LEHRBUCH

Sharon Heidenreich

Englisch für Architekten und Bauingenieure – English for Architects and Civil Engineers

Ein kompletter Projektablauf auf Englisch mit Vokabeln, Redewendungen, Übungen und Praxistipps – All project phases in English with vocabulary, idiomatic expressions, exercises and practical advice

6. Auflage

EXTRAS ONLINE

Springer Vieweg

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ISBN 978-3-658-26051-4 ISBN 978-3-658-26052-1 (eBook)
https://doi.org/10.1007/978-3-658-26052-1

Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über http://dnb.d-nb.de abrufbar.

Springer Vieweg

Lektorat: Karina Danulat

Springer Vieweg ist ein Imprint der eingetragenen Gesellschaft Springer Fachmedien Wiesbaden GmbH und ist ein Teil von Springer Nature.
Die Anschrift der Gesellschaft ist: Abraham-Lincoln-Str. 46, 65189 Wiesbaden, Germany

Preface

The mobility of architects and building engineers is increasing. This is not due merely to globalisation brought on by technology, but also the mutual recognition and international validation of degrees. Throughout Europe, the Bologna Process seeks to introduce common course modules leading to BA and MA degrees. As a result of the European Credit Transfer System (ECTS), students are encouraged to travel, and periods spent abroad are credited. This mobility and diversification has a significant common denominator and that is the English language. A good knowledge and understanding of English is essential for persons working or studying abroad.

The aim of this book, which can be used either in class or for self-study, is to give German students, graduates and professionals an insight into the terminology common to the building industry and, at the same time, to provide opportunity to practise and consolidate vocabulary and grammar. The 18 units accompany the reader through all planning phases of a project, from the brief and feasibility study through to the completion and acceptance of a scheme. Business skills, such as telephoning, writing emails, letters, etc., are practised throughout the book. The development of a single-family home, which is planned and realised during the course of the book, provides a background for dialogues and letter writing. Some of the more important grammar elements have been included, offering readers the opportunity to refresh and practise functions appropriate to the phase of construction.

This book does not purport to be a dictionary or a set of rules. It points out major differences between the UK and Germany, but does not cover all the rules and regulations. The purpose is to support those wishing to enhance their constructional knowledge with the equivalent English expressions and vocabulary. All terminology is introduced in an appropriate context, giving readers a lexical phrase, a short expression in English, rather than single words lacking context.

Acknowledgements

I am very grateful to all those who have made this book possible. Comments, suggestions and criticism have provided valuable insights and contributed immensely towards what "English for Architects and Civil Engineers" is today.

The changes, not only in the book but also in society, which have taken place since the first publication in 2008 are overwhelming. The first book was published before the release of the first iPad in 2010, in the same year as the Olympics took place in Beijing National Stadium, also known as the "Bird's Nest". In the meantime, tablets, smart phones and a variety of software programs have become an integral part of every practice. The evolution of this book reflects some of these changes, such as the introduction of the e-learning module in the 5th edition and now the use of scanning codes, which enable the reader to access audio material directly with a smart phone or other hand-held device.

In this context I would like to thank my editor, Karina Danulat, who is a continuous driver and keeps coming up with new ideas to make English for Architects and Civil Engineers more attractive to today's readers.

This edition also includes some new illustrations, which have once again been prepared by my husband, Nicholas Heidenreich. His support at the computer, but also his stories from his everyday life as an architect, help to keep the book attractive, more meaningful and up-to-date.

I would also like to thank my father, James Hawken, for once again spending endless hours reading and checking texts and for the emails with suggestions from across the globe. Susanne Zech, who has again contributed towards the book with her drawings, has also been a great help and support.

This sixth edition would never have been possible without all those who purchased the first five. The demand underlines how important a good knowledge of English has become for students of architecture and civil engineering as well as experienced professionals in practice. This applies particularly to the specialised vocabulary in the building industry.

The original idea of the book has been retained throughout all editions, but it has become broader, including aspects from related disciplines, such as building services engineering and now urban design, and longer to include the in-use and end of service life phases. All chapters have once again been reviewed and updated to reflect changes in workflows, standards and guidelines.

I would like to thank those who have contributed towards the development of this book, especially my students at the Technische Hochschule Nürnberg and all the other readers for their comments and suggestions. I look forward to receiving further input.

Nuremberg, July 2019 Sharon Heidenreich

Contents

Abbreviations and Acronyms

Abbreviation	English meaning	German meaning
adj	adjective	Adjektiv, Eigenschaftswort
v	verb	Verb
sb	somebody	jemand/en/em
sth	something	etwas
pl	plural	Mehrzahl
fig	figurative	im bildlichen Sinne
e.g.	for example (Latin: exempli gratia)	zum Beispiel
i.e.	in other words (Latin: id est)	das heißt
etc.	and other similar things (Latin: et cetera)	und so weiter
BE	British English	
AE	American English	
sqm, m^2	square metres	Quadratmeter
cbm, m^3	cubic metres	Kubikmeter

Acronym	English meaning	German meaning
AC	alternating current	Wechselstrom
ARB	Architects Registration Board	Britische Kammer zur Registrierung von Architekten
A/V ratio	envelope to volume ratio	Verhältnis von Hüllfläche zu Volumen (A/V Verhältnis)
BA	Bachelor of Arts	
BAMB	buildings as material banks	
BAS	building automation system	Gebäudeautomationssystem
BGB	civil code	Bürgerliches Gesetzbuch
BoQ	Bill of Quantities	Leistungsverzeichnis (LV)
BREEAM	Building Research Establishment Environmental Assessment Method	Britisches Gebäudezertifizierungssystem
BS	British Standard	Britische Norm
BSc	Bachelor of Science	
BSI	British Standards Institution	Britisches Normeninstitut
CAD	Computer Aided Design	computergestütztes Zeichnen
CAR	Contractor's All Risks Insurance	CAR-Versicherung, Bauwesenversicherung

Acronym	English meaning	German meaning
CCTV	closed circuit television	Fernsehüberwachungsanlage
CDW	construction and demolition waste	Bau- und Abbruchabfälle
CLT	cross laminated timber	Kreuzlagenholz
CO_2	carbon dioxide	Kohlenstoffdioxid
CPD	Continuing Professional Development	weitere berufliche Entwicklung
CV	Curriculum Vitae	Lebenslauf
C2C	cradle to cradle	von der Wiege zur Wiege (C2C)
DAAD	German Academic Exchange Service	Deutscher Akademischer Austauschdienst
DC	direct current	Gleichstrom
DGNB	German building certification system	Deutsche Gesellschaft für Nachhaltiges Bauen
DHW	domestic hot water	Warmwasser
DIN	German Institute for Standardisation	Deutsches Institut für Normung
DPC	damp proof course	Feuchtigkeitssperre
ECTS	European Credit Transfer System	Europäisches System zur Übertragung u. Akkumulierung von Studienleistungen
EEC	European Economic Community	Europäische Wirtschaftsgemeinschaft
EHEA	European Higher Education Area	Europäischer Hochschulraum
EN	European Standards	Europäische Normen
EnEV	German energy saving order	Energieeinsparverordnung
EPBD	Energy Performance of Buildings Directive	Richtlinie zur Gesamtenergieeffizienz von Gebäuden
FAR	floor area ratio (see also FSI)	Geschossflächenzahl (GFZ)
FIDIC	French: Fédération Internationale des Ingénieurs-Conseils	Internationale Vereinigung der Beratenden Ingenieure
FFL	finished floor level	Fertigfußboden (FFB)
FSI	floor space index	Geschossflächenzahl (GFZ)
GHP	geothermal heat pump	geothermische Wärmepumpe
GNP	gross national product	Bruttosozialprodukt (BSP)
GSI	ground space index	Grundflächenzahl
HOAI	Official Scale of Fees for Services by Architects and Engineers	Honorarordnung für Architekten und Ingenieure
HVAC	heating, ventilation and air conditioning	Heizung, Lüftung u. Klimatisierung (RLT)
IAQ	indoor air quality	Raumluftqualität
ICE	Institution of Civil Engineers	Britischer Bauingenieurverband
ISO	International Organization for Standardization	Internationale Organisation für Normung

Acronym	English meaning	German meaning
JCT	Joint Contracts Tribunal	Arbeitsgruppe für Bauverträge
LADs	liquidated and ascertained damages	vorher festgelegter Schadensersatz
LCA	Life Cycle Assessment	Ökobilanz
LEED	Leadership in Energy and Environmental Design	US-amerikanisches Gebäudezertifizierungssystem
LVL	laminated veneer lumber	Furnierschichtholz
MA	Master of Arts	
MDF	medium dense fibreboard	mitteldichte Holzfaserplatte
MINERGIE	Swiss label for sustainable buildings	Schweizerisches Qualitätslabel für nachhaltige Gebäude
MSc	Master of Science	
OSB	oriented strand board	Grobspanplatte
OSR	open space ratio	Freiflächenzahl
PCM	phase change material	Phasenwechselmaterial
PV	photovoltaics	Photovoltaik
QS	quantity surveyor	Kosten- und Abrechnungsingenieur
RIBA	Royal Institute of British Architects	Königlicher Britischer Architektenverband
RICS	Royal Institute of Chartered Surveyors	Königliche Kammer der Quantity-Surveyor und Grundstücksbewerter
SMA	smart memory alloy	Formgedächtnislegierung
UFL	unfinished floor level	Rohfußboden (RFB)
UK	United Kingdom	Vereinigtes Königreich
VOB	construction contracts procedures	Verdingungsordnung für Bauwesen
VOC	volatile organic compound	flüchtige organische Verbindung (VOC)

Introduction

The contents of the book are arranged in the same way as a project. The first units start with the fundamentals, the feasibility studies, first meetings among the project participants and the preliminary design. The last units describe the construction, completion and in-use phase of a building. The final unit takes a look at the various career opportunities in architecture and civil engineering.

Not all of the book contents are actually dealt with in every project and by every project participant, such as urban and structural design, building materials and building services, but form part of the work related to the development of a structure. The corresponding units or passages have been brought in at the appropriate stages. The subject matter of these related fields goes far beyond the scope of this book. The most important terminology is, however, covered and will hopefully serve as an introduction to the related disciplines.

It is possible to access the book at any stage; however, vocabulary explained in earlier units is not necessarily repeated and might have to be referred to in the alphabetic lists at the end of the book. The overview on the following pages will help the reader to locate the appropriate construction phase, business skill or grammar item.

Each unit offers reading texts describing a process or situation arising during the course of a project. These texts introduce vocabulary in a context corresponding to that specific phase. By working through the units, the reader will become aware of collocating verbs, nouns and adjectives. The significance of these collocations is explained in Unit 1. Word spiders have been added in Units 3, 4 and 13 to point out the importance of lexical phrases. Readers may find this method of illustration useful in understanding word families. Exercises and tasks are included throughout the book, which invite the reader to check and experiment with the terminology and phrases introduced. Some exercises are designed for practice, whereas others invite the reader to reflect on personal situations and consolidate the elements learned.

New words are written in italics and listed at the end of each unit according to the order in which they appear. Words appearing in diagrams and drawings have not been highlighted, but are included in the vocabulary lists. The words from the individual units can be found in alphabetical order at the end of the book, either English to German or German to English with a page reference. At the end of the book there is also a section containing the answers to the numerous exercises.

According to the Common European Framework of Reference for Languages, the level of this book is B2/C1.

Overview

	Title	Vocabulary	Grammar
1	Project Basics	Project team, appointment, office tools	Simple past and present, collocations
2	Town Planning	Design tools, fixed and variable factors, key issues	Word order
3	Preliminary Enquiries	Project definition, feasibility, surveys; numbers, units	Questions and answers, homophones
4	Sustainability	Energy, energy-efficient buildings, LCAs	Future tenses
5	Briefing	Project brief, construction costs	Expressing needs and requirements
6	Preliminary Design	Design (shapes, doors, windows, roofs, stairs)	Adjectives and modifiers, word families
7	Structural Design	Structural systems, loads, forces, foundations	Compound nouns
8	Building Materials	Material properties (concrete, steel, timber)	
9	Building Services	Plumbing, heating, ventilation, electricity	Phrasal verbs
10	Final Design	Project coordination, plans, alterations	Phrasal verbs, if-clauses
11	Planning and Building Permission	Planning application/ permission; fire safety	Idiomatic expressions
12	Tender Documentation	Procurement, tender documents	Passive and active speech
13	Tender Action	Estimations, negotiations, contracts	Comparative adjectives
14	Pre-Construction Phase	Time management, site set-up, site safety	Present perfect; prepositions of time and place
15	Construction	Construction trades, site meetings, variations	Cause and effect
16	Completion	Delays, acceptance, payment procedures	Business collocations
17	In Use and End of Life	Operation, upgrade, demolition, re-use	Comparing and contrasting
18	Education, Registration and more	Studying, finding work, practising as an engineer	

Business skill	**Project situation**	**Listening in E-learning**	
Project organisation			**1**
Working with statistics	Urban detail plan		**2**
Writing emails, email registers	First meeting, client update (email)	Site visit with client At the local authorities	**3**
			4
Telephone calls	Client's brief, Appointing consultants	Appointing consultants Client update	**5**
Comparing and contrasting	Project description	Project design	**6**
			7
Technical standards			**8**
Meetings	Discussion about sustainable building	Technical installations, (1^{st} with client, 2^{nd} with BSE)	**9**
Emails, meetings, presentation skills	Design presentation, meeting with structural engineer	Design presentation Design questions	**10**
Business idioms	Project update	Planning application	**11**
Writing business letters	Selecting contractors	Preparing the bills of quantities	**12**
Language in negotiations, comparative analysis	Contract negotiation	Contract negotiation	**13**
Time management	Transition from planning to construction, timing	Accident on construction site	**14**
Language in meetings, expressing requests	Client requests alteration, handling the request		**15**
Writing emails	Contractor's request for extension of time	Delay Acceptance	**16**
Intercultural competence	Demolition, waste house		**17**
Writing application letters, CVs; interviews			**18**

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Neu in der 6. Auflage – QR-Codes

Die Hörverständnisübungen können nun auch direkt im Buch beim jeweiligen Text per **QR-Code** abgerufen werden.

Conversation:	A first meeting
George Brown:	Hello, you must be Tim Smith, the architect.
Tim Smith:	Yes, that's right.
George Brown:	I'm George and this is my wife, Helen.
Tim Smith:	Hello, pleased to meet you.
George Brown:	So this is the piece of land we *inherited* last year. We've spent quite a long time thinking about it, but we've decided we'd like to build a house and move to this part of the town.
Tim Smith:	Well, it's a wonderful location, isn't it. And the plot is an adequate size, too.
George Brown:	Yes, we think it should be big enough for a small house leaving a bit of garden.

Die **QR-Codes** sind auf diesen Seiten zu finden:

32, 39, 58, 59, 73, 126, 129, 142, 144, 151, 161, 177, 195, 217, 219.

1 Project Basics

1.1 Construction industry

The construction industry touches the lives of virtually everyone on a daily basis and occupies a fundamental position in national economies. In Europe, it generates approximately 12 per cent of the *Gross Domestic Product (GDP)* and employs about 8 per cent of the *labour force*. The building industry is regarded as the *bellwether* of economic growth, and periods of prosperity are usually associated with high levels of construction activity. Unfortunately the opposite applies in periods of recession.

Approximately 20 per cent of this construction work is performed in cross-border operations where English is very often the common language. In such cases, the project participants need a good command of English and this is vital to the success of the projects.

The work involved in construction projects is heterogeneous and extremely complex. There are numerous classifications of construction which can differ considerably. One major aspect is the differentiation between new construction and *repair or maintenance work*. Not surprisingly the latter accounts for 35 per cent of all construction work carried out.

Construction projects involve a great deal of time and expense. It follows that close management control is required if they are to be completed within the agreed time and cost limitations. Each construction project is unique – no two jobs are ever quite the same. Each structure relates to its own environment, has its own particular function and is designed to reflect personal tastes and preferences.

No matter how small or large, every construction project is based on the *client*'s desire for change. Sometimes the client already owns a *property* and would merely like to make some *alterations*, in other cases, the client might own a *plot of land*, which could be developed. In some cases, the architect supports the client in finding a suitable plot for a *development*.

There is some confusion regarding the *services* provided by architects and engineers. On the one hand, it is often believed that the *fee* for a *commission* covers anything and everything the client desires, provided that it has some relation to the project. On the other hand, and equally erroneously, it is sometimes believed that the planner will prepare a *set of plans*, but anything else will cost extra. There is some truth in each belief, which is why it is often difficult to explain the scope of services satisfactorily.

The service phases help to structure the total development of a project. In progressing from initial planning to *completion*, the typical job passes through a series of distinct stages. The *work phases* function as a basis for fees and a means of separating the process into portions. This is especially useful if the process is split among a series of planners. The HOAI, the Official Scale of Fees for Services by Architects and Engineers in Germany, divides the process into nine stages. Up until recently, the *RIBA*, the *Royal Institute of British Architects*, divided the building process into eleven stages defined by the letters A to L. After 50 years in use, the RIBA Plan of Work was renewed in 2013 now incorporating eight numbered stages. Because the process of planning and constructing a development is continuous, it is not always possible to make a clear distinction between the individual phases.

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_1

The following table shows the subdivision used by the RIBA in Great Britain and the HOAI for building works in Germany. For more information on the RIBA Plan of Work 2013 see: http://www.ribaplanofwork.com/

The RIBA Plan of Work		HOAI Service Phases	
0	Strategic Definition	1	Fundamental evaluation
1	Preparation and Brief	2	Preliminary design
2	Concept Design	3	Final design
3	Developed Design	4	Planning permission application
4	Technical Design	5	Execution planning
5	Construction	6	Preparation of contract award
6	Handover and Close Out	7	Involvement in contract award
7	In Use	8	Project supervision
		9	Post-completion services

1.2 People involved

A construction project is not usually a one-person job, but a process taken care of by a project team, which comprises designers, *consultants* and contractors working on behalf of the client. A building project may have a relatively simple structure at the beginning with merely a client and an architect, but over a few months, depending on the size of the project, many more people become involved. The client is the customer and therefore the most important member of the team. Because the development of a project includes a mix of components and materials, a team often involves many different *trades* offering a variety of *skills*.

Despite the planning and construction work being more or less consistent across Europe, the responsibilities and tasks of the *project parties* may differ. Furthermore, the terms and their translations do not always correspond. A typical example is the German "Bauingenieur" which is usually translated as *civil engineer*. However, a civil engineer in English-speaking countries is responsible for civil engineering, which includes, for example, the planning and development of roads, bridges and tunnels. It is the *structural or building engineer* who plans and develops the structures of residential and non-residential buildings.

The following sections list the parties usually involved in project development and highlight the differences between the German and British terms.

1.2.1 Client

The client, whether public or private, is the party that commissions the design and the construction. *Public clients* range from the federal government to local authorities. Private clients may be individuals, partnerships or corporations. Either way, the client is the initiator of every project and the ultimate *owner* of the building. Under standard *building contracts*, the client is known as the e*mployer* and is the one who makes the investment and finances the project. A good relationship between the client and the planning team is extremely important and should *be based on trust*.

1.2.2 Planning team

It is the architect's task to translate the client's ideas into an acceptable design and produce a building that meets the client's needs. The architect must ensure that the result is properly related to the requirements of the owner and *occupant* and that the design is developed within the budget set by the client. In achieving the result, the architect has to relate to the surroundings, respect the natural and built environment and take account of social factors. The architect should always strive for an ecological, *sustainable* design. The profession requires creative skills and a thorough understanding of materials, construction techniques and their application on site. Furthermore, the architect must be able to manage a project team and maintain a clear overview of operations and cost.

Across Europe, the relations between team members and the responsibilities differ slightly. In Germany, the client tends to commission a single party, an architect or engineer, to perform the cost planning, the design and supervision work. In the UK, architectural work is divided and taken care of by two sometimes even three parties – an architect, a *quantity surveyor* and possibly a *clerk of works*. In this case, the client has a separate agreement with all three parties and three equal *representatives*. In civil engineering, the client usually only has a contract with the civil engineer. Civil engineers also work with quantity surveyors; however, in this case they are usually commissioned by the client or the civil engineer and merely function as a consultant.

As mentioned in 1.2, there is clear distinction in the UK between a civil engineer, who is responsible for civil engineering works, and a structural engineer, who is responsible for the structural design of buildings. Whereas the civil engineer tends to be the client's representative in the case of civil engineering works, the structural engineer tends to be engaged as a consultant in the construction of buildings. This book focuses mainly on the structural engineer as a consultant.

It is the structural engineer's task to offer advice on the structural design from the *foundations* to the roof. The structural stability of the building as well as the *thermal insulation calculation* are the responsibility of the structural engineer. Their work includes advice, *specifications*, design and the *monitoring* of structure related work.

As mentioned above, most projects in the UK also involve a quantity surveyor, referred to simply as QS, as a client representative. Quantity surveying is often described as the financial management of a project. Traditionally quantity surveyors were employed to prepare *bills of quantities*. Nowadays they advise on, forecast and plan costs, take part in the *procurement procedure*, prepare *final accounts* and settle *contractual disputes*. The nature and scale of the project determines the level of involvement. However, it is beneficial to the entire development process if the quantity surveyor is involved from the very beginning in order to become familiar with the special needs of the client and properly evaluate options.

Quantity surveying is a course of study in the UK. Similar to the Royal Institute of British Architects (RIBA) and the *Institution of Civil Engineers (ICE)*, the *Royal Institution of Chartered Surveyors (RICS)* affiliates quantity surveyors. Qualified members are allowed to use the title *Chartered* Surveyor.

The design team may also include the following consultants:

A *building services engineer* is responsible for the mechanical and electrical aspects of a project. A *landscape architect* is involved in the design and supervision of external works. Ground formation, planting and *arboreal work* provide the finishing touches to every project. *Interior designers* specialise in designing architectural interiors and furnishing. All these consultants provide advice and drawings. Depending on their degree of involvement, they may take care of the *tendering procedures* with specialist firms and the execution of the work.

1.2.3 Construction team

The *building contractor* is the second major party in the project team and responsible for turning the architect's design into reality. The contractor is usually selected by *competitive tender* and has a contract directly with the client. The client may choose to commission a general contractor for the entire project. In this situation, the contractor covers all aspects of the construction and assumes full responsibility for delivery of the finished job. Even if general contractors *sub-let* work to *subcontractors*, they retain responsibility for all construction operations and remain *liable* to the client for any defects in sub-contracted work.

The alternative to a general contractor is several independent contractors working on different aspects of the project. Each is responsible for a designated portion of the work and has a separate contract with the client.

Large construction companies will generally have a contract manager responsible for the management of the project. In addition, the construction company has a *site agent* who has control over all construction processes on site. The site agent receives instructions from the contract manager initiates each particular operation, coordinates it with other trades, ensures that it has a clear run and is supplied with appropriate plant, labour and materials.

If the architect is only employed for the design phase, a British client may employ a clerk of works as a full-time inspector on site. The clerk of works is responsible for checking that the materials and *workmanship* conform to the drawings and specifications set out in the contract documents. The clerk of works is the client's representative and collaborates with the architect, who is kept informed about all activities on site.

1.2.4 Who is who?

Read the paragraphs above and decide which person fulfils the tasks described on the left.

