost according to cost groups down to the 3rd level of cost breakdown and contain 218 individual cost data. The building description belonging to the cost forecast corresponds to the state of design and has the highest degree of detail in the course of the design work. The purpose of the cost forecast is to produce a document before the start of construction based on tenders, awards, already accrued costs and, if necessary, extra calculations, because this is the only possibility of cost control and correction.

Final cost statement

The final cost statement serves to record the actual costs accrued for purposes of comparison and documentation. The final cost is based on: 1. checked invoices, 2. remeasurement quantities, 3. explanations. In the final cost statement, the total costs should be classified down to the 2nd level of cost breakdown.