1. They know all about building structures. ………………………………
2. He/she pays the bills. ………………………………
3. In the UK, they offer advice on cost matters. ………………………………
4. They plan tunnels and bridges. ………………………………
5. The UK client's representative on site. ………………………………
6. The contractor hires them for a specific task. ………………………………
7. The architect needs one before he/she can practise. ………………………………
8. They develop the design of a building. ………………………………
9. They plan the supply and discharge of water. ………………………………

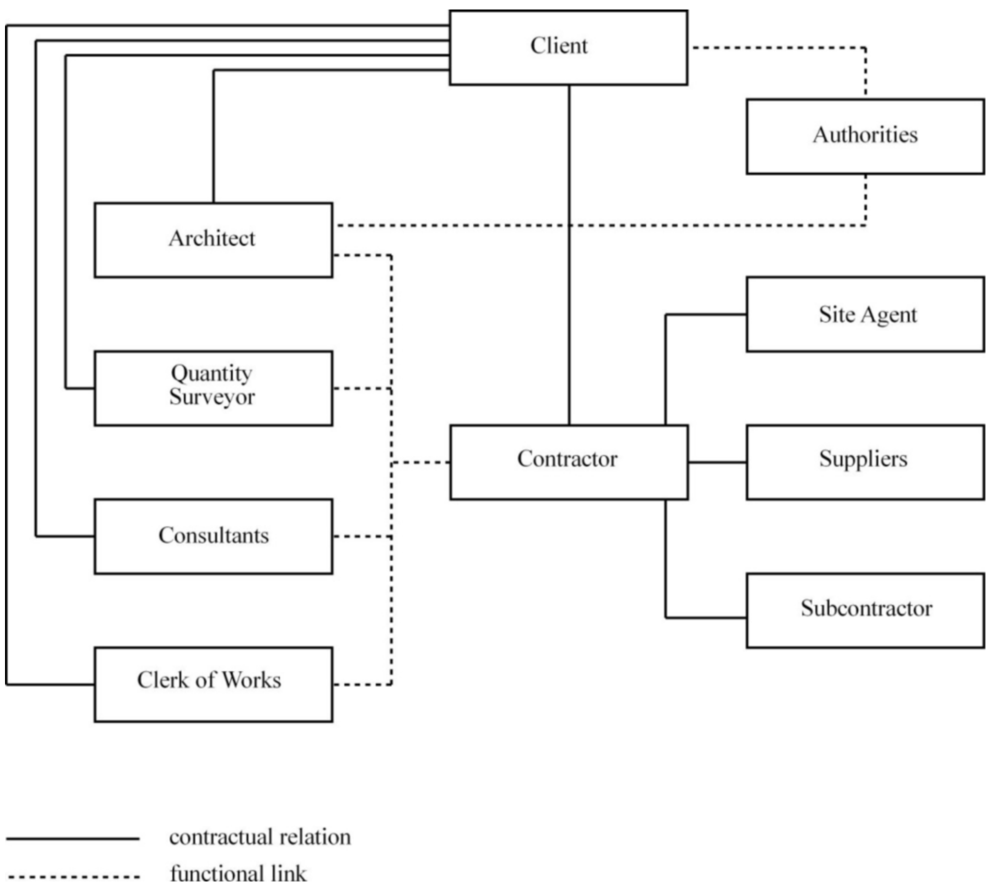
1.3 Project organisation

Organigrams display the organisation of a company or the people involved in a project. Because there are so many different contract formats, structures and roles within a construction project, an organigram is a useful tool to present the functions of individuals and the relationships between them.

1.3.1 Traditional contract

The organigram shown below is typical of one for a traditional contract for a medium-sized project. The client commissions the architect to lead a project from beginning to end. The architect advises the client to *appoint* consultants to deal with particular tasks, such as calculating structures, *cost estimating*, landscape design or technical matters.

Contractors are selected and commissioned by the client to execute the work according to the drawings and specifications produced by the design team. The contractor's site agent controls site operations and coordinates all trades. Contractors order material from *suppliers* and employ subcontractors to complete certain tasks within the project.



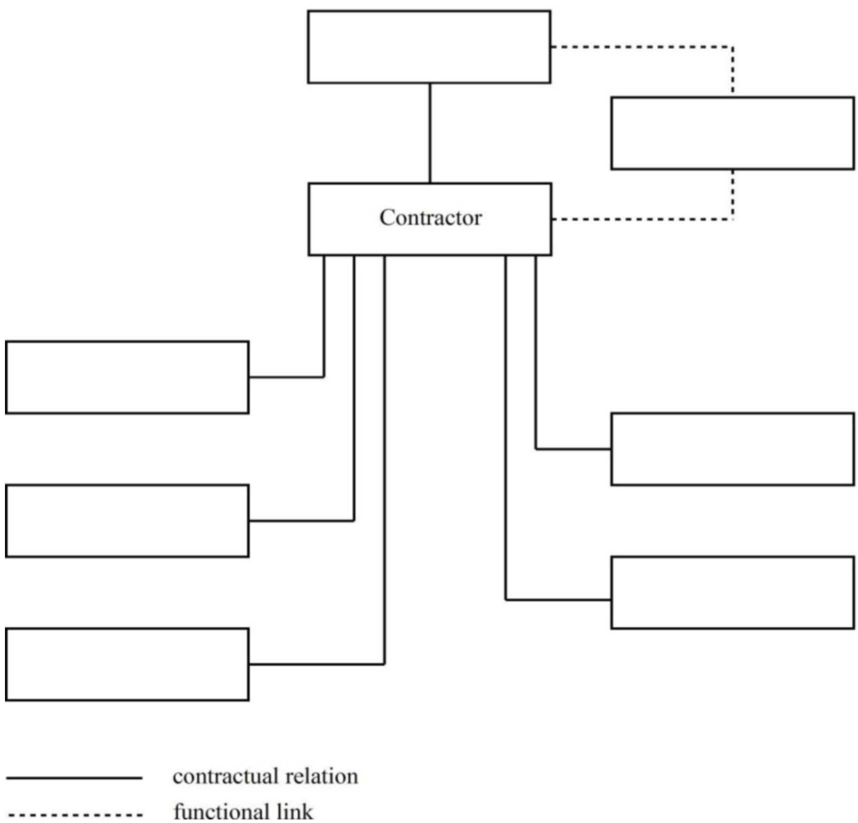
1.3.2 Design and build contract

The following organigram shows a contract form which has become very popular in recent years – especially in the UK. In this case, the contractor carries the responsibility for both design and construction. The concept is to offer the client a package or, what is known as, a *turnkey development*. The contractor is responsible for providing everything, sometimes even furniture and pictures on walls. As the name suggests the client simply turns the key and starts using the building.

It goes without saying that this system also involves architects. However, in this case, the architect's employer is not the client, but the contractor.

Insert the functions below into the organigram and describe the relationships. The lexical phrases used in 1.3.1, such as to appoint sb, to be responsible for, etc., should be helpful to create a similar description.

architect · authorities · supplier · subcontractor · client · quantity surveyor · consultants



1.3.3 Your project

Think about a project you are working on at the moment or have already completed. Which people or trades were represented in the project team?

1.4 The appointment

The relationship between an architect or an engineer and his or her client is contractual. A contract is a binding agreement between two or more parties. It sets down mutual rights and duties, which are enforceable at law.

A contract can exist by word of mouth. However, the dangers of an *oral contract* are often misunderstandings sometimes due to imperfect memory. A written contract has the advantage that it protects both parties' rights in the event of disputes, if necessary before a court of law.

Before signing a contract, the architect or engineer should pay careful attention to the *terms and conditions*. It is wise, wherever possible, to contract on the basis of standard terms. In contrast to Germany, the RIBA offers standard forms for the appointment of architects in the UK. There are several different forms depending on the size and the type of work. The form SFA/99 is intended for general use for the appointment of an architect. To find out more about different contract formats in Britain go to www.riba.org.

Civil engineers use contracts drawn up by the Institution of Civil Engineers (ICE). For more information go to www.ice.org.uk.

1.4.1 Code of conduct

All persons wishing to use the title architect for business purposes have to register with a *professional association*. In Germany, this is the Architectural Chamber of the Land in which the architect is practising; in the United Kingdom, the ARB (Architects Registration Board) holds and maintains the UK Register of Architects.

The *registration conditions* prescribed by most boards include adequate qualifications awarded by a school of architecture and usually at least two years of practical experience. Sometimes a written and/or oral examination is also required.

These professional associations, including the European Architect's Directive (85/384/EEC) and the UNESCO/UIA Charter for Architectural Education, on an international basis, issue guidelines regulating the actions of members between themselves, to their clients and the public. The codes published by the boards list guidelines regarding the professional conduct and the practice expected of architects, including *complaints handling* and client service. The principle of all codes is the requirement for architects to act with complete honesty and integrity at all times. Architects should carry out their professional work faithfully and conscientiously and with due regard to relevant technical and professional standards.

A failure to follow the guidance of a code may be taken into account should it be necessary to examine the conduct and competence of an architect. A shortcoming or failure to comply with the guidelines may give rise to *disciplinary proceedings*. The codes do not replace obligations placed upon architects by law.

1.4.2 Collocations

A collocation is an expression in which words are habitually combined. Some words sit together well and sound very natural in speech and script, whereas combinations using other words with similar meanings, can sound quite awkward and unnatural. The recognition of collocations is an effective way to learn vocabulary and improve general language skills. There are many different patterns of collocations.

The following table and exercises look into some of the patterns. Further exercises dealing with collocations can be found in Unit 16.2.2.

Word pattern	Technical engineering collocation	Everyday collocation
verb + noun	to appoint an engineer	to take a photo
verb + adverb	to inspect regularly	to eat regularly
adjective + noun	oral contract	heavy rain
noun + noun	site inspection	beer garden

Match a word from each side to form collocations that have appeared in this unit.

turnkey sign professional commission
quantity thermal disciplinary estimate

procedures development surveyor conduct
insulation a contractor the costs a contract

1. ………………………………………
2. ………………………………………
3. ………………………………………
4. ………………………………………
5. ………………………………………
6. ………………………………………
7. ………………………………………
8. ………………………………………

Now complete each sentence using a collocation from the table above in the appropriate form.

1. The thickness of …………………. has to be calculated carefully to best reduce the heat transfer between the building's interior and exterior.
2. In the UK, the costs of a project are usually managed by a …………………. .
3. Before any project can proceed to the next phase, the ………….. of the scheme should be ………….. and presented to the client.
4. The client has to …………………. to execute the construction work.
5. Companies that accompany a construction project from beginning to end are specialists in …………………. .
6. A written agreement is a ………….. that is ………….. by all parties involved in the project.
7. All institutes and associations for architects and engineers lay down rules of …………………. .
8. Professionals who do not adhere to regulatory standards may encounter …………………. .

1.5 The workplace

Architects and engineers who have been in practice for more than 20 years are fully aware of the changes, which have taken place due to information technology. Over the years, *drawing boards*, *tee squares*, *stencils* and *tracing paper* have been replaced by computer applications. There is no longer a need for large *filing cabinets* to store *dyelines*. Today the originals are nicely stored on disks and printed out on plotters when required. Changes are simply made by a mouse click without requiring *razor blades* to remove the *drawing ink* once used to make the drawings.

Nowadays, all office staff are computer trained and multi-skilled in that they not only prepare their own drawings, but also draw up diagrams and charts, as well as write a lot of their own letters and emails. The *cable clutter*, which once occupied much of the floor space behind and under tables and desks, has disappeared since the introduction of *wireless* equipment. Wireless phones, printers, monitors and keyboards bring great flexibility to once very rigid office arrangements.

Despite all these changes, the building industry is one sector which will never be able to cope as *paperless offices*. Paper and pencils will always remain the planner's first tool. A pencil is small, quick, totally independent of electricity and able to express such a lot in a small space of time.

1.5.1 Office equipment

Architects, engineers and *draughtspersons* are dependent on a wide range of equipment to fulfil the daily tasks of designing. Find the pieces of equipment from the box in the drawings.

scanner
plotter
T-square
tracing paper
monitor
mouse
mobile phone printer
file
folding rule
power outlet strip
pencil
keyboard
a pair of scissors
bin
calculator
sharpener

1.5.2 Grammar: Simple present and simple past

If you take a look at the two pictures, you will notice a lot of differences between the past and the present situation.

Simple Present is used to describe current facts and regular activities.

Signal words: adverbs of frequency such as always, usually, normally, sometimes, never, hardly ever, every day, etc.
adverbs contrasting the present and the past such as nowadays, today, currently, etc.

Form: The simple present has the same form as the infinitive but adds an s in the third person singular (I work, you work, he/she/it works, etc.). The negative is formed with the negative of the verb to do + the infinitive of the full verb (I don't work, he doesn't work).

Example: Today architects use computer programs.

Simple Past is used to describe completed activities or facts of the past.

Signal words: yesterday, last week, last year, time + ago, on + date, in + year

Form: In regular verbs, the simple past is formed by adding -ed to the infinitive (I worked). There are no inflexions, i.e. the same form is used for all persons. In irregular verbs, forms vary considerably and they simply have to be learnt. Most dictionaries include a list of irregular verbs. Like regular verbs, there are no inflexions.

The negative of regular and irregular verbs is formed with did not + the infinitive (I did not work).

Example: 15 years ago, draughtsmen sat at drawing boards.

1.5.3 Exercise: Simple present versus simple past

Complete the text below by putting the verb in brackets into either the simple present or simple past tense.

Architecture has always been practised. Even in ancient times *master builder* …..……… (design) buildings and …..……… (manage) their construction. Up until the late 80ies draughtspersons ……..…… (spend) their working hours at drawing boards using tee squares, *compasses* and stencils. In 1938, Konrad Zuse …………..… (invent) the Z1 – the first digital computer. The first CAD programmes ..…………. (appear) in the 70ies, however, they ………...…… (not become) affordable for smaller offices until the early 90ies. Nowadays, most architects ……...…… (sit) in front of flat screens and ……...…… (give) instructions to the computer by clicking the mouse. Despite all the changes, architects ……...……..… (still use) paper and pencil to jot down first thoughts.

1.6 Vocabulary

1.1	Gross Domestic Product, GDP	Bruttoinlandsprodukt
	labour force	Erwerbstätigen
	bellwether	Indikator, Leithammel
	repair or maintenance work	Reparatur- oder Instandhaltungsmaßnahmen
	client	Auftraggeber, Bauherr
	property	Immobilie
	alterations	Umbauarbeiten
	plot of land	Baugrundstück, Parzelle, Flurstück
	development	Bebauung
	services	Leistungen
	fee	Honorar
	commission	Beauftragung
	set of plans	Plansatz
	completion	Fertigstellung
	work stages/phases	Leistungsphasen
	RIBA, Royal Institute of British Architects	königlicher Britischer Architektenverband
	handover	Übergabe
	close out	Abschluss (hier: Projekt-)
	planning permission application	Genehmigungsplanung
	contract award	Vergabe
	supervision	Bauüberwachung
1.2	consultant	Fachplaner, Fachingenieur
	trade	Baugewerbe
	skill	Fertigkeit
	project parties	Baubeteiligte
	civil engineer	Bauingenieur für Tiefbau
	structural or building engineer	Bauingenieur für Hochbau
1.2.1	public client	öffentlicher Auftraggeber
	owner	Eigentümer, Besitzer
	building contract	Bauvertrag
	employer	Auftraggeber
	to be based on trust	auf Vertrauen basieren
1.2.2	occupant	Gebäudenutzer
	sustainable	nachhaltig
	quantity surveyor, QS	Kosten- u. Abrechnungsingenieur (Berufsstand mit eigenem Studiengang in GB u. anderen Ländern; berät auch bei Vertragsgestaltung u. Vergabe)
	clerk of works	Bauaufseher (meist des Auftraggebers)

	client's representative	Bauherrenvertreter
	foundations	Fundamente
	thermal insulation calculation	Wärmeschutznachweis
	specifications	technische Daten
	to monitor	überwachen, beaufsichtigen
	bill of quantities	Leistungsverzeichnis
	procurement procedure	Vergabeverfahren
	final account	Schlussrechnung, Endabrechnung
	contractual disputes	Vertragsstreitigkeiten
	ICE, Institution of Civil Engineers	Britscher Ingenieurverband
	RICS, Royal Institution of Chartered Surveyors	königliche Kammer der Quantity Surveyors und Grundstücksbewerter
	chartered	staatlich anerkannt
	building services engineer	Haustechnik-Ingenieur, Haustechniker
	landscape architect	Landschaftsarchitekt, -planer
	arboreal work	Arbeit an Bäumen
	interior designer	Innenarchitekt
	tendering procedure	Ausschreibungsverfahren
1.2.3	building contractor	Bauunternehmen
	competitive tender	Ausschreibung
	to sub-let work	einen Auftrag weitervergeben
	subcontractor	Subunternehmen
	liable adj	haftbar
	site agent	Bauleiter des Auftragnehmers
	workmanship	Ausführungsqualität
1.3.1	to appoint sb	beauftragen
	cost estimate	Kostenanschlag
	supplier	Lieferant
	contractual relation	Vertragsverhältnis
1.3.2	design and build contract	Generalübernehmervertrag
	turnkey development	schlüsselfertige Bebauung
1.4	appointment	Beauftragung
	oral contract	mündlicher Vertrag
	terms and conditions	Konditionen
1.4.1	conduct	Verhalten, Betragen
	professional association	Berufsverband
	registration conditions	Eintragungsbedingungen
	complaints handling	Beschwerdebearbeitung
	disciplinary proceedings	Disziplinärverfahren
1.5	drawing board	Reißbrett, Zeichenbrett
	tee-square	Reißschiene

	stencil	Schriftschablone
	tracing paper	Transparentpapier
	filing cabinet	Aktenschrank
	dyeline (copy)	Lichtpause
	razor blade	Rasierklinge
	drawing ink	Tusche
	cable clutter	Kabelsalat
	wireless	drahtlos
	paperless office	papierloses Büro
1.5.1	draughtsperson/-people pl draughtsman/-men pl draughtswoman/-women pl	Bauzeichner/in
	folding rule	Zollstock
	power outlet strip	Mehrfachsteckdose
	(rubbish) bin BE, trashcan AE	Mülleimer, -kübel
	to bin sth (e.g. old things, an idea/concept)	etw. wegschmeißen
1.5.3	master builder	Baumeister
	compass	Zirkel

2 Town Planning

2.1 Basics of town planning

Construction of a building requires planning approval, which is subject to rules that have been carefully devised, discussed, adapted and approved by a number of experts long before the planning of an individual *scheme* can take place. In developed countries, the *legislation*, enacted by parliament, provides a framework for regulations and procedures that govern the planning process. It leads on to solutions for *habitation*, communication, education, transportation and more, all guided by professionals who have become known as *town or urban planners*. These planners and the experts supporting them carry enormous responsibility, because they are the people who determine the right position and mix of urban elements, which eventually lead to how successful a community is. Town planning or urban design is about the quality of the *built environment*.

Layout	→	**Scale**	→	**Appearance**	→	**Public realm**
urban structure, density, mix		height, massing, interface		facade, details, materials		streetscape, microclimate

Urban design is relevant from the largest to the smallest scale project, from the historic town centre to the latest suburban development. As long as people live in cities, there will always be a need for town planning.

2.1.1 History of town planning

Most cities have simply grown. The more people that gather in one place the greater the need for planning and engineering, for example to provide a supply of fresh water, for the *disposal of sewage and waste*, for the construction of roads to facilitate transportation and communication.

There is evidence of planned communities even in very early *settlements*. The ancient Romans developed their cities not only for community purposes and but also for military defence. Roman settlements provided much inspiration for the structural development of cities throughout the following centuries.

The tremendous growth of cities during the industrial revolution was particularly challenging, and many towns grew in a very *haphazard* and unplanned manner. It was not until the end of the 19th century that theorists actually started planning developments to *mitigate* the consequences of the industrial age.

The term town planning was first used in Britain in 1906. The first statutory practice of town planning stemmed from the Housing and Town Planning Act in 1909, which permitted *local authorities* to prepare schemes for land use under close *supervision* of the local government.

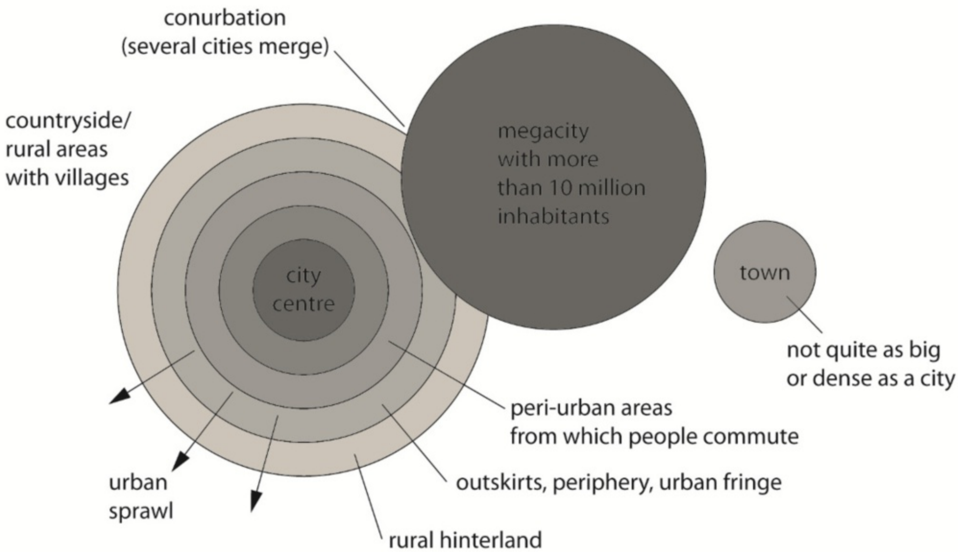
The Royal Town Planning Institute was founded in the UK in 1914. The main objects of the largest planning institute in Europe are to advance the study of town planning and promote the artistic and scientific development of towns and cities for the benefit of the public. For more information about the Royal Town Planning Institute go to https: www.rtpi.org.uk.

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_2

2.1.2 Urbanisation

According to the United Nations, only two per cent of the world population lived in urban areas in 1800, whereas more than 50 per cent live in cities today. This increase is not solely due to *population growth*. It also stems from the shift of the population from *rural* to urban areas, a process called urbanisation. It occurs when people move away from the countryside, possibly to escape from the *dwindling number* of jobs caused by *automated farming*, and seek employment opportunities in a city *labour market*.

Money, wealth, services and economic opportunities tend to centralise in cities with both positive and negative effects. City growth is often associated with the development of crime and slums with a large proportion of *unskilled workers*. The *detrimental environmental effects*, such as the occurrence of *heat islands*, air pollution and light smog, are also disadvantages of urbanisation. On the other hand, large cities can provide better health, social and educational facilities. Overall, compact cities are the most efficient and *environmentally sustainable* way to secure the *welfare* of a growing population.



The divides between urban and rural areas are often *blurred*, and there is no clear separation between the different areas and regions. Naturally, the inner city areas are denser than the *suburbs*. The distance travelled to and from work, and therefore also the commuting time, tends to rise the further people live away from the city centre.

2.1.3 Statistics

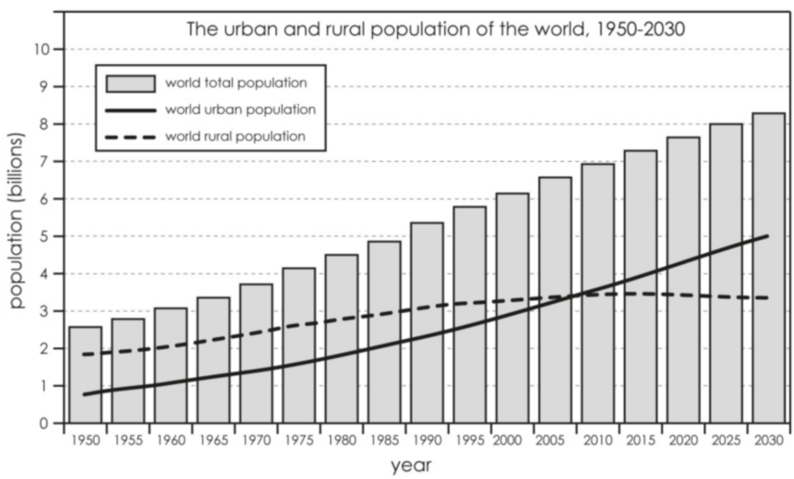
A statistic is a set of numbers that provides information about a certain situation or event. It is usually based on collecting and analysing figures with regard to people's behaviour, habits or, in this case, the preferred place to live.

The following vocabulary is useful for presenting data that has been collected by studying a situation or performing *surveys*. Even though some of the words look very similar, such as per cent and percentage, or have similar meanings, such as a fraction and proportion, they can only be used in certain circumstances and there is only one solution for the following exercise.

Insert the words and check your solutions at the back of the book.

proportions · equal · growth · rate · fraction · peak · marginally · minority per cent · decreasing · projections · majority · share · percentage · rise

The following diagram shows the (1) …....….….…. of the world population from 1950 onwards. The last bars are (2) …....….….…. , which show that the population will continue to (3) …....….….…. . According to scientists, a (4) …....….….…. is not expected in the next decades. The lines in the diagram show the (5) …....….….…. of the population living in either rural or urban environments. In 1950, the (6) …....….….…. of the population lived in the countryside; there was only a low (7) …....….….…. of *city dwellers*. Whereas, up until 2000, the number of *rural residents* grew only (8) …....….….…. , the number of urban residents increased at almost the same (9) …....….….…. as the population. The crossover point of the two graphs in 2007 highlights the time at which an (10) …....….….…. proportion of persons lived outside and inside of cities. Today 55 (11) …....….….…. of the world population live in urban areas. The (12) …....….….…. of rural residents is (13) …....….….…. . This development is expected to continue with the result that, in future, a larger (14) …....….….…. of the population will be urban dwellers, while the (15) …....….….…. of the population will live in the countryside.



2.2 Principles of town planning

Town planning is a process requiring a mix of disciplines. These include subjects such as engineering, architecture, *surveying*, transportation planning and much more. The intention of town planning is to satisfy the needs of today's residents and future generations and prevent the haphazard growth of urban centres.

Some of the guiding principles of town planning are as follows:

Zoning	The town should be divided in suitable zones such as commercial, industrial, *residential*, etc. and suitable rules and regulations should be established for the development of each.
Green belt	The green belt is a non-development zone on the periphery of the town. This prevents haphazard sprawling and also restricts the town's size. In a way, the green belt is an invisible border around a specified area. *Green wedges* and *greenways* have a linear character and run across, not around the town.
Housing	Housing has to be carefully studied and designed to suit the local population. Care should be taken to prevent the formation of slums and ghettos. There are various types of housing styles and the *zoning map* should allocate zones to suit the different needs of our heterogeneous society. The creation of a safe, healthy and pleasant living environment must be considered when planning *accommodation*.
Non-residential buildings	Non-residential buildings should be well grouped and distributed throughout the town. Unnecessary concentrations should be avoided. Factors such as parking facilities, road widths have to be taken into consideration when allocating the space for non-residential buildings.
Recreation centres	Depending upon the size of the town, enough space should be reserved for the development of recreation centres for the general public. They include parks, playgrounds and sports facilities that are easily accessible and are generally designed to improve the quality of city life.
Road systems	The efficiency of a town is often measured by the layout of its road system. A network of roads that works well and enables traffic to flow adds to the quality of a city. An ineffective road system is difficult and costly to change.
Transport facilities	The town should provide suitable transport facilities so that there is a minimum loss of time when travelling from the place of work to the place of residence. When considering the efficiency of transport facilities both public and private networks are included. The *public transportation network* gives access to travel by bus, train, tram or even boat. An efficient public transport system is one of the factors that determines the success of a city in terms of design.

2.2.1 Fixed factors

The physical factors of a city – so the location, climate and *proximity* to sources of food and water – are very often given. There is little that can be done about these features, in fact, quite the opposite. The following factors influence the way a city develops.

Topography: The topography refers to the configuration of *surface features*, which influence where and how to build and develop a site. We can understand the topographical nature of a site by reading the horizontal spacing and shape of *contour lines*. Contours spaced far apart indicate a relatively flat or gently *sloping* surface. Closely spaced contours represent a relatively *steep* rise or fall in *elevation*. When developing a site, the intention should be to minimise disturbance of existing landforms while taking advantage of natural ground slopes and the microclimate. The aim should be to retain the *natural drainage patterns* of the site and also to equalise the amount of *cut and fill* required for construction of the *foundation* and site development.

Climate: The climate is the general weather condition found in a particular place. It is classified by the temperature, the *humidity*, *atmospheric pressure*, wind, rainfall and other meteorological factors. It is influenced by the *latitude*, the distance north and south of the equator, the ground, the height and the vicinity to bodies of water and large land masses. The Köppen climate classification divides climates into five main categories: tropical, dry, *temperate*, continental and polar. *Precipitation* and temperature patterns are also features of the five climate groups. According to Köppen, London is classified as Cfb, which means the climate is temperate oceanic. The C means the region is temperate, the f indicates that it is without a dry season and the b, at the end, that it has warm summers.

Water: Mankind has always settled close to water. In addition to man's basic need for water and the practical functions of a means of transportation and source of food, it also has structural qualities: it defines space without being a solid boundary; it can separate different functional zones but also connect them; water also has a calming, relaxing effect on people and can be a source of inspiration.

A distinction may be made between natural and artificial bodies of water. Words associated with natural water features are displayed here. Match the terms on below with numbers in the illustration.

….. seafront	….. mountain
….. *upstream*	….. lake
….. pool/pond	….. *downstream*
….. spring	….. waterfront
….. sea/ocean	….. river
….. riverbed	….. stream
….. bridge	….. riverbank
….. waterfall	….. *estuary*

….. dam with *hydroelectric power plant*

2.2.2 Confusing words

The words *channel*, *canal* and *canalisation* are often confused.

Of course, most people are familiar with TV channels, but a channel in terms of water is a passage for water or indeed for other liquids, man-made or natural.

Sample sentences: There are drainage/irrigation channels in this field.
The boats have to pass through this narrow channel.

It is also a name for the area that separates England from France, i.e. the *English Channel*. Since it is a name, it is written with a capital C.

The word canal is particularly confusing, on the one hand, because it is pronounced differently to the German word – the second syllable is short in English – and, on the other hand, because it is only an artificial waterway for boats and not a large underground pipe for carrying waste water, which would be a *sewer*. The word canal can, however, also be used in a medical context when speaking about tubes in the body.

The word canalisation, which generally means canalising fluids, could also refer to the system of sewers. Nevertheless, a native speaker would most probably still opt for the word *sewer system*.

2.2.3 Variable factors

The success or *competitiveness* of a city can be measured by how well it is able to provide jobs, income, cultural and recreational *amenities*. It is also dependent on factors like *social cohesion*, *governance* and the urban environment. It can generally be said that a city is successful if the wellbeing of the city community can be maintained and new residents are attracted.

A number of key elements have been identified as central to the success or competitiveness of a city. It is not down to a single element, such as the location on an island, but the *interplay* of elements and the balance between relationships. Since cities *evolve* slowly, it is important that there is a long-term vision for planning and maintaining developments.

As with sustainability, the three main factors for a successful city concern the economic, social and environmental aspects.

Economic factors	• Competitiveness of businesses • Attractiveness of a city for inward investment and tourism, e.g. the number of accommodated guests • Effectiveness of the labour market, e.g. the number of employed/unemployed persons • Openness of a city's economy, e.g. *revenue* from exported goods
Social factors	• *Human resources*, i.e. the structure and skills of the working age population • Education system, i.e. the number of pupils and students • Level of wealth, i.e. *average gross monthly wage* and *social burden*, i.e. number of families receiving social welfare • Social (e.g. health care and hospitals) and public (e.g. recorded *criminal offences*) security • Effectiveness of local governments and city development strategies • Quality of transportation and recreational facilities
Environmental factors	• *Air, water and noise pollution* • Waste disposal systems • Green space

2.3 Building authorities

Every country has a hierarchy of institutions that set out the planning policies and the overall strategies in a particular field, for example housing or transportation. The ministerial department ranks highest. They set out objectives and empower regional and local authorities to deliver by, for example, increasing the availability of land.

State, regional or local authorities then draw up *land use* or *spatial plans* for specific areas. The intention of a spatial plan is to identify needs on a larger scale. Spatial plans are the basis for the creation of *development plans*. They are drawn up to balance business, residential and community needs and, at the same time, protect areas from the negative effects of development. Development plans influence the scale, location and timing of land development and redevelopment. The starting point for the local planning authority in considering any *planning application* will therefore be the development plan. If this includes provisions relating to the specific site, area or type of proposed structure, the scheme will need to conform.

Every *plot of land* is recorded in a *land register,* which contains information about the legal and economic status of all *estates*. The land registry produces two documents when land is registered: a written description of the piece of land and a plan showing the boundaries of the property. The plan is an *Ordnance Survey* map, which is drawn to scale and has a north point. The boundaries of the property are outlined in red. The position of the plot will also determine the *standard ground value*, the square metre price according to area and possible usage. Ordnance Survey is the national mapping agency of Great Britain. They produce digital and paper maps, which can be ordered online at www.ordnancesurvey.co.uk.

2.3.1 Rules and regulations

There are different rules and regulations around the world to ensure that towns develop in an acceptable way. The most commonly used tools are explained in the following passages.

The *floor space index (FSI)* or *floor area ratio (FAR)* is used to control the amount of construction in a certain area. The variable expresses the relation of the amount of *built floor area* to the area of a site. If the relevant zone permits construction with an FSI of 0.10, the total area of all floors in all buildings constructed on the *parcel of land* must be no more than one-tenth the area of the parcel itself.

The concept of site coverage is expressed through the *ground space index (GSI)*. This is defined as the relationship between built and non-built land irrelevant of the number of storeys. The ground space index (GSI) is used principally to indicate the distribution of built mass and open space. A *figure-ground analysis* visually presents the contrast.

The *open space ratio (OSR)* is the ratio, in a development, of open space to developed land. It is used as a benchmark to ensure that each development also provides a certain amount of open space in a specified district. The measurement allows for *spaciousness*, which is seen as a quality of urban space.

Building height and the well-known German concept of *minimum distance* or *clearance* between buildings or a building and its boundary are further tools that are used to structure and control urban developments. Sometimes the buildable area of a site is limited by existing *easements* or *rights-of-way*. In this case, another person, the *dominant tenement*, has a right over land owned by somebody else, the *servient tenement*. The most common easement is probably the one that allows *underground services*, for example sewers or communications cables, to pass beneath the land of one or more neighbouring properties.

2.3.2 Listed buildings and conservation areas

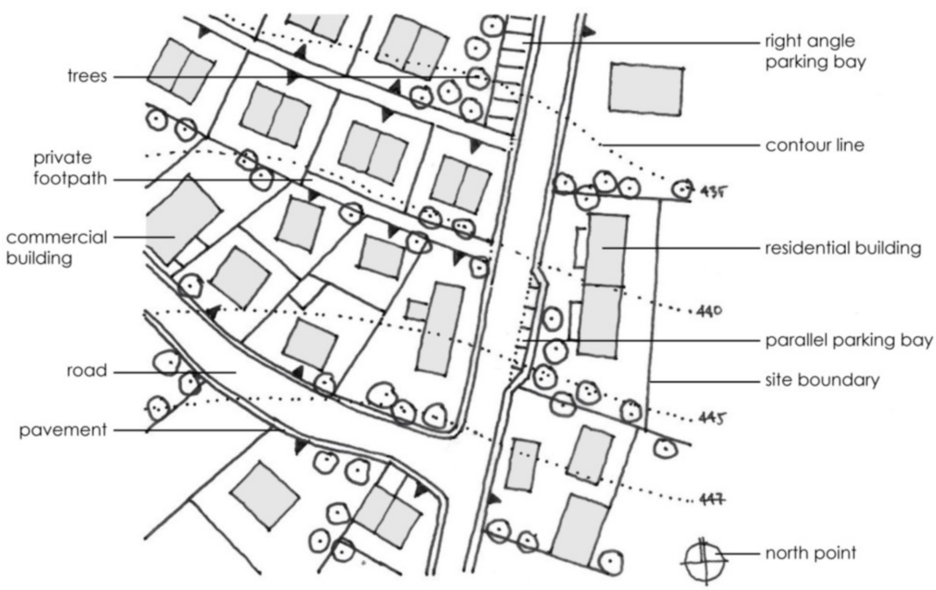
Buildings and areas that are of special architectural or historic interest can be protected by putting special *preservation notice* into place. In this case, local planning authorities must designate the object as being *worthy of protection*. Whereas the listing of a building protects only the *heritage* of a single building, a conservation area preserves the character or appearance of an area, a group of houses, a village or even a park or landscape. The designation introduces a general control over the work that is performed. A listed building may not be *demolished* or altered without special *consent*.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) selects landmarks or areas as *World Heritage Sites*, which are then legally protected by international treaties. A good example is Stonehenge, with its prehistoric megalithic monuments, which was one of the first sites to be nominated by the UK.

2.4 Planning developments

The planning of an urban development is a process with several layers, which become more detailed as time progresses. Generally, each project starts with a *survey of the initial situation*. This is performed by using a selection of aerial photos, maps, reports and statistical information. After establishing the *urban design principles*, usually by creating various sketches that are not to scale or creating a figure ground plan, an *urban masterplan* is drawn up. This plan sets out the general concept for the organisation of structures and is usually to a scale of 1:25,000 to 1:5000.

The *outline* or *framework plan* is slightly more detailed and shows the future development embedded in its surroundings. The scale of these plans ranges between 1:5000 and 1:2000. These plans are commonly used by authorities as a basis for planning new development areas (*preparatory development plan*) or granting planning permission for a scheme (*binding development plan*). Town planners also create more detailed drawings, such as *urban detail plans*, to examine the actual development scheme with its functional and spatial relationships.



2.4.1 Grammar: Word order

Word order refers to the way words are arranged in a sentence. The standard word order in English is fairly strict and follows the pattern subject + verb + object.

Sample sentence: Company ABC is constructing a new office building.

With regard to the objects, the order is place and then time.

Sample sentence: Company ABC is constructing a new office building in Manchester next year.

Unlike other languages, we cannot simply rearrange the phrases without making significant alterations to the sentence so that it makes sense. The major differences between English and German word order are listed in the following table.

German	English
Verb and object are often separate: Thomas **trifft sich** jeden Mittwoch **mit seinem Team**.	Verb and object must stay together: Thomas **meets his team** every Wednesday.
Dependent infinitives and participles are placed at the end of the sentence (Satzklammer): **Sie kann** fließend **Spanisch sprechen**. **Er hat** auf der Konferenz in Rom **eine Rede gehalten**.	A "cluster" instead of a "bracket" is used, i.e. closely connected words (subject, verb, object) stay together. She **can speak Spanish** fluently. He **made a speech** at the conference in Rome
The subject moves to third position if there is an adverbial phrase at the beginning of the sentence: Im April 2017 / wurde / **die neue Brücke über das Tal** / für den Verkehr geöffnet.	The subject always comes before the verb; in other words, the word order stays the same when an adverbial phrase is put at the beginning of the sentence: In April 2017 / **the new bridge across the valley** / was opened to traffic.

2.4.2 Exercise: Word order

Find the mistakes in the following sentences, which describe the upgrade of High Wycombe, and correct them.

1. The Buckinghamshire town High Wycombe was during the 1980s by industrial decline hit.
2. The town was left struggling a new identity and economy to find.
3. High Wycombe is fortunate in that its excellent location it new industries based on logistics and manufacturing has allowed to develop.
4. An agency developed in 2002 for the renaissance of the town a 25-year vision.
5. In community workshops were the ideas then examined.
6. The vision was into a masterplan refined, and a model was in the town centre for a public exhibition constructed.
7. A development brief for the along the waterfront public space has been based on the masterplan commissioned.
8. The aim of the masterplan is for High Wycombe for business, workers, visitors and investment a more attractive place to become.

2.5 Key issues in urban design

In addition to the factors already set out in this chapter, town planning is also influenced by political discussion. The more important topics, together with synonyms and related words, are listed below.

2.5.1 Affordable housing

- Synonyms for affordable: inexpensive, cheap, economical, low-cost, budget, reasonably priced
- Synonyms for housing: accommodation, flats, apartments, dwellings, dwelling/residential units, residences, homes

Affordable is an elastic concept since what is affordable is very much dependent on income and lifestyle. Nevertheless, most governments have determined what makes housing affordable. In the UK, for example, the affordable rent for a property should be no more than 80 per cent of its local market rent. *Eligibility* is determined by the household's income. Affordable rented housing is let by local authorities or other providers, such as *housing associations*.

Social housing, on the other hand, is let at low rents to persons who are most in need. Unlike affordable housing, where *tenancies* are offered by the *landlord* or a letting agent to tenants of their choice, accommodation in social housing is granted according to the local council's *allocation scheme*. Many cities have long waiting lists for social housing.

2.5.2 Mixed use

- Synonyms for mixed: blended, varied, diverse, heterogeneous

Mixed-use developments are a blend of residential, commercial and cultural uses. The mixed use can apply to a single building, a block or entire neighbourhood.

For centuries, urban centres evolved naturally in a mixed way. However, the interference of authorities and the development of larger structures has brought about a separation of uses and a number of drawbacks, such as the creation of residential ghettos or business districts resembling ghost towns at weekends.

Mixed-use developments are ideally not only more varied and compact, they are also more accessible, leading to shorter distances in general and lower transportation costs for commuters. Cities with mixed-use developments are generally healthier and have more social benefits.

2.5.3 Densification

- Synonyms for dense: compact, crammed, crowded, jam-packed

Density in urban design is an indicator of the number of persons or properties in a given area, usually persons per square kilometre or dwelling units per acre. The factor varies considerably throughout the world and there have been and will presumably always be lengthy discussions concerning what is thought to be a healthy density. Whereas the *population density* lies at around 5000 people/sq km in London, the density in Paris is four times as high.

Densification is a term commonly used by planners and developers to describe an increasing density of people living in urban areas. It is becoming far more prevalent in towns and cities since ground space remains the same, but the population and its needs increase.

One of the consequences of densification is pressure to make better use of existing space. However, it is also a fact that the denser a city, the more sustainable it is. Dense cities use less energy per person than rural suburban areas where people are spread over a wider distance and travel greater distances.

Densification measures include the development of *brownfield sites*. These are parcels of previously developed land that were often used for industrial and commercial purposes and are now *derelict* and possibly even *contaminated*. *Extensions,* both horizontal and vertical, are also developments which lead to the better use of existing space.

2.5.4 Public participation

- Synonyms: public involvement, citizen participation, public engagement

Public participation has evolved considerably in planning systems around the globe since the mid twentieth century. Europe's 1998 Aarhus Convention also states that everyone has a right to receive environmental information held by public authorities and participate in decision-making processes. The aim is to involve the public and gain greater acceptance for, in this case, urban developments. Naturally, the more persons involved in the decision making, the longer and more complex each issue becomes. It is fundamental in public participation processes that all information is shared and made transparent to all parties, those directly but also those indirectly involved.

2.6 Vocabulary

2.1	scheme	Plan, Projekt
	legislation	Gesetzgebung
	habitation	Behausung
	town/urban planner	Stadtplaner
	built environment	gebaute Umwelt
	density	Dichte
	scale	Maßstab
	massing	Baumassenverteilung
	interface	Schnittstelle, Verbindung
	public realm	öffentlicher Raum
	streetscape	Straßenbild
2.1.1	sewage/waste disposal	Abwasser-/Müllbeseitigung
	settlement	Ansiedelung
	haphazard	willkürlich, planlos
	to mitigate	mildern, abschwächen
	local authority	Gemeindebehörde
	supervision	Überwachung, Aufsicht
2.1.2	population growth	Bevölkerungswachstum

	rural	ländlich
	dwindling number	nachlassende Zahlen
	automated farming	automatisierte Landwirtschaft
	labour market	Arbeitsmarkt
	skilled/unskilled worker	(ausgebildeter) Facharbeiter, ungelernte Arbeitskraft
	detrimental environmental effects	nachteilige Umweltauswirkungen
	heat island	Wärmeinsel
	environmentally sustainable	umweltverträglich, ökologisch nachhaltig
	welfare	Wohl, Wohlbefinden
	peri-urban	periurban, stadtnah
	urban fringe, outskirts	Stadtrand, -saum
	to commute	pendeln
	urban sprawl	Zersiedelung
	conurbation	Ballungsgebiet, Zusammenwuchs von Städten
	to blur	undeutlich machen, verwischen
	suburb	Vorort
2.1.3	survey	Umfrage, Studie, Untersuchung
	city dweller	(Groß-)Stadtbewohner
	rural resident	Landbewohner, -bevölkerung
2.2	to survey, surveying	vermessen, Vermessung
	zoning	Raumordnungsplanung
	residential zone	Wohngegend
	green belt	Siedlungsrand, Grüngürtel
	green wedges	Grünkeil
	greenway	Grünzug
	zoning map	Raumordnungsplan
	accommodation	(Wohn-)Unterkunft
	non-residential building	Nichtwohnbau
	recreation	Erholung
	public transportation network	öffentlicher Nahverkehrsnetz
2.2.1	proximity	Nähe
	surface features	Oberflächenbeschaffenheit
	contour line	Höhenlinie
	to slope	sich neigen, fallen
	steep	steil
	elevation	Anhebung
	natural drainage pattern	natürliche Wasserablauf
	cut and fill	ausheben und verfüllen
	foundation	Fundament, Gründung

	humidity	Luftfeuchtigkeit
	atmospheric pressure	Atmosphärendruck, Luftdruck
	latitude	Breitengrad
	temperate	gemäßigt
	precipitation	Niederschlag
	estuary	(trichterförmige) Flussmündung
	up/downstream	flussauf/abwärts
	hydroelectric power plant	Wasserkraftanlage
2.2.2	channel	Rinne, Wasserlauf
	canal	Kanal, Wasserstraße
	canalisation	Kanalisierung, Kanalisation
	English Channel	Ärmelkanal
	sewer	Abwasserkanal
	sewer system	Kanalisation
2.2.3	competitiveness	Wettbewerbsfähigkeit
	(public) amenity	(öffentliche) Einrichtung
	social cohesion	soziale Kohäsion, sozialer Zusammenhalt
	governance	Führung, Leitung
	interplay	Zusammenspiel
	to evolve	sich entwickeln
	revenue	Einnahmen
	human resources	Humankapital
	average gross monthly wage	durchschnittliches Monatseinkommen
	social burden	Sozialfall
	criminal offence	Straftat
	air/water/noise pollution	Luft-/Wasserverschmutzung, Lärmbelästigung
2.3	land use/spatial plan	Flächennutzungsplan
	development plan	Bebauungsplan
	planning application	Bauantrag, Baugesuch
	plot of land	Flurstück
	land register, land registry	Grundbuch, Grundbuchamt
	estate	Gut, Grundstück
	Ordnance Survey	engl. Landvermessungsagentur
	standard ground value	Bodenrichtwert
2.3.1	floor space index (FSI); floor area ratio (FAR)	Geschossflächenzahl (GFZ); Ausnutzungsziffer
	built floor area	Geschossfläche
	land parcel	Flurstück
	ground space index (GSI)	Grundflächenzahl
	figure-ground analysis	Schwarzplan

	open space ratio (OSR)	Freiflächenzahl
	spaciousness	Weiträumigkeit
	minimum distance, clearance	Abstandsfläche
	easement	Nutzungsrecht, Baulast
	right-of-way	Durchgangsrecht, Wegerecht
	dominant/servient tenement	herrschende/dienende Grundstück
	underground services	Grundleitungen
2.3.2	listed building	denkmalgeschütztes Gebäude
	conservation area	Denkmalerhaltungsgebiet
	preservation notice	Denkmalschutzauflage
	worthy of protection	schützenswert
	heritage	Kulturerbe
	to demolish	abreißen
	consent	Bewilligung
	World Heritage Site	Weltkulturerbe
2.4	survey of the initial situation	Bestandsaufnahme
	urban design principles	städtebauliches Leitbild
	urban masterplan	städtebaulicher Entwurf
	outline/framework plan	Rahmenplan
	preparatory development plan	vorläufiger Bebauungsplan
	binding development plan	(verbindlicher) Bebauungsplan
	urban detail plan	städtebaulicher Detailplan
2.5	affordable housing	bezahlbarer Wohnraum
	eligibility	Beihilfefähigkeit, Berechtigung
	housing association	Wohnungsbaugesellschaft
	social housing	sozialer Wohnungsbau
	tenancy	Mietverhältnis
	landlord	Vermieter
	allocation scheme	Zuteilungsplan
	population density	Bevölkerungsdichte
	brownfield site	Brachfläche
	derelict	verlassen, verfallen
	contaminated	verseucht
	extension	Anbau
	public participation	Bürgerbeteiligung

3 Preliminary Enquiries

3.1 Project definition

The first step in every project is to define the work that is actually to be performed. Is the planner going to be dealing with a new build or a property within the *existing stock of buildings*? New buildings can generally be separated into two categories: residential and non-residential buildings. Work on existing structures, which makes up 35 per cent of all construction work, is a lot more complex. Despite having very specific definitions, the terms used in this case are often used interchangeably and sometimes one project will involve more than just one of the processes described below.

- Extension is the addition of an element with the aim of increasing the floor area or improving the use of a development. A *roof extension*, for example, involves adding one or more extra floors to the top of the building. This is a very popular way of densifying urban environments and thus reducing urban sprawl.
- *Conversion* is the process of changing a building or part of a building for a new use, e.g. converting a house into flats. *Loft conversions* are performed to add extra floor space to a home and frequently involve adding *rooflights* or *dormers*. The words reuse and rehabilitation are very similar in meaning.
- Upgrade or *refurbishment* both refer to the improvement of quality or usefulness by removing, renewing, replacing and/or retrofitting components. A *sustainable upgrade* involves measures that are performed to achieve greater energy efficiency and reduce carbon emissions. A sustainable upgrade is ideally coincided with a refurbishment and involves measures such as adding *insulation* or upgrading windows. A *partial refurbishment* involves only one component, e.g. the facade or the ground floor, and is usually carried out while the rest of the building is still in use.
- *Remodelling* involves making over the design of a building. It usually means changing the structure or volume, for example by raising the roof or removing walls. Depending on the extent of the work, it may be necessary to strip back the building to its *load-bearing components*.
- The terms preservation, restoration and renovation are very similar in meaning and often used in the context of listed buildings. Preservation is the treatment involved in keeping a building in its current state. A lack of preservation work will presumably require restoration work at a later date. Restoration generally refers to the process of returning something to its former state. Renovation refers to the process of returning something to a good state of repair and usually means laying new carpets or repainting walls.
- *Retrofit* means providing something with a component or feature not fitted during the initial construction. It is often used for the installation of new building systems, such as a mechanical ventilation system, but it could also refer to the building fabric, for example retrofitting insulation or *shading devices.*
- *Maintenance* is the process of keeping something in good condition. It generally involves performing inspections, fixing errors, changing filters but also repainting or renewing surfaces. Maintenance and *servicing* performed at regular intervals should ideally increase the lifespan of a component or effectively the whole building.

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_3

- Rebuild is the construction of a new building on a site where a former development was demolished.

3.1.1 Feasibility

Before the architect or engineer gets too involved in the project, a decision has to be made as to whether it is at all feasible to build. Feasible means possible as well as practicable and is influenced by a number of factors. For example, the decision may depend on the *access* to the site, *building lines* and specific requirements regarding the *number of storeys*, *parking provisions* and, of course, *geological conditions*. The decision to proceed or to stop lies with the client; however, it is the planner's task to present the information in a structured way so that it is possible for the client to come to a decision.

In order to prepare a feasibility study, the planner needs to check various aspects of the site. Some questions will be quite straightforward, however, others may require input from a consultant or might have to be based on assumptions, at least before making a detailed *survey*. In the following, there are some typical considerations that need to be made before putting together a feasibility study.

- Is the site appropriate for the client's proposed scheme?
- How does the topography suit the scheme?
- Does the size of the plot seem reasonable for the scale of the project?
- What is the nature of the soil?
- Will it be necessary to make a *soils report*?
- Can the project be realised for the money the client wishes to spend?
- Does the project involve any existing buildings or structures?

3.1.2 Grammar: Questions

Take a look at the questions above. There are two different types of questions:

- those which can be answered with yes or no (Yes/No-questions) and
- the others which require a more detailed answer (Wh-questions).

Yes/No-questions always start with a verb. Take a look at the different categories below.

Yes/No questions using a form of **do** (do, does, did) at the beginning:
Question: Form of do + subject + full verb
Example: Does the project involve any existing buildings?

Yes/No questions using a form of **be** at the beginning:
Question: Form of **be** + subject
Example: Is the site appropriate for the client's proposed scheme?

Yes/No questions using a modal verb (have, be, will, might, etc.) at the beginning:
Question: Modal verb + subject + full verb
Example: Will it be necessary to make a soils report?

The short answers should always repeat the helping verb used in the question.
Is there access to the plot? – Yes, there is. / No, there isn't.
Will it be necessary to make a soils report? – Yes, it will. / No, it won't.

Wh-questions are formed with **do** unless the question word itself is the subject or the full verb is a form of be. These questions cannot simply be answered with yes or no, but require a full sentence.
Question: Question word + form of do + subject + full verb
Example: How does the topography suit the scheme?

Question tags work in a similar way to the short answers of Yes/No-questions. The modal verb is either repeated or, if the sentence contains only a full verb, do (present tense) or did (past tense) are used. A negative question tag is used after a positive sentence and a positive one after a negative sentence. Look at the following examples.

- It **will** be necessary to make a soils report, **won't** it?
- The site **isn't** appropriate for the client's proposed scheme**, is** it?
- The topography **suits** the scheme, **doesn't** it?
- The architect **met** the client for the first time last week, **didn't** he?

3.1.3 Exercise: Questions and answers

Match the Yes/No-questions on the left with the appropriate short answers on the right.

1. Will it be fairly easy to obtain planning permission?	a. No, they aren't.
2. Does the client's time schedule seem reasonable?	b. Yes, it will.
3. Is the client aware of the infrastructure offered?	c. Yes, it might.
4. Are the existing buildings protected?	d. Yes, they can.
5. Might it be possible to fell some of the trees?	e. Yes, there are.
6. Are there any requirements regarding the number of storeys?	f. No, he isn't.
7. Has a water table been provided by the local planning authority?	g. Yes, it does.
8. Can the planners cope with the scale and nature of the project?	h. No, it hasn't.

3.1.4 Pre-application advice

In order to judge the feasibility of a project, the owner or planning engineer should consult the local authority. Local planning authorities have a wealth of information and will be able to advise on, for example, development plans, conservation areas, listed buildings and trees with preservation orders.

Pre-application advice is usually free of charge. It gives the owner an insight into how local and national policies will be applied to the development. If a *proposal* is unlikely to be accepted, the authority may even be able to suggest an alternative form of development. The result of taking the advice into account may be that the formal submission is handled more smoothly since local planning authorities have a view on the *acceptability* of proposed schemes. It is even possible to submit an *outline application* to determine the likelihood of a proposal being accepted; this is especially useful for more daring designs and expensive projects.

The local planning authority will also be able to provide information on the *water table*, the *liability to flooding* and the *nature of the subsoil*. Furthermore, they will be able to indicate the position and depths of all services.

3.2 Site visit

A site visit at the beginning of each project is absolutely essential to understand the full scope of the job. It is a fundamental part of a feasibility study and should be performed by all persons involved.

In the case of this project, which will accompany the reader through the book, the client owns a plot he would like to develop. He was recommended to an architect, whom he has contacted and with whom he has arranged a meeting on site. We will simply assume that the client and the architect get on well, that the architect is competent and his current *commitments* allow him to take on another job. The *terms of appointment*, the *programme of work and costs* will be discussed in a later meeting.

Conversation: A first meeting

George Brown: Hello, you must be Tim Smith, the architect.

Tim Smith: Yes, that's right.

George Brown: I'm George and this is my wife, Helen.

Tim Smith: Hello, pleased to meet you.

George Brown: So this is the piece of land we *inherited* last year. We've spent quite a long time thinking about it, but we've decided we'd like to build a house and move to this part of the town.

Tim Smith: Well, it's a wonderful location, isn't it. And the plot is an adequate size, too.

George Brown: Yes, we think it should be big enough for a small house leaving a bit of garden.

Tim Smith: I presume there won't be a problem obtaining planning permission.

George Brown: No, I don't think so. We're not sure how far back we can build or how close to the neighbours, but surely that isn't a problem to find out.

Tim Smith: No, not at all. The local authority will be able to provide all the necessary information. So, what is it you actually have in mind?

Helen Brown: Well, we're thinking of something quite normal really. Living, dining, kitchen on the ground floor; the bedrooms, we'll be needing two for the children and one for us, maybe an extra guest bedroom, upstairs. I'd love either a cellar or a utility area to take care of all the technical equipment and offering *storage facilities*; oh, and of course, we'll need a garage.

Tim Smith: Okay, I've made a note of all of that. Have you got an idea how many square metres you're looking at.

Helen Brown: The house we're living in at the moment is a 4-bedroom *semi*. It would be great to have a bit more space.

George Brown: I suppose we're thinking of something between 150 and 200 sqm. But of course a lot depends on the costs.

Tim Smith: Yes, I can understand that. I'll tell you what. Let me speak to the local authority, take some measurements of the site and I'll get back to you in a week or two with some first ideas and thoughts.

George Brown: That sounds wonderful. I'll give you my card so that you know where we are and I look forward to hearing from you soon.

3.2.1 Comprehension

Are the following statements concerning the dialogue true or false.

	true	false
1. Tim Smith and Helen Brown had never met before.		
2. The Browns' *purchased* the site.		
3. The plot of land is extremely large.		
4. There are several neighbours.		
5. The Browns' would like at least 3 bedrooms.		
6. There has to be cellar for technical equipment and storage.		
7. They are currently living in a flat.		
8. The architect is going to contact the local authorities.		

3.2.2 Numbers

Thanks to many ancient cultures, such as the Egyptians and the Romans, the decimal numeral system is the most widely used method for calculations throughout the world. It is based on the number 10 and each further *digit* has a value ten times that of the position to its right.

Despite using the same numbers in international business, different countries read them in different ways. For example, the Germans read their numbers, at least the tens and the units, from right to left. In French, 90 is an equation of 4 x 20 + 10 (quatre-vingt-dix). In English, numbers are simply read from left to right.

There are also differences in the way numbers are separated when written, with English speaking countries being opposite to countries in continental Europe. This means that in the UK a point is used to separate units and decimals and a comma is used for separating thousands. However, there is a trend towards separating thousands with a space or half space instead of a comma and this system has been adopted by the British construction industry. As an example, two thousand two hundred and twenty-two point two in numbers appears as 2,222.2 in the UK and 2.222,2 in Germany.

In written text, all numbers between 21 and 99 are *hyphenated*. There is also a slight difference between American English and British English, in this context, in that Americans tend to leave out the "ands", e.g. two thousand two hundred twenty-two point two.

When getting into higher numbers, for example when speaking about the costs of a construction project, it is important to understand that words that look identical in different languages have different meanings. In English, the sequence for higher numbers is million, billion, trillion, quadrillion, and so on. Therefore, a German "Milliarde" is an English billion, and a German "Billione" is in actual fact an English trillion!

The English translation of the German word "null" depends on the context. When referring to numbers in maths, zero or nought are used, e.g. nought point five for 0.5. In telephone numbers, the zero is often read as "oh", and in sports, if England beat Germany 4 : 0, the score is spoken as "four nil".

So far this section has been about *cardinal numbers*, e.g. one, two, three. *Ordinal numbers*, e.g. first, second, third, indicate a position in a series or order. In most cases the spelling of an ordinal number is based on the corresponding cardinal with a "th" ending. However, first, second and third are notable exceptions. Ordinal numbers are important not only to read dates

(31 January 2014 – the thirty-first of January twenty fourteen) but also *fractions* ($\frac{7}{8}$ – seven eighths) and roots ($\sqrt[3]{27}$ – the third root of twenty-seven).

When ordinal numbers are expressed as figures, the last two letters of the written word are added to the ordinal number. The suffix is usually raised.

1	first	1^{st}	10	tenth	10^{th}	21	twenty-first	21^{st}
2	second	2^{nd}	11	eleventh	11^{th}	22	twenty-second	22^{nd}
3	third	3^{rd}	12	twelfth	12^{th}	23	twenty-third	23^{rd}
4	fourth	4^{th}	13	thirteenth	13^{th}	100	one hundredth	100^{th}
5	fifth	5^{th}	20	twentieth	20^{th}	101	one hundred first	101^{st}

There are also a few words that can refer to numbers or amounts, such as:

a dozen = 12	half a dozen = 6	a pair = 2
decade = 10 years	a century = 100 years	a fortnight = 2 weeks

Luckily the meaning of symbols in maths is the same in most modern cultures. Engineers can therefore communicate easily, but the spoken forms need to be learnt. The following table lists the most important mathematical symbols.

Symbol	Symbol name	Read or spoken as:
+	plus sign (addition)	plus or and
-	minus sign (subtraction)	minus or less
x	times sign (multiplication)	times or multiplied by (for areas only use by, e.g. 2 by 3 metres)
÷	division sign	divided by or through
=	equality	equals, is or makes
≈	approximately equal	is approximately
<	strict inequality	is less than
>	strict inequality	is greater than
(….)	brackets or parentheses	in brackets, e.g. (4+2) is 4 plus 2 in brackets
√	square root	the square root of
x^n	power (exponent)	x^2 is x squared, x^3 is x cubed, x^n is x to the power of n or x raised by n
$\frac{7}{8}$	division slash (fraction)	seven eighths (the denominator below the line is read as an ordinal number; the plural form is used if there is more than one denominator, e.g. one eighth but two eighths)

3.2.3 Units

Like numbers and symbols, units of measurement are an essential part of life; however, while we take international standards for granted today, their introduction within the last 150 years has to be seen as quite recent. Originally many units of length were based on parts of the body, such as a foot or ell, but these differed from country to country and sometimes even within countries. To some extent these differences persist today and the length of a foot may depend on where you are.

Over time, it became apparent that there would be a need for universal measurements. Two historic milestones in history towards this goal were the Metre Convention in 1875 and the introduction of the International System of Units in 1948.

The main aim of the International System of Units was to introduce a single practical system of units of measurements and rules on writing and presenting measurements in a standardised manner around the globe. The system is built on seven base units. There are a further 22 named units, for example *velocity* (v) which is metre per second (m/s), and an indeterminate number of unnamed units.

The following table shows the seven SI base units.

Physical quantity	**Name of unit**	**Abbreviation**
mass	kilogram	kg
length	metre	m
time	second	s
temperature	kelvin	K
amount of substance	mole	mol
electric current	ampere	A
luminous intensity	candela	cd

If the SI unit name is derived from a person's name, such as electric current from André-Marie Ampère, its symbol begins with an uppercase letter. When the name appears in full as a unit, e.g. three amperes, a lowercase letter is used. The only exception is degrees Celsius. Remember that the plural form is used in English if there is more than one unit, e.g. one degree Celsius and two degrees Celsius.

Despite plans *to go metric* in 1965, people in the UK, especially those not involved in jobs requiring measurements, still tend to use feet and inches instead of metres and centimetres. This is even more apparent in the USA. This phenomenon is very noticeable when you are travelling. All road signs express distances in miles and speeds in miles per hour (mph).

For an easier understanding, the metric system has been used throughout this book since it is intended mainly for German readers.

A conversion table has not been added here, since there are so many *unit converters* on the Internet and free apps for smart phones. These tell you not only the length of, for example, an inch, but automatically convert any length into the corresponding amount of centimetres and millimetres. Make sure to use the right country. An American gallon, for example, is not equal to a British gallon. An American gallon is 3.79 litres, whereas a British gallon is 4.55 litres.

3.2.4 Exercise: Numbers and units

Now practise writing the following numbers and units.

1. 31.09.1808 (date) ……………………………………………………………
2. 12.02.2017 (date) ……………………………………………………………
3. ⅞ ……………………………………………………………
4. 6,789,101,022 ……………………………………………………………

   ……………………………………………………………
5. 3.5 m x 6.3 m (size of a rectangle) ……………………………………………………………
6. 1,023.45 m^3
7. 56.3 % ……………………………………………………………
8. 0044-812-983210 (telephone number) ……………………………………………………………
9. 7.5 h (time) ……………………………………………………………
10. 7.23 kWh ……………………………………………………………
11. 47 kN/m^2 ……………………………………………………………
12. 10^3 x (9 - 6) = 3000 ……………………………………………………………

3.3 Plots

The plot is the fundamental element in every new construction project. It is the piece of land on which the building will stand.

In some cases, a client will approach an architect regarding a plot already owned; in others, the client may seek the help of the architect to identify a suitable plot for a desired scheme. A *land or estate agent* is usually the first port of call for most people wanting to purchase land. Land for sale is generally categorised as brownfield, which is land that is or was occupied by a now vacant or derelict structure and has redevelopment potential, or *greenfield*, which, as the name implies, is undeveloped land.

The legal procedure for buying land is conducted by a *solicitor*. After checking important questions concerning, for example, *title*, permitted use and boundaries, the lawyer can prepare all the necessary documents and initiate the transaction.

A plot of land undergoes changes during the development, becoming first a construction site and then a property or *estate*. A plot may be *developed*, which means all services – water, electricity and possibly gas – are provided, partially developed or undeveloped with no services whatsoever. The appropriate authorities are able to offer information on their provision. The following diagram shows the changes in a piece of land from a vacant plot through to a plot with buildings.

intended for use, e.g. construction - land - ground - plot BE - lot AE not intended for development: space	→	- construction / building site - to be under construction	→	- building - property: land and buildings - complex: a group of buildings - structure: sth made of several parts, not necssarily a building - real estate: land or buildings owned by somebody - estate: a large area of land with or without buildings, usually in the countryside

3.3.1 Homophones

The words *cite*, site and sight are homophones, which means they sound exactly the same but are spelt differently. They are often confused. Luckily cite has got nothing to do with land or space but is simply a synonym of the word mention or quote. The noun citation may be more familiar.

The word sight refers to something that is seen. Sightseeing is an activity enjoyed by tourists visiting new places, and good *eyesight* for seeing the sights is extremely valuable. A site is a plot of land, in particular a place where some kind of activity is being performed, hence the construction site. So the spelling of sight/site depends on what is being referred to. If it is a place a person might visit to look at something, sight is correct; if it is a location for a specific purpose, such as a campsite or a website, then site is the correct spelling.

3.3.2 Considerations

When making plans for a plot of land the following aspects should be considered:

- Is there access to the plot?
- What are the approximate dimensions of the plot?
- Is the ground level or inclined?
- If there are existing buildings, where are they positioned?
- What about the *orientation* of the site?
- Where does the sun rise and set in relation to the plot?
- What are the general characteristics of the landscape, planting and trees?
- Are there any buildings *adjoining* or *overlooking* the site?
- What about services such as sewers, water, electricity, gas and communications?
- Does the neighbourhood have special features that might affect the scheme?

3.3.3 Situations

The two plots presented below are very different. Assign the vocabulary to the appropriate situations. For a clear, unambiguous description, it might be necessary to add a noun, e.g. a narrow road.

A

B

in town
on a slope
constricted
spacious
small
rural
commercial
wide
busy
narrow
in the countryside
close
urban
noisy
friendly
dense
peaceful
distant
quiet
large

3.3.4 Descriptions

Read the passages describing two different plots. Try to imagine what they look like.

The plot is a narrow *gap* between houses in an urban, very dense, environment. It is rectangular measuring about 6 by 20 metres. It is totally flat. To the north and south, tall 5-storey buildings, with *saddle roofs,* border the site. These buildings are part of a *perimeter development*, which surrounds a large inner courtyard with a variety of tall trees. To the west there is a busy road with a mixture of shops and offices. At the rear, facing east, the plot has a typical courtyard atmosphere.

The plot is rectangular measuring about 20 by 80 metres. It is on a slope and slightly wider at the top than at the bottom. In total the difference in height is about 5 meters. There is a small area of woodland beyond a small path at the top of the site, which faces north. To the east and south there is a quiet road. There are three plots with detached two-storey houses to the west – none of the houses border the plot directly. There is a view from the top of the plot; the town centre with about 500,000 inhabitants is 10 minutes walking distance away.

3.3.5 Your plot

Think about a plot for which you are planning or have planned a structure. It could also be the piece of land you are living on. Extract the lexical phrases from the sections above and write an appropriate description highlighting the main characteristics.

3.4 Survey

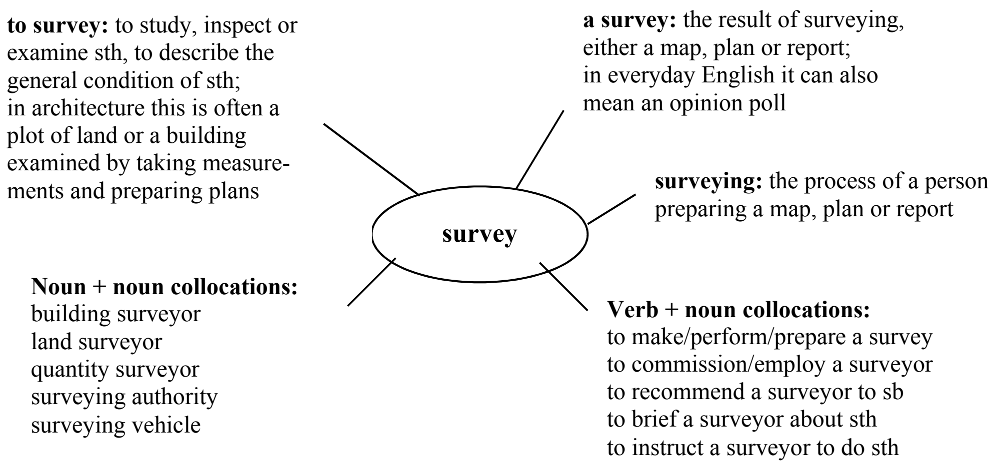
The term survey has several different meanings. Here, the term refers to the activity of taking measurements and performing *levelling* operations to ascertain the various levels of the ground. Finally all data collected is translated into drawings.

If the site or buildings are fairly simple, the planner will probably perform the surveying work without difficulty. In more complex situations, a survey should be produced either by a land *surveyor* for undeveloped plots or a building surveyor for already developed property.

However, a detailed survey prepared by a qualified surveyor should not prevent the architect or engineer from visiting the site. A *site investigation* also includes reference to the nature of the ground under the site. Depending on the site and the proposed building, a special consultant engineer should be employed to investigate ground conditions. Usually the work of a specialist *ground consultant* includes *sinking boreholes* and *examining soil samples*.

3.4.1 Lexis: Survey

The term survey is a very complex term with several different meanings. It is both a verb and a noun. Take a look at the term survey and some collocations.



3.4.2 The Browns' plot

Tim Smith, the architect, makes a trip to the local authority's planning office the next morning. He obtains a copy of the Ordnance Survey map showing all boundaries of the site and the surrounding properties. He also receives information regarding the building lines and services.

He returns to the site equipped with a digital camera, a *levelling instrument* and a *staff*, pencil and paper. As it is easier to perform measurements in a team, a member of staff accompanies him. The architect and his assistant spend a few hours taking measurements and photos, making a note of trees and other important features. Since the plot is on a slope and the neighbouring building to the east is quite close, the architect decides to make a rough model.

The architect chose to perform the site analysis himself, as the plot is undeveloped and very straightforward. In many cases, a surveyor would have been commissioned to perform this work. However, the architect does come to the conclusion that a soils report is necessary. He has worked with a good consultant before and recommends him to the client. The consultant is briefed by the architect and, after the client obtains an estimate of cost and time, is instructed to proceed with the work.

3.5 Communicating with the client

Architects and engineers are expected to report to their clients at various stages throughout the project. It is often difficult to decide in advance when there will be a need to contact the client. Usually some kind of communication takes place whenever the client has to make a decision. There will also be situations when no decision is required, but it is simply good for relations to report on progress. Take a look at the following methods used for reporting:

Email: Over the last two decades, email has replaced most other forms of letter writing. It is used to send a quick note, but also to attach a formal letter and transmit large quantities of text and drawings from one place to another. Unfortunately, the ease with which an email can be sent encourages the sending of messages even about the most trivial matters.

Letter: Formal letters, especially those sent by post which can be referred to as snail mail, may seem inappropriate if the matter is fairly trivial and the aim is simply to keep the client informed. However, when it comes to documents like contracts or invoices, formal letters are indispensable.

Phone calls: Telephone calls, either using a fixed-line or a mobile-line network, are appropriate if an immediate decision is required. Unlike a written message, a phone call has the added benefit of a voice. It is possible to actually hear whether somebody is enthusiastic or disappointed without having to make use of emoticons. For more information about telephone calls see 5.2.2.

Messaging: Sending a message with a mobile phone is a quick and simple way of sharing information or making arrangements when out and about and an immediate reply is not absolutely necessary. Writing a message, if it is a short one, often takes less time than making a phone call, especially if the person who is being called is chatty. Text sent with a messaging service tends to be shorter than that of an email. Moreover, salutations and closes are often left out. A typical message to inform somebody about your delay might be: Running late. Be in touch asap.

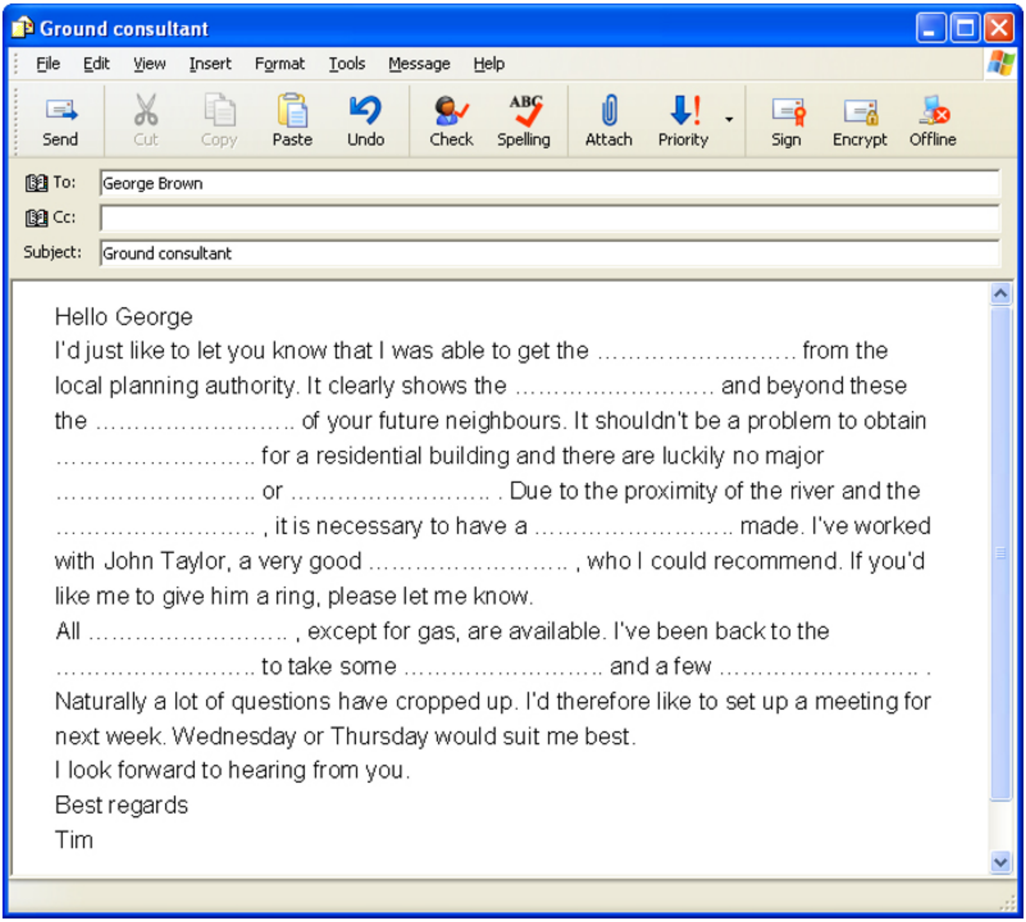
Here are a few aspects, which should be considered when writing emails:

- Even though emails are different to formal letters, they should still be clear, use concise language, correct grammar and appropriate vocabulary.
- The structure of an email is similar to that of a formal letter in that it consists of a salutation, the body with an introduction, an appropriate ending and a close. For more information regarding the structure of letters see 12.5.2.
- The *subject line* is useful not only for telling the *recipient* what the email is about before it is read but also for finding the email later when it is filed away in the sender's inbox or the recipient's outbox.

3.5.1 Email

The architect sends the client an email informing him about the outcome of his visit to the local authority and some thoughts concerning the next steps.
Insert the correct words from this chapter.

photographs · site location plan · boundaries · *constraints* · planning permission · services soils report · measurements · site · restrictions · properties · water level · ground consultant


Ground consultant

File Edit View Insert Format Tools Message Help

Send Cut Copy Paste Undo Check Spelling Attach Priority Sign Encrypt Offline

To: George Brown
Cc:
Subject: Ground consultant

Hello George
I'd just like to let you know that I was able to get the …………………… from the local planning authority. It clearly shows the …………………… and beyond these the …………………… of your future neighbours. It shouldn't be a problem to obtain …………………… for a residential building and there are luckily no major …………………… or …………………… . Due to the proximity of the river and the …………………… , it is necessary to have a …………………… made. I've worked with John Taylor, a very good …………………… , who I could recommend. If you'd like me to give him a ring, please let me know.
All …………………… , except for gas, are available. I've been back to the …………………… to take some …………………… and a few …………………… .
Naturally a lot of questions have cropped up. I'd therefore like to set up a meeting for next week. Wednesday or Thursday would suit me best.
I look forward to hearing from you.
Best regards
Tim

3.5.2 Register

The register of an email (how formal or informal it is) depends on the type of message you are writing and who you are writing to. An email about rescheduling a meeting might be less formal than a first enquiry or an apology. Similarly, an email to a new client will probably be more formal than an email to an old client or friend.

As you will have noticed, this email is fairly informal. Read it again and decide which words you would replace by this more formal vocabulary.

to present · to arise · to return · to contact · to inform · to receive · to arrange

3.6 Vocabulary

3.1	existing building stock	Baubestand
	roof extension	Aufstockung
	conversion	Umbau
	loft conversion	Dachausbau
	rooflight	Dachflächenfenster
	dormer	Gaube
	refurbishment	Sanierung
	sustainable upgrade	energetische Sanierung
	insulation	Wärmedämmung
	partial refurbishment	Teilsanierung
	remodelling	Neugestaltung
	load-bearing component	tragendes Bauteil
	retrofit	Nachrüstung
	shading device	Verschattungselement
	maintenance	Instandhaltung
	servicing	Wartung
3.1.1	feasibility	Machbarkeit
	access	Zufahrt, Zugang
	building lines	Baulinien
	number of storeys	Geschosszahl
	parking provisions	Stellplatzrichtlinien
	geological conditions	geologische Bedingungen
	survey	hier: Aufnahme, Untersuchung (siehe 3.4)
	soils report	Bodengutachten
3.1.4	pre-application advice	Beratungshilfe vor Antragsstellung
	proposal	Vorschlag
	acceptability	Genehmigungsfähigkeit
	outline application	Bauvoranfrage
	water table	Grundwasserspiegel
	liability to flooding	Überschwemmungsgefahr
	nature of the subsoil	Bodenbeschaffenheit
3.2	site visit	Ortsbegehung
	commitments	Verpflichtungen
	terms of appointment	Bedingungen der Beauftragung
	programme of work	Arbeitsaufwand
	programme of cost	Kostenrahmen
	to inherit sth	erben
	storage facility	Abstellraum, Lagermöglichkeit
	semi, semi-detached house	Doppelhaushälfte

3.2.1	to purchase	erwerben
3.2.2	digit	Ziffer
	to hyphenate	mit Bindestrich abtrennen
	cardinal number	Grundzahl
	ordinal number	Ordnungszahl
	fraction	Bruch
3.2.3	velocity	Geschwindigkeit
	amount of substance	Stoffmenge
	electric current	elektrischer Strom
	luminous intensity	Lichtstärke
	to go metric	auf das metrische System umstellen
	unit converter	Einheiten-Umrechner
3.3	plot	Baugrundstück
	land/estate agent	Grundstücks-/Immobilienmakler
	greenfield	auf der grünen Wiese
	solicitor	Anwalt
	title	Eigentumsrecht
	estate	Anwesen
	developed, partially developed, undeveloped adj	erschlossen, teilerschlossen, unerschlossen
3.3.1	homophone	gleichlautendes Wort, Homophon
	cite	angeben, zitieren
	eyesight	Sehvermögen
3.3.2	orientation	Ausrichtung, Himmelsrichtung
	adjoining adj	angrenzend
	overlooking adj	einsehend, mit Blick auf
3.3.3	rural adj	ländlich
	urban adj	städtisch
	dense adj	dicht besiedelt
3.3.4	gap	Baulücke
	saddle roof	Satteldach
	perimeter development	Blockrandbebauung
3.4	survey	Aufnahme, Vermessung, Baugutachten, Bestandsaufnahme eines Gebäudes, aber auch Umfrage
	levelling	Höhenmessung, Nivellieren
	surveyor	Vermessungsingenieur
	site investigation	Baugrunderkundung
	ground consultant	Bodengutachter
	to sink a borehole	Bohrloch ausheben
	to examine a soil sample	Bodenprobe untersuchen

3.4.1	surveying	Vermessungsarbeit
	surveying authority	Vermessungsbehörde
	surveying vehicle	Vermessungsfahrzeug
	opinion poll	Umfrage
3.4.2	levelling instrument	Nivelliergerät
	staff	Messlatte
3.5	subject line	Betreffzeile
	recipient	Empfänger
3.5.1	constraints	Beschränkung
	proximity to sth	Nähe zu etwas

4 Sustainability

4.1 Sustainable building

Sustainability is a significant and much discussed concept, yet, unfortunately not one that is always clearly understood. In recent years, it has been applied to lots of things, often simply because it sounds good. What it really means in human terms is “meeting today’s needs without compromising the ability of future generations to meet their needs”. This definition suggests that we are *stewards*, not owners, of resources and should be responsible for the long-term effects of our decisions and actions.

All aspects of construction, urban design, road construction, etc., have an impact on the environment. Future generations should not suffer any disadvantages from the structures we put in place today in terms of their appearance or the materials used.

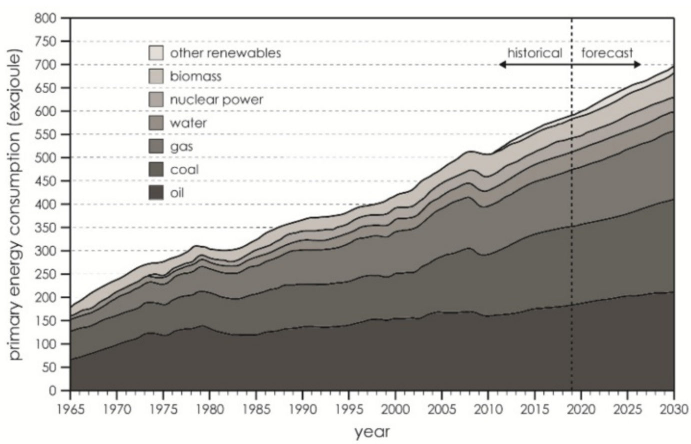
Building energy-efficient, passive, green or even *regenerative* buildings is only a step on the road toward sustainability. Architecture alone cannot provide sustainability. On the other hand, society cannot achieve sustainability without the active participation of the planning team.

4.1.1 Historical development

Before industrialisation and the development of technical equipment, living comforts depended upon natural phenomena. For example, the hypocaust structures invented by the Romans, living above animal stables to make use of their heat, drawing air through buildings with simple openings to remove heat and cool the interior.

Technical building services have made us more and more independent of climatic conditions and once uninhabitable places have become habitable through air-conditioning and heating. It was not until the end of the 20^{th} century, when the damage to the environment caused by CO_2 (carbon dioxide) and other *greenhouse gases* became clear, that an ecological motivation to optimise the use of energy in buildings materialised. Since then technology has made incredible advances and many different energy saving orders have been introduced to limit the consumption of fossil fuels.

The diagram illustrates the primary energy consumption from 1965 onwards. Despite a growing awareness for the environmental damage already caused, energy consumption will presumably continue to rise.



S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_4

4.2 Energy

Energy is the capacity of a physical system to perform work. It is not produced or consumed, as is often wrongly believed; it is merely converted from one physical state to another, in the form of heat, electricity or fuel.

We generally have to distinguish between energy from renewable sources, such as wood, waste, wind, solar radiation, etc. and *exhaustible* sources, such as fossil fuels. Whereas renewable energy is naturally *replenished* and can therefore be used by humans more or less indefinitely, provided the rate of consumption is in balance, non-renewable energies tend to be exhaustible and *pollutive*. The energy in fossil fuels is released upon burning when the carbon and *hydrogen* within them combines with oxygen in the air to form carbon dioxide (CO_2).

Although renewable energies are non-pollutive, the manufacturing processes of technical equipment, e.g. solar cells, the displacing of natural habitats and the large areas of land required in the case of wind or solar farms, also have an impact on our living environment.

Here is just a small selection of compound nouns that are used with regard to energy and buildings.

Energy

Energy payback time
Period required for an energy generating system to *harvest* the same quantity of energy as was invested in its production.

Primary energy
Energy that exists in a naturally occurring form, such as coal, before being converted into an end-use form.

Final energy
Quantity of energy provided to the end consumer after subtracting loss through conversion and *distribution*.

Geothermal energy
The thermal energy generated and stored in the ground. *Earth tubes* or *energy piles* in combination with heat pumps can make use of the higher ground temperatures.

Embodied energy
Total of energy required for the extraction, processing and manufacturing of building materials. Ideally it should be as low as possible.

Energy efficiency
Less energy is used to provide the same level of performance, comfort and convenience, also referred to as efficient energy use. For example, insulating a home allows a building to use less heating and cooling energy to achieve and maintain a comfortable temperature.

Energy storage
A means to retain the energy derived from a primary source for use at a later time.

Comment:

In Germany, a refurbishment aimed at reducing energy consumption is referred to as “energetische Sanierung”. This is often translated directly into English as “energetic refurbishment”. However, energetic has a different meaning in English. It is an expression that can be used to describe a person full of energy. The correct translation in this case is “energy efficiency refurbishment”. In different contexts, too, the translation of “energetisch” should never be “energetic”.

4.2.1 Saving energy

Saving energy means increasing the efficiency of energy usage, at the same time as decreasing energy consumption. It can result in increased financial capital, environmental quality, national and personal security and human comfort. There are many quick and simple ways to start saving energy, such as turning off lights and appliances when they are not being used, reusing plastic bags or dressing warmly rather than turning up the heating – every little bit helps.

The same applies to our built environment. Buildings are responsible for almost 40% of energy consumption in the EU. There is therefore great potential to save energy and an energy-efficient alternative is available for almost every appliance, material and process. Take a look at the following characteristics of an energy-efficient building. Match an item on the left with the correct definition on the right.

1. Hot water supply	a. All systems to control, regulate, monitor and operate building services automatically.
2. Heat recovery	b. In a passive house, the heat loss through *unsealed* joints must be less than 0.6 times the house volume per hour.
3. Preheating of fresh air	c. Low-energy refrigerators, stoves, freezers, lamps, washing machines, dryers, etc. are indispensable.
4. Sun tube lights	d. Sufficient area to absorb the energy from the sun in winter and means to limit the *heat gain* in summer.
5. Airtightness	e. Solar collectors or heat pumps provide the necessary energy to heat water.
6. Building automation system (BAS)	f. They transfer daylight via a tube, with internal mirror finish, to the inside of the building.
7. Continuous insulation	g. They should have U-values not exceeding 0.80 W/m²K with *solar heat-gain coefficients* around 50 %.
8. Southern orientation and shading device	h. Ducts draw fresh air through the ground exchanging heat with the ground.
9. Energy-efficient window glazing and frames	i. The heat remaining in the exhaust air is transferred to the incoming fresh air.
10. Energy-saving household appliances	j. The exterior shell is enveloped by an uninterrupted blanket of low heat conductivity material without *thermal bridges*.

4.2.2 Energy saving orders

New energy saving orders for existing and new dwellings are being introduced worldwide. Their overall aim is to help *counter* climate change by making buildings more energy efficient with measures such as improved insulation and more efficient heating systems. Some saving orders have made *air pressure leakage testing* mandatory to improve airtightness. They also cover aspects such as minimum acceptable U-values for walls, roofs and floors.

In the UK, the amendments to Part L of the Building Regulations include the key requirements for new and existing dwellings. In Germany, it is the *EnEV* that sets minimum requirements for energy-saving buildings. The European Union's *Energy Performance of Buildings Directive (EPBD)* has been implemented to set common standards throughout Europe.

4.3 Energy-efficient buildings

An energy-efficient building is any type of residential or non-residential building that uses less energy than what might be regarded as standard. Today, there are five main categories of energy-efficient buildings:

- low energy building
- passive building (ultra-low energy house)
- net-zero energy building (or zero-energy house)
- autonomous building (building with no bills)
- energy-plus building

There is no global definition for an energy-efficient house and the national standards vary considerably. However, it is generally considered that the energy consumption of a low-energy house is about half that of an average house. Passive houses, which are almost energy-self-sufficient buildings, use solar collectors and geothermal energy to provide heating and warm water, and photovoltaic elements to produce electricity. They can maintain a comfortable indoor climate without active heating and cooling systems. In central Europe, their energy demand may not exceed 120 kWh/m² per year for heat, hot water and electricity.

Most energy-efficient houses, except those defined as autonomous or energy-plus, employ *boosters* to cover peak situations. There are many different names for energy-efficient homes, such as eco house, zero-carbon house, 3-liter house, etc. They all have common features. In some cases, in order to qualify for *subsidies or grants*, there are limits which may not be exceeded, such as the total primary energy consumption.

4.3.1 Compactness

The shape of a building is influenced by the site, the urban environment and the use of the building. Since most interior spaces benefit from a good relation to the exterior, the shape of the building is often neglected. Nevertheless, a compact building with a small *envelope to volume ratio (A/V ratio)* is one of the most basic ways to improve energy efficiency. Thus, a single-family dwelling with a sprawled layout has a much higher A/V ratio (1.2) than a compact semi (0.7). Stacked units in blocks have the lowest A/V ratio (0.3).

A low A/V ratio can bring several benefits. In terms of town planning, density is important, and a low A/V ratio implies reduced use of land. This is highly relevant for prevention of urban sprawl, the often uncoordinated spreading of developments into neighbouring regions. It also has an impact on the building itself. A low A/V ratio means less building envelope in relation to the space inside. This leads to cost savings owing to the fact that the building envelope is usually the most expensive part of any new structure. In addition, the facade is responsible for heat loss and heat gain. It follows that a smaller surface area helps to reduce heat loss in winter and heat gain in summer. This, in turn, clearly has a positive effect on the costs for heating and cooling. So compact buildings, without any *setbacks, cut-outs* and *add-ons*, have numerous benefits.

4.3.2 Orientation

All buildings interact with their surroundings. The planning should therefore take into consideration the local environment, the landscape, other buildings and structures in the immediate neighbourhood, and, not least, the position in relation to the sun. The orientation of a building is critical since the passage of the sun across the sky affects the way in which it functions. Knowledge of the sunpaths is therefore fundamental when designing the building facades to let in light, make use of *solar heat gain* in winter, prevent *overheating* in summer and reduce *glare*. It is important to remember that the position of the sun changes according to the time of day, time of year and the site's *latitude*.

Well-oriented buildings maximise daylight and reduce the need for artificial light. Rooms requiring light should therefore be positioned alongside the facade and the openings should be suited to the needs of the space inside. Deep rooms and dwelling units should be avoided to prevent darker areas being created in the inner zones. In office buildings, systems to prevent glare tend to be standard practice.

A south orientation is most suitable in the northern hemisphere to make use of solar heat gain in winter (due to the low position of the sun) and avoid heat gain in summer (due to the high position of the sun). However, suitable shading devices, e.g. *overhangs*, have to be provided at these south-facing windows. A south-orientation is also most suitable for the application of active solar systems, such as solar collectors or photovoltaic modules.

It is also important to consider the sunpaths in terms of *overshadowing*. Neighbouring buildings and features in the landscape, such as hills and trees, but also elements of the building itself, can prevent the sun from reaching the facades. The openings should therefore be arranged in such a way that they are most beneficial in terms of visual links, thermal comfort and daylight.

There are numerous building simulation programs available to examine how a building is best positioned to optimise all of the aspects mentioned above.

4.3.3 Building certification systems

Building certification systems have been developed as tools to measure the sustainability of buildings. They generally assess and certify that a building has been designed and built using, among others, methods to secure energy savings, improve water efficiency, reduce CO_2 emissions, enhance *indoor air quality* and ensure the sustainability of products and resources.

One of the first systems created was BREEAM (BRE Environmental Assessment Method). It was established in 1990 in the UK and has since been exported across the globe in various guises. Its equivalents include LEED in the USA, Green Star in Australia, DGNB in Germany, MINERGIE in Switzerland and many more.

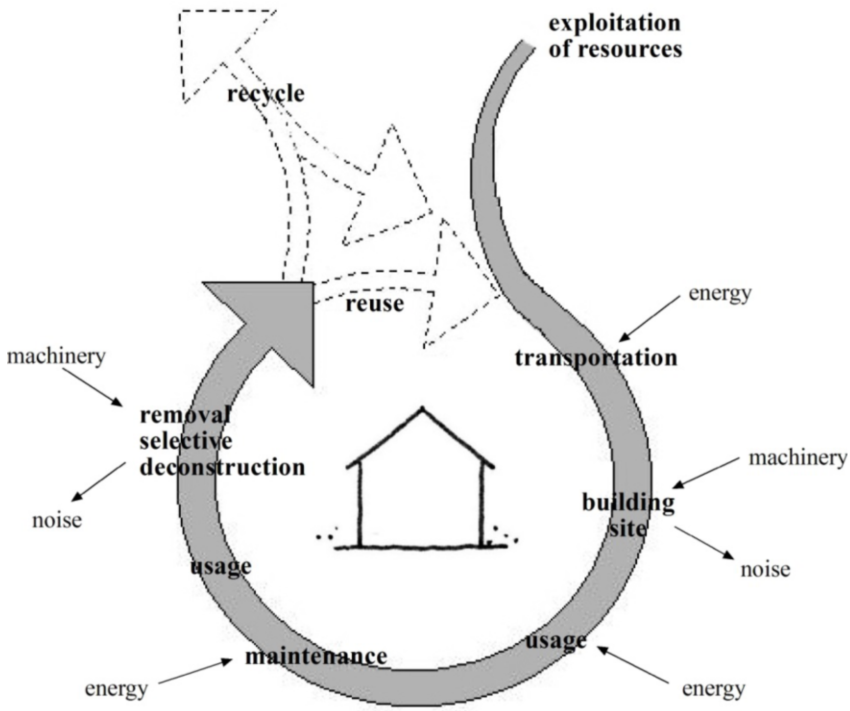
The costs for certification vary considerably and depend on the size and type of the building. A BREEAM certificate, for a new office building with a gross floor area of 5000 m², for example, costs just under 3000 Euro. According to professionals, approximately 0 – 8 % must be added to the construction costs for designing, building and certifying a green building. The cost and effort involved in obtaining certification, however, is more than worthwhile since certified projects have:

- a positive image
- over the lifetime of the structure, the green building practices required for certification can result in energy and cost saving
- occupants are more productive and have less days off sick which contributes towards company profits
- retail sales are higher and students reach higher grades in daylit buildings - a criterion in most certification systems

4.4 Life cycle assessment

A life cycle assessment (LCA) is a tool that evaluates the environmental impacts of a development from conception through to *demolition* and disposal, i.e. from *cradle to grave*. It is used to compile an inventory of the inputs (raw materials and energy) and outputs (waste and emissions) associated with the building. By evaluating and interpreting the potential impacts, it is possible to identify weak points in the life cycle and affect environmental improvements.

The methodology of a life cycle assessment is defined in the ISO standards 14040 and 14044.



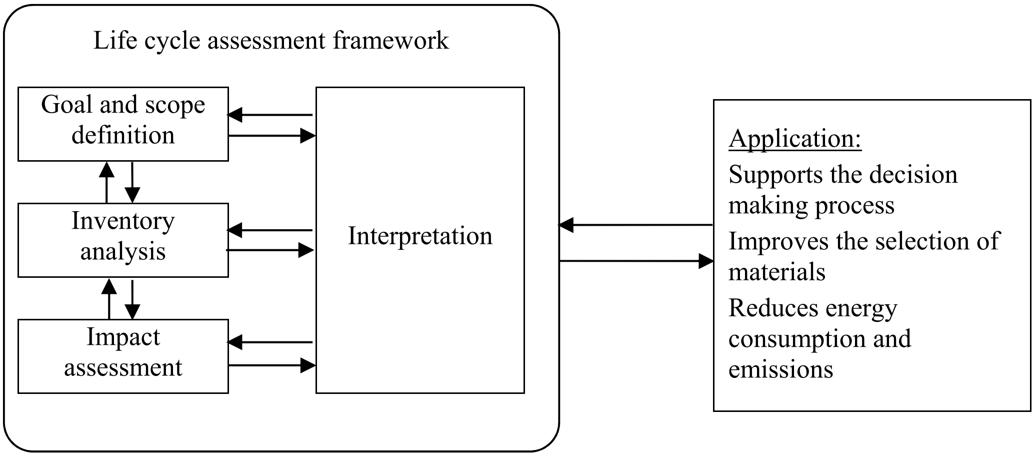
4.4.1 LCA phases

Goal and scope definition phase: The purpose of this first phase is to identify the *system boundary* (what is and is not to be included in the study), the *functional unit* (the amount, weight and quality of the item to be assessed, e.g. a cubic metre of building) and determine the level of detail. The energy consumption on the construction site, for example, is often something left outside the system boundary.

Life cycle inventory analysis phase (LCI phase): This phase involves creating an inventory of all material quantities. By using *product inventory databases*, the inputs and outputs of an item are tracked and listed in detail.

Life cycle impact assessment phase (LCIA phase): This is essentially the "what does it mean" step. The inventory items from the LCI phase are analysed for their impacts on human health and the environment.

Interpretation phase: The purpose of the fourth and last phase is to check and evaluate the information from the third phase in order to meet the requirements determined in the goal and scope definition phase. The results are used to compare different concepts and make improvements to the design.



4.5 Future trends

People have constructed buildings and other structures since prehistory, including bridges, amphitheatres, roads and canals. These developments have been largely dependent on the needs of the population, but also the availability of materials, skills and tools. Our generation is currently having to deal with a growing and ageing population, a more diverse one, dwindling non-renewable resources and a greater *awareness* of the harm population has already caused to the environment. New legislation and tough carbon reduction targets mean that all businesses are having to incorporate green strategies into their overall business plans.

Over the last decades – an important turnaround came with the oil crisis in 1973 – the need to minimise energy consumption and the use of raw materials has brought about a number of different tools and strategies. Some of these, such as building certification systems and LCAs, help to avoid a narrow outlook on environmental concerns by considering green criteria and providing a means of comparison and a basis for improvement. The future will undoubtedly see an even greater focus on environmental issues and sustainability in the building industry.

4.5.1 Grammar: Future tenses

In English, there are various ways to express an activity in the future. Unfortunately the tenses are not simply interchangeable, but each one of the following possibilities has its own area of use.

Going-to future is used to talk about intentions, plans or decisions that have been made before the time of speaking. In this case, it is more or less interchangeable with the present continuous form. It can also be used for *predictions*, especially if the outcome is clear.

Form: am/is/are going to + infinitive

Example: Building authorities are going to introduce stricter rules next month.

Will future is used to express spontaneous decisions made at the time of speaking and for making predictions in the future with an indefinite outcome.

Signal words: perhaps, probably and phrases like "I (don't) think/ I expect/I guess/I'm (not) sure/I reckon"

Form: will + infinitive (in spoken English, won't is used in negative sentences)
Example: The performance of an LCA will probably become *mandatory*.

Will can also be used in the continuous form (will be doing something) to talk about an action that will be in progress at a point of time in the future, e.g. They will be pouring the concrete this afternoon. The future perfect form is used for actions that will be completed before a point of time in the future, e.g. The planning team will have completed the design by this time next week.

Simple present is used to talk about schedules and programmes.

Example: Work on site commences next Monday.

Present continuous is used for plans and arrangements as well as actions just before they set in.

Example: The contractor is starting on the 2^{nd} storey tomorrow.

4.5.2 Exercise: Future tenses

Choose the correct verb forms in the following text.

The Kyoto Protocol to the United Nations Framework Convention of Climate Change (UNFCCC) is an international treaty that sets binding targets for reducing greenhouse gas. According to the agreements for the second commitment period, which **will end/has ended** in 2020, the EU **was planning/is planning** to reduce the amount of emissions by an average of 30% in comparison to the levels of 1990. In future, more homes and offices **will have been insulated/will have to be insulated,** and home owners **will have to install/will be installed** low carbon alternatives, such as heat pumps, instead of gas boilers. The way people travel **was changed/is going to change**; furthermore, there **will be/is being** a shift away from fossil fuels to generate electricity from renewable energy sources. It has been predicted that by 2050, 80% of electricity in Germany **will be generated/will have been generated** from renewable sources. The *feed-in tariffs* **are going encourage/are encouraging** the use of new energy technologies. We **will probably become/probably are becoming** accustomed to solar panels on roofs and facades. Further conferences **are planned/will be planning** to fight global warming and more and more countries **was signing/are signing** up to multilateral agreements. It **will only be/will have only been** possible to stop global warming if everybody is willing to do their part.

4.6 Vocabulary

	sustainability	Nachhaltigkeit
4.1	steward	Aufseher, Haushalter
	impact	Auswirkung
	regenerative adj	erneuerbar
4.1.1	greenhouse gas	Treibhausgas
	primary energy consumption	Primärenergieverbrauch
4.2	exhaustible adj	erschöpfbar
	to replenish	auffüllen
	pollutive	umweltbelastend
	hydrogen	Wasserstoff
	energy payback time	Energieamortisationszeit
	to harvest	ernten
	final energy	Endenergie
	distribution	Verteilung
	geothermal energy	Geothermalenergie
	earth tubes	Erdkollektor
	energy piles	Energiepfahl
	energy storage	Energiespeicher
	energy efficiency	Energieeffizienz
	embodied energy	graue Energie
4.2.1	unsealed adj	unversiegelt, hier: offen
	sun tube lights	Tageslichtröhren
	heat gain	Wärmegewinn
	airtightness	Luftdichtheit
	building automation system (BAS)	Gebäudeautomationssystem
	solar heat-gain coefficient	solarer Wärmegewinnkoeffizient
	thermal bridge	Wärmebrücke
4.2.2	energy saving order	Energieeinspargesetz
	to counter	entgegenwirken
	air pressure leakage testing (blower door test)	Differenzdruck-Messverfahren (Blower-Door-Test)
	German energy saving order	Energieeinsparverordnung, EnEV
	Energy Performance of Buildings Directive, EPBD	Richtlinie zur Gesamtenergieeffizienz von Gebäuden
4.3	low-energy house	Niedrigenergiehaus
	zero-energy house	Nullenergiehaus
	autonomous building	Autarkhaus
	energy-plus house	Energieplushaus
	booster	Zusatzgerät, Verstärker

	subsidy, grant	Zuschuss, Fördermittel
4.3.1	compactness	Kompaktheit
	envelope to volume ratio (A/V ratio)	Verhältnis von Hüllfläche zu Volumen (A/V Verhältnis)
	setback	Rücksprung
	cut-out	Ausschnitt
	add-on	Erweiterung
4.3.2	solar heat gain	solare Wärmegewinne
	overheating	Überhitzung
	glare	Blendung
	latitude	Breitengrad
	overhang	Auskragung
	overshadowing	Verschattung
4.3.3	building certification system	Gebäudezertifizierungssystem
	indoor air quality	Raumluftqualität
4.4	life cycle assessment (LCA)	Ökobilanz
	demolition	Abriss
	disposal	Entsorgung
	cradle-to-grave	von der Wiege bis zur Bahre
4.4.1	goal and scope definition	Festlegung des Ziels und Untersuchungsrahmens
	system boundary	Systemgrenze
	functional unit	funktionelle Einheit
	inventory analysis	Sachbilanz
	product inventory database	Sachbilanzdatenbank
	impact assessment	Wirkungsabschätzung
	interpretation	Auswertung
4.5	awareness	Bewusstsein
4.5.1	prediction	Vorhersage
	mandatory	verpflichtend
4.5.2	feed-in tariff	Einspeisetarif

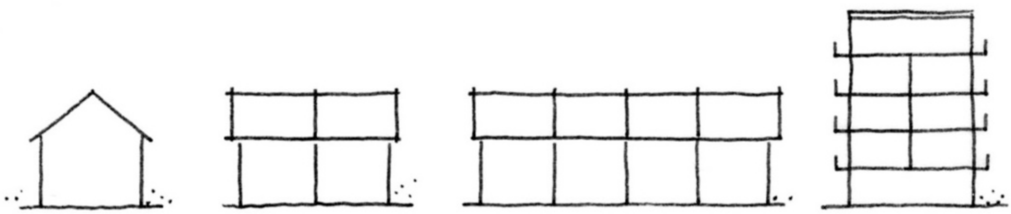
5 Briefing

5.1 Accepting the brief

The project brief is the key document upon which the design will be based. It is a set of instructions given to the architect or engineer by the client. In this sometimes very delicate and lengthy process, it is the planner's task to understand and interpret the statements made by the client and finally produce a project design. The project brief tends to evolve through the early phases and benefit from information gained through consultations with authorities, consultants and other stakeholders.

Since domestic, public and commercial buildings all have different requirements, the building's design and construction is strongly influenced by its function. It follows that the form, scale and appearance is dependent on the purpose and the occupants of the development. There are many different types of buildings with differing characteristics. As a general rule, they are separated into two categories, residential buildings and non-residential buildings.

- Non-residential buildings are quite simply all buildings which are not used for living purposes. These include public buildings (schools, hospitals, libraries and museums), buildings for sport (stadiums and swimming pools), commercial buildings (shops, factories, warehouses and offices), agricultural and military buildings, religious buildings and buildings for transport (stations, parking, airports and bus terminals).
- Residential buildings are *dwellings*, places where people live, and amongst others, include bungalows, blocks of flats and flat sharing communities.



single-family home (also referred to as detached house)	semi-detached house (semi)	terrace houses with middle terrace houses and an end-terrace house at each end	multi-unit dwelling with flats or apartments

Other than a general description of the building, the project brief may include aspects concerning materials, design quality and length of use. The choice of materials is frequently related to personal preferences, attitudes concerning the environment but also costs. The same applies to the quality of the design. The length of use is usually determined by the client's age and/or future plans. It goes without saying that a temporary building should be developed using different materials and components to a building with a potential life span of 20 or even 40 years.

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_5

5.1.1 Client's needs

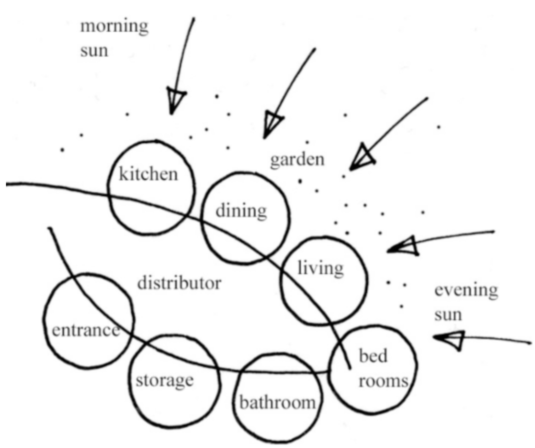
The architect or engineer has to analyse the client's needs in terms of activities and identify, in respect of each activity, a number of key criteria including *areas*, *volumes*, requirements for *finishes* and orientation, interaction with other activities, number of persons involved, social and psychological needs. Usually the result of taking a brief is the preparation of a *space-utilisation schedule*, a *user requirement programme* or at least something in writing or in graphical form.

During a meeting with the architect, the client, George Brown, says the following:

> "We are thinking of a light and *spacious* house. We would like to enter the house through a large *entrance area*, which offers enough space to store all the jackets and shoes. Also on the ground floor, we could imagine having a fairly open-plan arrangement with the kitchen, dining and living areas interlinked. We would definitely like a *larder* close to the kitchen. The garden should be *accessible*, too, with a terrace for eating outside in the summer.
>
> Then, above the ground floor, we visualise having two further *storeys* one for the adults and one for the children, each with their separate bathrooms. A *walk-in wardrobe* connected to the *master bedroom* would be great. We'll also need a *study* somewhere. We'd like a *utility room* and a *workshop* in the cellar. Of course we'll also need a garage and lots of storage space throughout the house.
>
> We're looking for something quite simple really – nothing too elaborate. We don't want any little towers or *bay windows*. It should definitely be homely, possibly in wood. We're quite sure we don't want anything with an industrial feel and certainly nothing looking like a factory or a *bomb shelter* with lots of grey concrete."

As you can see here, the client already has quite clear ideas, at least concerning the scale and *arrangement of rooms*. He has not said anything about the *technical installations* or their location. It is the architect's job to point out these technical details and clarify any other uncertainties. The brief should always be confirmed by the client before the next stage is commenced.

Here is a diagram showing the outcome of an architect's meeting with a client.



5.1.2 Needs and worries

As you can see from the following questions and answers, the client's needs do not always correspond with the architect's thoughts. The whole briefing process may require numerous meetings before the complete information, especially for a large job, is obtained.

Match the client's needs with the architect's worries.

We'd like a cellar for technical equipment and storage facilities.

Should all bedrooms have an *en-suite bathroom*?

We'll be needing a guest bedroom.

There has to be a terrace for dining in the summer.

We'll need four bedrooms on the first floor.

A loft assumes a gable roof. Could storage space be located somewhere else. Could the roof also have a different shape?

Does the office need a separate entrance?

Would it be possible to locate the guest bedroom on the ground floor?

We'd like an office integrated in the main living area.

A cellar makes the building very expensive. Is the site big enough to offer the necessary space on the ground floor?

I'd like l*oft* space for storage.

Does the kitchen have to be linked to the terrace?

5.2 Consultants

During the early design stages, it is the planner's task to decide whether any support regarding a particular feature or function of the development is required. Consultants are qualified in particular fields and give expert advice or assistance. As mentioned at the beginning of this book, there are numerous possibilities regarding the organisation of a project. The consultants can either be employed by the client directly, or may be part of the main contractor's team in a design-build contract. If the client commissions a general contractor, or a civil engineer for civil works, the architect may function as one of the consultants.

Common types of consultants in connection with building work are:

- Structural engineers
- Electrical engineers
- Building services engineers
- *Building physicist*
- Quantity surveyors or cost managers
- Interior designers
- Urban planners
- Landscape architects

On smaller building projects, the architect, as the planner and project manager, may feel capable of carrying out the entire design work alone, except for the structural engineering. If the project is large or has special features, the architect may nominate several consultants to deal with the areas of work which are outside his or her competence.

Experience has shown that the appointment of experienced professionals at the beginning of a project will deliver long-term value. They should be appointed as soon as their need is identified; usually this is shortly after the architect has clarified the brief with the client. Given the client's natural desire to limit fees, it is sometimes difficult to convince him or her that additional consultants are necessary. The client may need to be made aware of the fact that the total construction cost of a new building is only approximately 15 per cent of the building's *life cycle cost*. The professional fees are around 15 per cent of the construction cost and therefore only represent 2 to 3 per cent of the life cycle cost. Viewed in this way, the cost of specialist services, which aim at optimising planning and development phases, as well as the use and maintenance of the completed structure, may be seen as very worthwhile.

5.2.1 Appointing a consultant

Read this telephone conversation between the architect, Tim Smith, and the structural engineer, Joe White. You will notice that the conversation is taking place at a fairly early stage in the design, since the architect has only just received the brief. However, it is good to refresh contacts and *forewarn* possible contractors sooner rather than later.

Secretary:	Good morning, White Engineers. Can I help you?
Tim Smith:	Er, yes, it's Tim Smith. Could I speak to Joe White, please?
Secretary:	Yes, of course. Can I tell him the reason for your call?
Tim Smith:	Certainly. It's about a single-family home for a client called George Brown.
Secretary:	Thank you. I'll put you through.
Secretary:	Joe, Tim Smith is on the phone. He'd like to speak to you about a single-family home for a client called George Brown. I'll connect you.
Joe White:	Hello, Tim. Nice to hear from you. What can I do for you?
Tim Smith:	Hello, Joe. Well actually, I'm phoning about a new project I'm working on.
Joe White:	Is it a big one?
Tim Smith:	No, not really. It's a single-family home, but the clients are interested in timber construction and would like everything spacious and open plan.
Joe White:	I understand. That sounds interesting.
Tim Smith:	I've really only just started with some sketches, but wanted to let you know that I'll be needing some support regarding the structure. Are you available for some additional work over the next few weeks?
Joe White:	Well, we're fairly busy at the moment, but I'm sure we'll be able to help you out. It would be nice to work on something other than steel and concrete.
Tim Smith:	That would be great. I'll let the client know you're interested and get back to you in a couple of weeks, if that's okay.
Joe White:	Yes, certainly. Well, thanks for phoning Tim and I look forward to hearing from you. Bye.
Tim Smith:	Bye, bye, Joe.

5.2.2 Standard telephone phrases

As you can see from this simple conversation, there are many standard phrases used on the telephone, especially at the beginning and the end of a call.

Function	**Standard Phrases**
Introduction	This is … This is …. speaking. Good morning/Hello …, …. here.
Request	Could I speak to … I'd like to speak to … Can you tell him/her to ..../that ... I'd like to leave a message for ...
Replies to requests	Yes, certainly. I'll put you through. Hold the line, please. I'll see if I can find …. I'm afraid the line's busy. Would you like to wait? I'm afraid he/she is in a meeting. Would you like to leave a message? I'm sorry he/she is out of the office. Can I take a message?
Communication difficulties	I'm afraid, I can't hear you very well. Could you speak up a bit? I'm sorry, I didn't catch that. Could you repeat it, please? The line's not very clear. Could you spell that, please?
Reason for calling	I'm phoning to inquire/ask … The reason I'm phoning is … I'm calling about …
Ending	I'll be in touch as soon as possible. Thank you for your call. I look forward to seeing you on …/hearing from you next … Thank you very much. Goodbye.

5.2.3 Exercise: Telephoning

Put the sentences of this telephone conversation between the architect and the client into the correct order. Number the boxes.

That sounds good. So how about our meeting then?
How does Thursday late afternoon suit you?

Yes that suits me fine. I'll be round at 5.

I'm just phoning to let you know that I've spoken to Joe White and he'd be interested to do the structural planning for your house.

George Brown.

Oh, that's good news. Should I arrange a meeting with him?

Goodbye.

Yes, definitely, but there's no rush at the moment. I'd like you to take a look at some sketches first and confirm the brief. And once I have got some preliminary drawings prepared, we could all sit down together.

Excellent, I look forward to seeing you. Goodbye George.

Hello, George. It's Tim.

Thursday would be fine. Shall we say 5 o'clock? Would you like to come round to the office?

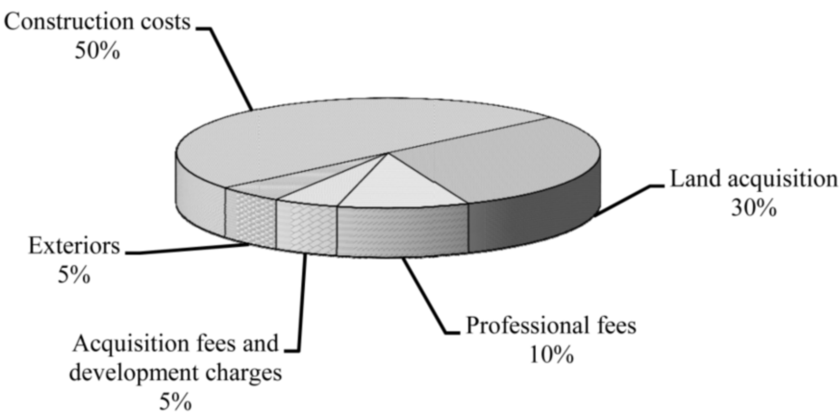
Hello, Tim. Nice to hear from you. What can I do for you?

5.3 Building costs

The building costs include all the *expenses* for goods, services and charges necessary to carry out a development. Before planning and constructing a property, the client needs to be aware of all the expenses associated with the development. Architects and engineers have a detailed knowledge of the costs involved and are able to support the client by preparing a realistic *cost estimate*. The client will then be able to determine the *feasibility* and *affordability* of the project. The design team may need to recommend adjustments in order *to bring the scope of the project into line* with the *client's means*. The final step of this early process is the agreement of the *budget* for the project.

The total *expense budget*, at the start, is the sum of a large number of individual items. As work progresses, the expense budget is replaced by *actual costs* until, on completion, the *final statement* is drawn up with the total cost of the project. Throughout the period of development, as actual costs are *invoiced*, it is essential to monitor progress against the original budget or revised budget if alterations have been agreed along the way. Since there is a tendency for all parties *to pitch* estimates *on the low side*, it is always prudent to allow for a *contingency sum*.

The different *cost categories* for an average sized building are shown in the diagram below.



5.3.1 Cost categories

As mentioned above, the subdivision of the total costs enables the client to understand the different cost categories. In Germany, the DIN 276 is concerned with the *determination of cost* and the structure of cost categories.

Land acquisition: In most cases, clients already own a plot when they approach an architect for the first time. It follows that the costs involved in purchasing a plot seldom really affect the architect. In addition to the acquisition price, the client may need to pay for a survey before the architect can proceed with design work. Giving advice on the acquisition of a site or building is regarded as an *additional service*.

Development charges: This cost category includes the connections to all services, the *public sewer*, the *water mains*, *gas supply mains*, *power connection* and *cable connection*. The costs deriving from these connections are payable to the appropriate supplier.

Construction costs: These costs cover the entire construction of the building, from the foundations to the paintwork including all materials and the labour costs to perform the work. The client's budget can easily be translated into areas (cost per square metre) or volumes (cost per cubic metre) based on different constructional systems and finishes, e.g. expensive or basic. This calculation gives the client and the architect a rough guide as to the feasibility.

No project is ever designed perfectly – there will always be unforeseen items, situations or misjudgements. A contingency sum allows for these unknown factors. Depending on whether it is a new construction, an extension or a renovation, between 10 and 15 % is usually included as a *provision*.

Incidental building costs: The incidental building costs, also called on-costs, include the costs of professional services before construction begins as well as those incurred during the course of development. In other words, all fees, costs for the *planning permission application*, which is usually a percentage of the total building costs, *legal charges*, *insurance* and *finance costs* arising during the total planning and construction period.

Establishing the fee may involve *negotiations* since there is a variety of methods in settling them. Architects, engineers and other consultants charge either a percentage of the building construction cost, a *time charge* or a *lump sum*. Higher rates apply for work involving existing buildings.

- Percentage Charge:
  In most countries there is an *official scale of fees*, which applies to services offered by architects, engineers and other building professions. In Germany, architects and engineers consult the HOAI (Honorarordnung für Architekten und Ingenieure – Official Scale of Fees for Services by Architects and Engineers). For architects practising in Great Britain, the RIBA has published a chart, "A Client's Guide to Engaging an Architect", which indicates percentages for each class, simple, average and complex, over a range of construction costs. Usually these fees are paid in *instalments* based on the *estimated final cost*. The final instalment fee is adjusted to match the total fees to the actual cost of the building.
- Time charge:
  Time charges are based on an *hourly rate*. In comparison to the rates stated by the HOAI, there are no recommendations given by the RIBA and the actual amount charged per hour varies from practice to practice. An hourly rate is appropriate for *partial or additional services*.
- Lump sum:
  A lump sum fee is often *quoted* if the extent of the work required is absolutely clear and the time scale of the service is known. Therefore when architects offer clients a lump sum, the services included should be specified precisely.

Others: Clients should also be aware of the costs for *removal*, furnishings, such as kitchen and lighting, telephone and computer cabling, since it is not usual for these to be included in the construction costs.

5.3.2 Loans

A client usually requires additional capital to purchase land or develop a property. This is normally achieved by *borrowing* from a bank or *building society*. The client takes out a *mortgage,* which grants the *lender* a charge on the property as security for the loan.

There are numerous types of mortgage offered today, but most involve regular payment of *interest* and capital to the lender to ultimately repay the *loan*. When a property is being developed, the lender may agree to make capital available in stages as the construction proceeds, and the architect or other professionals may be asked to supply certificates confirming stage completion.

5.3.3 Cost management

A major difference between practising architecture in the UK and Germany is the availability of quantity surveyors in Great Britain. Even though all architects are able to, or should be able to, look after the financial aspects of construction work and determine the *probable cost of a building* from a set of drawings, architects in the UK are often relieved from this work and may concentrate on design and realisation.

Quantity surveyors are qualified to prepare *cost plans* of building costs from a brief at a very early design stage. Quantity surveyors then work hand in hand with architects and engineers and manage and monitor cost matters throughout a project. Depending on the stage at which the determination of cost is prepared, the *margin of error* should be reduced towards the completion of the scheme.

No matter who is responsible, it is necessary to develop a cost plan at an early design stage *allocating a sum of money* to each element. The cost plan, which reflects the client's estimated expenditure, needs to cover everything forming part of the project i.e. all aspects of construction, fixtures and fittings, furniture (if included) and professional fees. The person involved in setting up the cost plan has to take account of all outstanding and potential risks with potential cost implications. A lot of good software has been developed to support cost management in the building industry.

5.3.4 Lexis: Building costs

Match the term on the left with the correct definition on the right.

1. contingency	a. a loan to buy, build or refurbish a property
2. lump sum	b. a sum of money withheld in case of unforeseen events
3. hourly rate	c. charges for services offered by architects, engineers and other consultants
4. professional fees	d. amongst other things, the costs for the planning application and insurance
5. to purchase	e. a guarantee issued by a company for compensation in case of damage in return for a payment
6. on-costs	f. a fixed charge for a clear task
7. mortgage	g. to buy
8. insurance costs	h. a time charge

5.4 Vocabulary

	briefing	Vorbesprechung, Bedarfsermittlung
5.1	brief	Übermittlung der Planungsgrundlagen an den Planer durch den Bauherrn
	to brief sb	jmdn. unterrichten, informieren
	dwelling	Wohnung
	single-family home, detached house	Einfamilienhaus
	terrace house BE; row house AE	Reihenhaus
	end-terrace house	Reiheneckhaus
	multi-family dwelling	Mehrfamilienhaus
5.1.1	area	Fläche
	volume	Rauminhalt, Kubatur
	finishes	Ausbau
	space-utilisation schedule	Raumprogramm
	user requirement programme	Bedarfsanalyse
	spacious adj	geräumig
	entrance area (hall)	Eingangsbereich
	larder	Speisekammer
	accessible adj	zugänglich
	storey/s BE; story/ies AE	Geschoss, Stockwerk, Etage
	walk-in wardrobe	begehbarer Kleiderschrank
	master bedroom	Elternschlafzimmer
	study	Arbeitszimmer (im Wohnhaus)
	utility room	Wirtschaftsraum
	workshop	Werkstatt
	storage space	Lagerfläche, Stauraum
	bay window	Erkerfenster
	bomb shelter	Bunker
	arrangement of rooms	Raumanordnung
	technical installations	betriebstechnische Anlagen
5.1.2	en-suite bathroom	an ein Schlafzimmer direkt anschließendes Badezimmer
	loft	Dachboden
5.2	consultant	Fachplaner, Fachingenieur
	building physicist	Bauphysiker
	life cycle cost	Lebenszykluskosten
5.2.1	to forewarn sb	jmdn. vorwarnen
5.3	building costs	Baukosten
	expenses	Aufwendungen
	cost estimate	Kostenschätzung, Voranschlag

	feasibility	Durchführbarkeit, Machbarkeit
	affordability	Erschwinglichkeit
	project scope	Leistungsbedarf
	to bring sth into line with sth	in Einklang bringen
	client's means	Bauherrenmittel
	budget	Haushalt
	expense budget	Kostenplan
	actual costs	tatsächliche Kosten
	final statement	Schluss(ab)rechnung
	to invoice	in Rechnung stellen
	to pitch sth on the low side	unterschätzen
	contingency sum	Summe für Unvorhergesehenes
	cost categories	Kostengruppen
	construction costs	Baukosten
	development charges	Erschließungskosten
	exteriors	Außenanlagen
	land acquisition	Grundstückserwerbskosten
	professional fees	Honorare für Freiberufler
5.3.1	determination of cost	Kostenermittlung
	additional (planning) service	besondere Leistung
	public sewer connection	Kanalisationsanschluss
	water mains	Wasseranschluss
	gas supply mains	Gasanschluss
	power connection	Stromanschluss
	cable connection	Kabelanschluss
	provision	Vorkehrung, Vorsorge
	incidental building costs	Baunebenkosten
	planning permission application	Antrag auf Baugenehmigung
	legal charges	gesetzliche Gebühren
	insurance	Versicherungen
	finance costs	Finanzierungskosten
	negotiation	Verhandlung
	time charge	Vergütung auf Stundenbasis
	lump sum	Pauschale
	official scale of fees	Honorarordnung
	instalment	Abschlagszahlung
	estimated final cost	geschätzte Endkosten, Kostenanschlag
	hourly rate	Stundensatz
	partial or additional services	Teilleistungen oder bes. Leistungen
	to quote sth	anbieten, Preis angeben
	removal costs	Umzugskosten

5.3.2	to borrow sth	sich etwas leihen
	building society	Bausparkasse
	mortgage	Hypothek
	lender	Kreditgeber
	interest	Zins(en)
	loan	Kredit, Darlehen
5.3.3	probable cost of a building	voraussichtliche Baukosten
	cost plan	Kostenaufstellung
	margin of error	Abweichung
	to allocate a sum of money to sth	eine Geldsumme für etw. zur Verfügung stellen

6 Preliminary Design

6.1 Design presentation

Taking into account the client's brief and additional information obtained, the architect or engineer will start to prepare drawings illustrating possible solutions. The first drawings, of which there may be many, may not be very detailed, but will show what the planner has in mind. They should illustrate and make it possible to appreciate the general *massing*, the external *appearance* of the building and its position on the plot. The arrangement of the interior, at least a rough outline, should also be included in a first presentation of the planner's thoughts.

Usually several meetings take place with the client during this phase. The architect or engineer takes along drawings, sketches etc. to these meetings. While these should, of course, be *self-explanatory*, it is absolutely necessary to guide the client through the presentation with oral explanations.

Presentation form
There are numerous terms used to describe the various forms of presentation. Match the terms with the correct explanation.

1. a sketch	a. a drawing made with paint
2. a diagram	b. often used to express the preparation of a technical drawing and still found in many collocations such as draughtsperson (AE draftsperson) or draughting machine (AE drafting machine)
3. a plan	c. a free-hand drawing made quickly and not including a lot of detail
4. a painting	d. a computer-aided presentation offers the viewer a realistic understanding of the building by for example *taking a virtual walk* through the various rooms
5. a drawing	e. a two-dimensional image of what the building will look like once it has been completed
6. to draft	f. a physical representation of a structure
7. rendering	g. *compilation of* drawings showing all views
8. computer simulation	h. a usually *to-scale illustration* in pencil or ink often made by using rulers, stencils or CAD
9. model	i. often used to sketch out the functional arrangement of rooms or routes within a building

Adding an appropriate adjective can help to qualify these expressions. A *rough sketch* might be a sketch made with a thick pen with only a few lines, whereas a detailed drawing offers a clearer insight. The *scale* of a drawing also gives some indication of the amount of detail. Naturally a 1:50 (read: one to fifty) drawing is more detailed than a 1:200 drawing.

Other forms of presentation are possible, for example a detail drawing or model showing only part of the development, a collection of *material samples*, illustrations or simply a concise report.

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_6

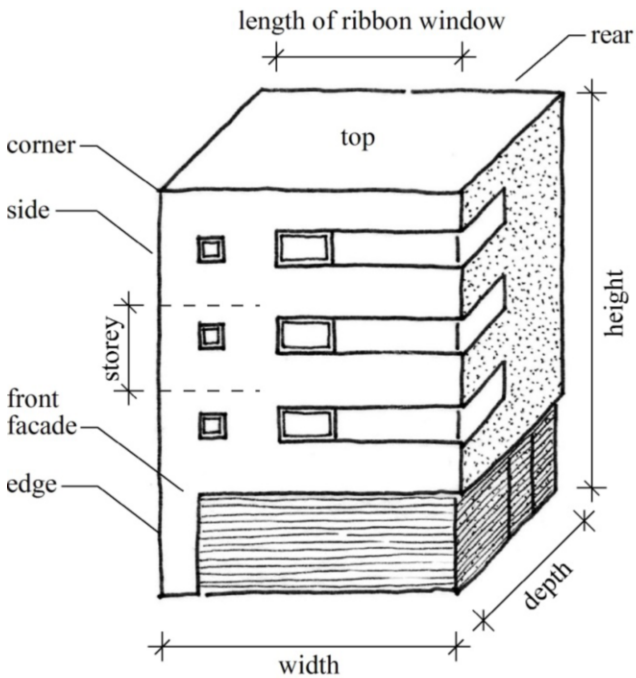
6.2 Proportions

The *cubage* of a building gives us an indication of the size, whether it is a small or a large building. However, it tells us nothing about the proportions, the relation between width, depth and height. The cubage is measured in cubic metres (cbm; m³). Similarly the *gross floor area* only indicates the size of the *covered area*, not the *relation* between width and depth. In some areas, especially non-residential, the proportion of a site, which may be covered, is determined by the *ground space index (GSI)*.

Cubage and areas are particularly relevant when it comes to costs and calculations. Planners apply the *volume method* when preparing a preliminary cost estimate. In order to determine the construction costs, the cubage is multiplied by an average cubic metre price, which includes everything from the structure to the finishes.

The client tends to focus on the *net floor area* since this indicates the number of square metres *excluding* the *external walls*, i.e. usable space, which may be sold or *let*. Architects and designers, on the other hand, are more interested in the individual dimensions. These determine the proportions and are what actually characterise the appearance of a building, a room or even a piece of furniture.

6.2.1 Dimensions



<u>long/length</u>
The ribbon window is 5 m long.
The length of the window is 5 m.

<u>high/height</u>
The structure is 12 m high.
The height of the structure is 12 m.

<u>deep/depth</u>
The structure is 8 m deep.
The depth of the structure is 8 m.

<u>wide/width</u>
The structure is 9 m wide.
The width of the structure is 9 m.

6.2.2 Word families

A greater understanding of word families will help to improve your language proficiency. A word family consists of a base word and its inflected forms and derivations. By adding prefixes to the beginning and/or suffixes to the end of the word, they take on different meanings.

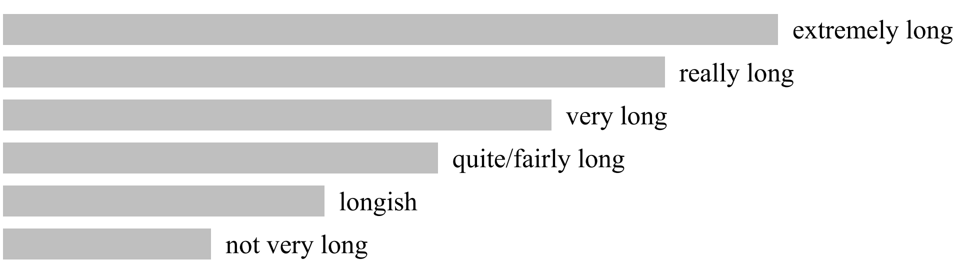
Complete the chart to understand the word families of the adjectives.

adjective	**verb**	**noun**	**others**
high	…..	…..	…..
long	lengthen	…..	…..
short	…..	shortness	shortage
wide	…..	…..	…..
large	…..	…..	…..
broad	broaden	…..	…..
deep	…..	…..	…..
weak	…..	…..	…..
strong	…..	…..	…..
thick	…..	…..	…..

Now use the words from the table above to complete the following sentences.

1. Can you tell me the …………….. of the bridge span.
2. If we remove this supporting beam, we will …………….. the whole structure.
3. By extending the building down to the river, the floor area has been …………….. by $40m^2$.
4. In order to calculate the volume of a box, you need the …………….., the …………….. and the ……………… .
5. Due to the *drought*, there's a …………….. of water in southern England.
6. The road is too narrow, it'll have to be …………….. by an extra lane.
7. The presentation time has been limited to 15 minutes. We'll have to …………….. our talk.
8. High-…………….. steel provides better mechanical properties than carbon steel.

It is possible to add modifiers to the adjectives in order to amplify or quantify their meaning.



6.3 Comparisons

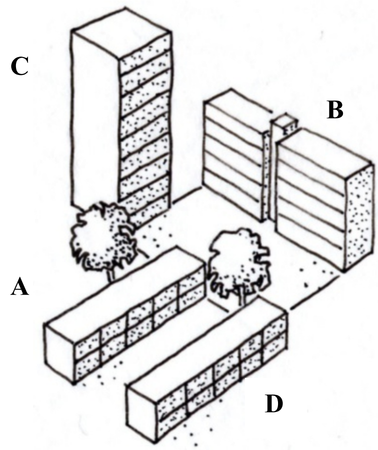
Usually a design does not consist of just one element, but of several. Pointing out the relationships between the various elements helps the listener to gain a better understanding of the overall appearance. Making a comparison is an easy method to *emphasise* a difference.

Adjectives have three forms of comparison: positive, comparative and superlative.

Building A is tall. (positive adjective)

Building B is taller. (comparative adjective)

Building C is the tallest. (superlative adjective)

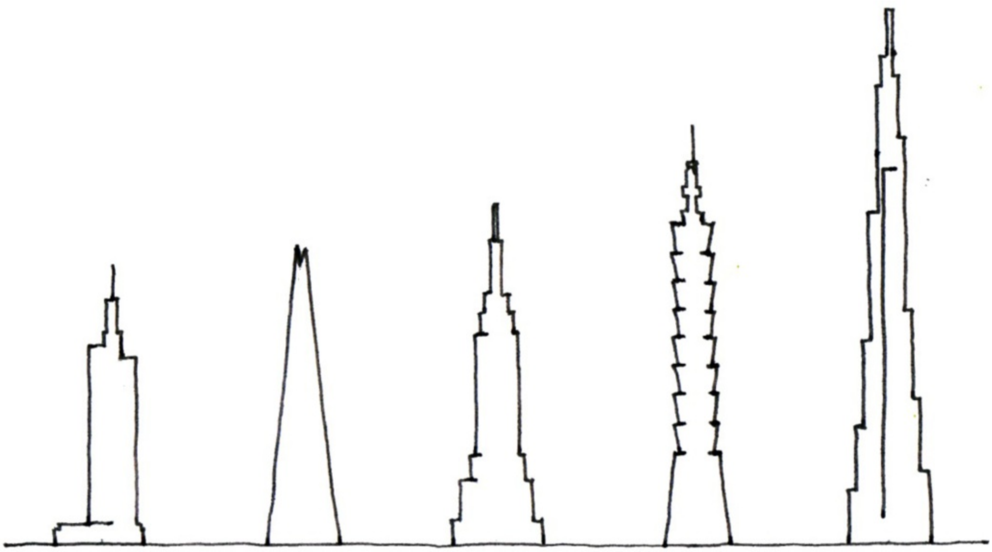


If we compare two elements, we use **than** in the comparison:
Building B is taller than building A.
If we compare more than two elements, we use **the** in the superlative:
Building C is the tallest of the three.
If we compare two elements that are the same, we use **as …… as**:
Building A is as tall as building D.
There are various groups of adjectives. The following table shows how the comparative and superlative forms depend on the structure of the positive form.

Form	Positive	Comparative	Superlative	Note
one syllable	tall	taller	tallest	add -er/-est
two syllables, ends in -y	busy	busier	busiest	change -y to -i and add -er/-est
one syllable, ends in -e	wide	wider	widest	add -r/-st
one syllable, ends in t or g	big	bigger	biggest	consonant is doubled
two or more syllables	interesting	more interesting	most interesting	add more and most
exceptions	good bad little far	better worse less further	best worst least furthest	

6.3.1 Exercise: Comparisons

Use the information below to complete the following exercise.



Commerzbank Tower Frankfurt, Germany	The Shard London, England	Empire State Building New York, USA	Taipei 101 Taipei, Taiwan	Burj Khalifa Dubai, United Arab Emirates
Completed: 1997	Completed: 2012	Completed: 1931	Completed: 2004	Completed: 2010
Height: 259 m	Height: 310 m	Height: 381 m	Height: 509 m	Height: 828 m

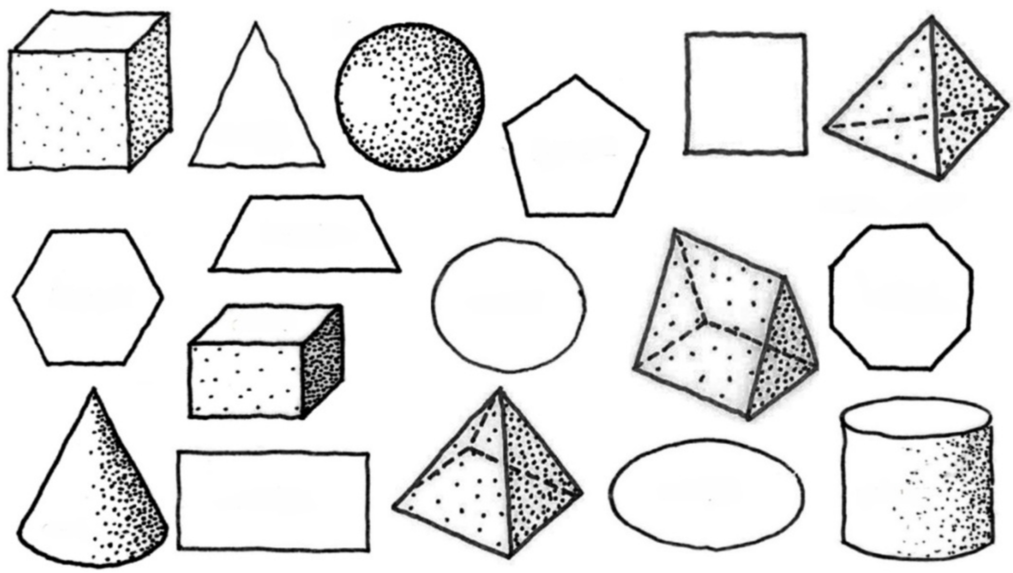
Up until January 2010, Taipei 101 in Taiwan was ….…………. (tall) building in the world. It was designed to look like a bamboo stalk; it possibly has ….…………. (distinct) shape of all the skyscrapers above. Now the skyscraper, Burj Khalifa, with a height of 828 m, towers above the rest of the world’s skyscrapers. It not only has ………………. (large) number of floors in the world, it also has ….…………. (high) mosque with a place on the 158th floor. The Shard in London is ….…………. (tall) building in Western Europe. It is approximately 50 metres ….…………. (tall) than the Commerzbank Tower in Frankfurt and has almost twice as many lifts. The Commerzbank Tower is ….…………. (high) building in Germany, but ….…………. (low) of all the buildings mentioned above. The Empire State building in New York is one of ………..……. (ancient) skyscrapers. It is not even half……….………. (tall) the Burj Khalifa building, but it is a lot ……….………. (famous).

6.4 Shapes

The appearance of a building is not only characterised by its dimensions and proportions but also by its shape. Some shapes are very straightforward like a *cube* or a *rectangle*. Others are slightly more difficult and require language skills to be described. We often use letters or appearances in nature – like L-shaped or *egg-shaped* – to describe a design to a client. The following vocabulary and expressions should help you to prepare a precise presentation.

6.4.1 Standard shapes

Match the terms and shapes shown below. Some are two-dimensional and others are three-dimensional. A dot has only got one dimension.



rectangle · ellipse · cuboid · cube · octagon · triangle · circle · sphere · pentagon · cylinder
pyramid · square · trapezium · cone · hexagon · triangular prism · tetrahedron

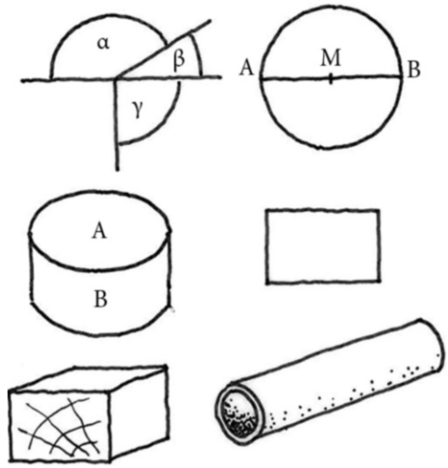
Instead of using a noun to describe the shape of a building, an adjective is often more elegant, e.g. the building is a cube may be changed to it's a cubic building. Sometimes the pronunciation differs between the noun and the adjective and the stress is on another syllable, e.g. '**oc**tagon and oc'**ta**gonal. Note that not all adjectives are formed in the same way.

The panel is a rectangle.	– a rectangular panel
The pool is an ellipse.	– an elliptical pool
The floor plan is an octagon.	– an octagonal floor plan
The window is a circle.	– a circular window
The rooms are arranged in a line.	– a linear arrangement
The roof is a cone.	– a conical roof

6.4.2 Descriptive terms

The following vocabulary is also related to dimensions, angles and surfaces.

curved · acute · perimeter · flat · obtuse · hollow
right · solid · circumference · diameter · radius



1. α is an …………… angle; β is an …………… angle; γ is a …………… angle.
2. AM is the …………… of the circle; AB is the …………… ; the total length of the circular line is called ……………
3. The outline of a rectangle is called …………
4. Surface A of the cylinder is ……………; surface B is ……………
5. A block of wood is ……………; a tube is ……………

6.4.3 Descriptive expressions

Sometimes the shape of a structure is so obvious, that we use a letter, a shape or an element from nature to describe it. Some descriptions, such as shaped like a *horseshoe*, *U-shaped* or looks like a ship, are used quite frequently. Similarly, the building configuration can be described as a *maze* or the layout of buildings as a *jigsaw*.

There is no limit to the number of possibilities. Some appearances have even given buildings nicknames. To name just a few, the Congress Hall in Berlin, the American contribution to the International Building Exhibition in 1957 designed by Hugh A. Stubbins, which is nicknamed "Pregnant Oyster" or 30 St. Mary Axe in London, designed by Norman Foster, which is now known as "The Gherkin".

Here are some useful expressions to describe the appearance of a structure:

It resembles …	It is shaped like a …	It has *similarities* with …
It looks like …	It appears as ….	It is similar to a …
It is …-shaped.	It is comparable with …	It is arranged as a …

6.4.4 Exercise: Description

Read this text and underline all the descriptive terms. Try to imagine what the building looks like and make a sketch.

The main building is a rectangular, *two-storey* structure with a *mono-pitched roof*. A smaller rectangular one-storey structure *protrudes* at a *right angle approximately* a third of the way along the longer and taller side of the larger element. From a *bird's eye view* it looks like a T with differing lengths. The smaller element is a single-storey structure with a flat roof. There are no organic shapes or circles; the right angle *prevails*.

You can practise this activity of characterising shapes at any time. Look at things when you are out and about and try to find the right words to describe them.

6.5 Roofs

The roof, the top covering of a building, is a universal element found in all structures. Its purpose is to protect the building from the effects of the weather. Primarily this means to shed water off the building and to prevent it from accumulating on top. Depending on the location of the building it may also be required to prevent *heat loss*. Nowadays, solar panels are installed in *roof areas* in order to provide electricity for the inhabitants of the building.

The roof areas with the *roof covering* can be detailed in many different ways. There is a major distinction between *roof sealing* for flat or *low-pitched roofs* and *roofing* for *pitched roofs*. *Bituminous materials* are used to seal flat or low-pitched areas most commonly found on industrial and commercial type structures. Materials for pitched roofs range from *roofing tiles*, *corrugated roof panels*, *zinc sheet* to *thatching*.

6.5.1 Roof shapes

Roof shapes not only have a significant effect on the appearance of a building, they also determine how well the structure can withstand certain elements. The slope of a roof and its *overhang* system are often dictated by the climate. This phenomenon leads to specific styles becoming dominant and characteristic for certain regions.

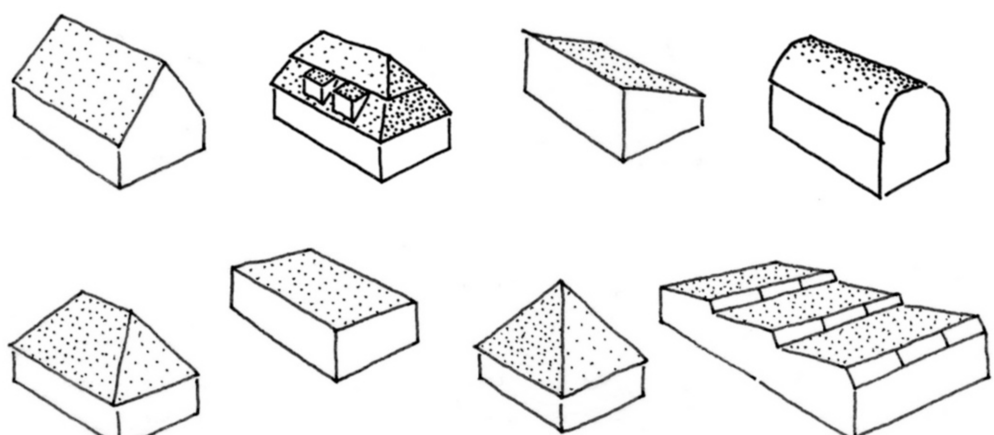
Connect the roof descriptions with the appropriate drawings.

flat roof with one horizontal surface

single- or mono-pitched roof with one inclined surface

tent roof with 4 identical surfaces forming a point at the top

gable roof or saddle roof with two usually identical surfaces



mansard roof with 2 slopes per side, the lower almost vertical, named after French architect Francois Mansart (1598-1666)

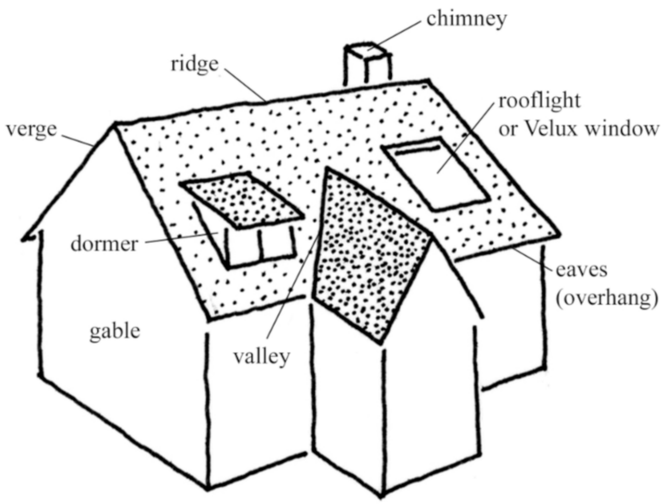
the profile of the sawtooth roof looks like the teeth of a saw

a hip roof is similar to a gable roof, except that the gables are also inclined

barrel roof with a semi-cylindrical section

6.5.2 Roof parts

The *pitch* of the roof, the roof covering and the overhang with the *verge* and the *eaves* all have an impact on the external appearance of a building. The roof elements can also tell you something about the use and character of the interior space.



6.6 Doors and windows

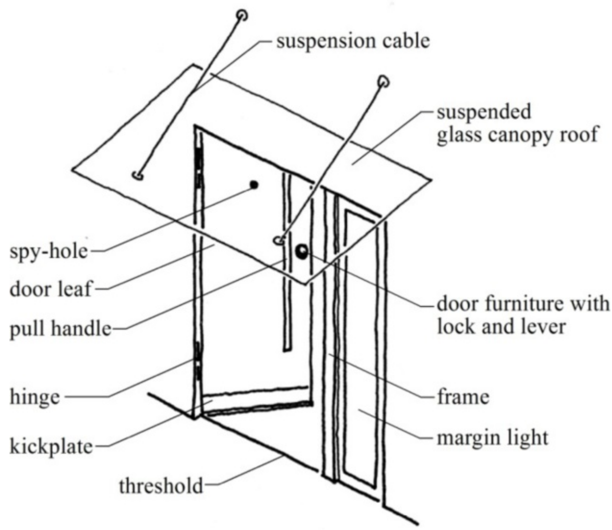
All doors and windows are a form of penetration through the interior and exterior walls of buildings. Whereas doors provide access, windows provide light. Their significance in structuring the facade is indisputable. There are many examples throughout the world where architects have applied different window and door formats to the same volume – the differences and effects are remarkable.

Glass is not only a thermal insulator – despite windows always being the weak point in the skin – it also enables light to penetrate and flow into the rooms beyond. There is a connection, a link, despite the barrier of *single, double or even triple glazing*. Depending on the size of the elements, a fully glazed wall enhances the transmission of light; punctuated or pierced walls allow only a reduced amount to enter or offer a very specific view to the outside. Roof lights or *skylights* let in a lot of light, do not, however, offer a view.

The importance of daylight for our well-being is often underestimated. As psychological research has shown, this is not limited to ventilation and a sense of openness. The ability to feel time elapse and observe the weather are also extremely significant factors. Other than windows, methods to introduce natural light include *sun tube lights* – simple tubes set into the roof, which collect and reflect daylight into the building.

6.6.1 Doors

Doors provide access to the building as well as passages within the interior space. They should be large enough to cater for an appropriate number of people and accommodate the movement of furniture and equipment. Exterior doors should provide weathertight seals when closed and similar insulation values to the walls they penetrate. All doors have to meet the requirements for fire resistance and escape routes. Since doors and window units are normally factory-built, manufacturers have introduced standard sizes. The *rough openings* correspond to these dimensions.

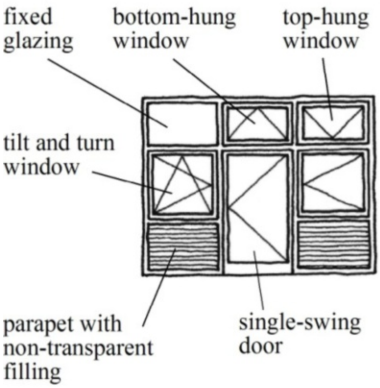


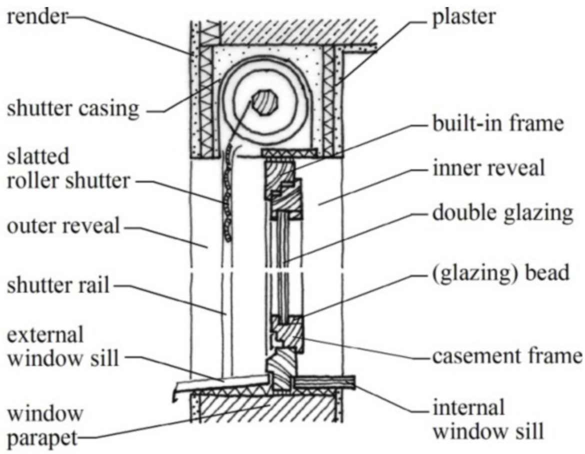
Main entrance doors to residential buildings tend to be solid core doors either with a *flush* finish or any number of glass inserts or panels. They are more solid than interior doors which are normally lightweight with hollow cores. Most of the latter are *single-swing doors*. Entrances to public buildings often have glass entrance doors made of *single-pane safety glass*. There may be a single door, a *revolving door* or a storefront, which folds away and becomes invisible during opening hours. These doors can be frameless with minimal door furniture such as hinges, *closers*, *panic hardware*, *push-and-pull bars* or *handles* and locks.

6.6.2 Windows

There are many types and sizes of windows. The choice not only affects the appearance of a building, but also the entrance of natural light, ventilation, view and the quality of the interior space. Good windows should be weathertight, provide good heat and sound insulation, be easy to open, close and clean and provide a maximum amount of light, which requires narrow frames.

Generally windows can either be placed flush with the exterior wall, protrude beyond it or set at varying depths into the rough opening. The most frequently applied window in Germany is the *tilt-and-turn window*, which opens to the inside. Builders in the UK very often use a combination of *side-hung* and *top-hung windows* which open to the outside. S*ash windows* also used to be common. Windows can be arranged as single-light or two-light windows, as *strip* or *ribbon windows*.





Despite their natural charm, wooden window frames are today often replaced by PVC or aluminium. Not only do these frames require less maintenance, they can also be easily shaped and configured to meet the client's needs. Aluminium or even steel is more suitable for fully glazed facades.

Larger buildings are often provided with *framed glazing* or *curtain walls*. These large glass surfaces are interrupted by narrow *mullions* (vertical element) and *transoms* (horizontal element). The glazed areas can be substituted by different materials to create closed areas in the facade. *Cable net walls* make do without frames and employ *laminated safety glass*. They transfer the horizontal wind loads to the main building structure by using *spider fittings*.

6.6.3 Shading devices

Wherever there is an opening, there should also be a device to reduce sun, glare and provide privacy. Generally, these can be fitted internally or externally. However, external shading is more effective at reducing solar heat gain than internal shading.

In contrast to Germany where roller shutters are regularly installed, residential buildings in the UK often suffice with *curtains* or blinds, either a *roller blind*, which is a sheet of cloth on a spring roller, or a *Venetian blind* made of horizontal slats, which overlap when closed. In Germany this is a “Jalousie”. In English, however, a *jalousie* is a window with overlapping panes that can be tilted to allow ventilation. *Window shutters* are fitted to the outside of a building. These may include a filling of horizontal slats and either turn on hinges, slide in front of the windows or even fold away.

Over the years, the word *louvre* (AE louver) has changed slightly in its meaning. It originally comes from the French word “ouvrir”, meaning to open in English, and describes the horizontal openings in a panel to let in light. Therefore the horizontal slats in shutters, windows or doors can also be termed louvres. However, today we tend to think of larger elements fitted to the outside of a building. Louvre units are either fitted parallel to the facade, the distance can vary from a few centimetres to almost a metre, or protruding horizontally above each floor, like a roof overhang, in order to keep out the steep summer sun. Louvres are usually made of aluminium and wing-shaped for optimal solar effectiveness.

6.7 Circulation

The circulation within a building does not necessarily affect the exterior appearance. It does, however, influence the internal organisation of space, the structural system and the layout of heating, plumbing and electrical systems. Corridors and *halls* provide access within a single level; stairways provide access from one level to another. Whether tucked away in a small enclosure or designed as a major feature, a stairway is indispensable in a multi-storey building and always takes up a significant amount of space.

Single family homes usually have a single stairway; multi-storey buildings require sufficient staircases to meet fire protection requirements and *elevators* to move people, equipment and freight from one floor to another. For accessibility by persons with disabilities, federal regulations require *barrier-free developments*. Statuary requirements cover items such as the provision of elevators and ramps rather than steps at entrances, with *gradients* and lengths specified. Many public buildings have *escalators* to move large numbers of people efficiently and comfortably between floors.

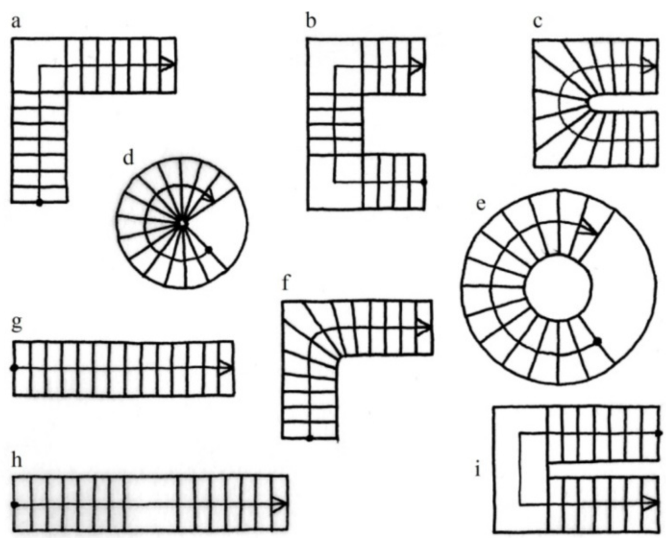
6.7.1 Stair layout

Since most stairways are an essential part of the emergency system, their design is regulated by the building code. The regulations include the width, the pitch, the dimension and ratio of *risers* and *treads*, the *landings* and, not to be overlooked, the *handrails* and *banisters*.

The most frequently applied stair layout is the *half turn stair*, also called *dog leg* as it resembles the hind leg of a dog. Its layout is efficient on use of space, is safe because it has no winding elements, merely 180° turns, and relatively short *stair flights*. If separate emergency exits are provided, the architect has greater latitude to create sculptural stairways.

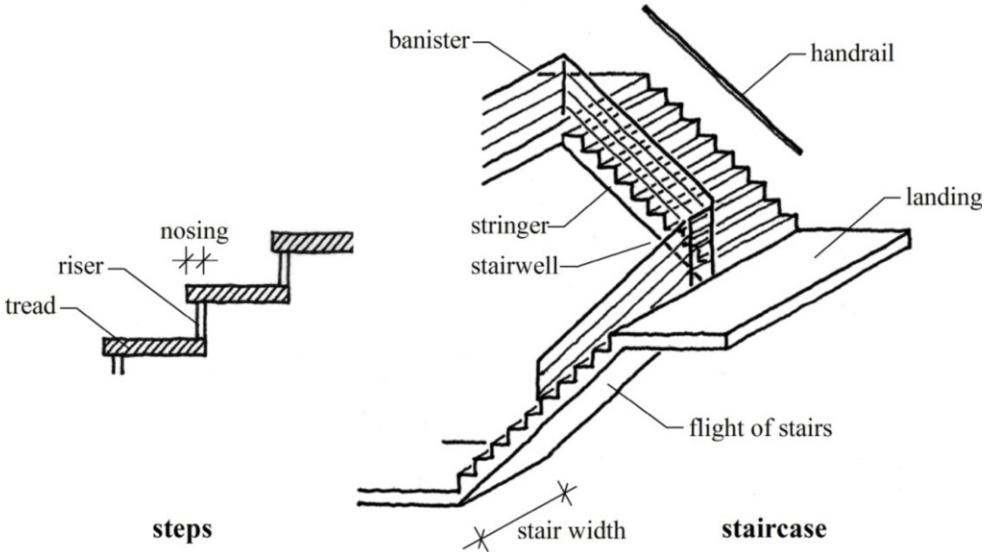
Apart from the dog leg stair, there are many more layouts. Connect the terms below with the appropriate stair layout.

1. Straight flight stair or single run stair
2. Straight flight with landing
3. Half turn stair or dog leg stair
4. Three quarter stair
5. Quarter turn with winder or single winder stair
6. Spiral stair
7. Helical stair with open stair well
8. Half turn stair with winder or double winder stair
9. Quarter turn stair



6.7.2 Stair design

There are some basic rules that should always be observed in stair design. For example, all risers in a flight of stairs should have the same height and all treads should have the same depth. The *rise and run ratio* in residential buildings should be approximately 19/25 cm. Stairways only used for maintenance can be steeper, whereas stairways in theatres or outside can have a pitch of around 20°. They require a handrail if there are more than three steps. Especially if children are expected to be using the stairway, banisters should be designed in such a way that they are difficult to climb and all gaps should be smaller than 12 cm.



6.8 Vocabulary

6.1	massing	Massenverteilung, Ausmaße
	appearance	Erscheinung
	self-explanatory adj	selbsterklärend
	painting, to paint	Gemälde
	drawing, to draw	Zeichnung
	to draft	Zeichnen, entwerfen
	to take a virtual walk	einen virtuellen Spaziergang machen
	compilation of sth	Zusammenstellung von etw.
	to-scale illustration	maßstabsgetreue Darstellung
	rough sketch	grobe Skizze
	scale	Maßstab
	material samples	Bemusterung
6.2	proportions	Verhältnisse
	cubage	Kubatur, umbauter Raum

	width n; wide adj	Breite, breit
	depth n; deep adj	Tiefe, tief
	height n; high adj	Höhe, hoch
	length n; long adj	Länge, lang
	gross floor area	Bruttogeschossfläche
	covered area	überbaute Fläche
	relation	Verhältnis
	ground space index (GSI)	Grundflächenzahl
	volume method (of construction cost estimate)	Kostenschätzung nach umbautem Raum
	net floor area	Nettogeschossfläche
	excluding external walls	Außenwände ausgenommen
	to let	vermieten
6.2.1	ribbon window	Fensterband
6.2.2	shortness	Kürze
	shortage	Mangel, Knappheit
	drought	Trockenperiode, Dürre
6.3	to emphasise	betonen
6.4	cube, cubic adj	Würfel
	rectangle, rectangular adj.	Rechteck
	egg-shaped	eierförmig
6.4.1	pentagon, hexagon, octagon	Fünfeck, Sechseck, Achteck
	sphere, spherical adj.	Kugel
	triangle, triangular adj	Dreieck
	trapezium BE, trapezoid AE	Trapez
	cone, conic or conical adj	Kegel
	cuboid, cuboidal adj	Quader
	tetrahedron	Tetraeder
6.4.2	diameter	Durchmesser
	circumference	Kreisumfang
	perimeter	Umfang
	hollow	hohl
	obtuse angle	stumpfer Winkel
	acute angle	spitzer Winkel
	right angle	rechter Winkel
6.4.3	horseshoe	Hufeisen
	U-shaped	U-förmig
	maze, labyrinth	Irrgarten, Labyrinth
	jigsaw	Puzzle
	to resemble	ähneln, gleichen
	similarity/ies	Ähnlichkeit/en

6.4.4	two-storey adj	zweigeschossig
	mono-pitched roof (single-pitched roof)	Pultdach
	to protrude	herausragen, vorstehen
	approximately	ungefähr
	bird's eye view	Vogelperspektive
	to prevail	überwiegen, vorherrschen
6.5	heat loss	Wärmeverlust
	roof areas	Dachflächen
	roof covering	Dacheindeckung
	roof sealing	Dachabdichtung
	low-pitched roof	Dach mit leichtem Gefälle
	roofing	Dachdeckung
	pitched roof	geneigtes Dach
	bituminous materials	bituminöse Materialien
	roofing tile	Dachziegel
	corrugated roof panel	Welldachplatte
	zinc sheet	Zinkblech
	thatching	Strohbedachung
6.5.1	overhang	Ausladung, Überhang
	tent roof	Zeltdach
	gable roof	Giebeldach
	saddle roof	Sattledach
	mansard roof	Mansardendach
	sawtooth roof	Sheddach
	hip roof	Walmdach
	barrel roof	Tonnendach
6.5.2	pitch	(Dach-)Neigung
	verge	Ortgang
	eaves	Traufe
	ridge	First
	gable	Giebel
	valley	Kehle
	chimney	Schornstein
6.6	single/double/triple glazing	Einfach-/Doppel-/Dreifachverglasung
	skylight	Oberlicht
	sun tube lights	Tageslichtspot
6.6.1	rough opening	Rohbauöffnung
	suspension cable	Tragseil, Kabelaufhängung
	glass canopy roof	Glasvordach
	door furniture or door hardware	Türbeschläge
	lever	Griff

	margin light	Seitenverglasung
	threshold	Türschwelle
	kickplate	Trittblech
	hinge	Scharnier
	pull handle	Griffstange
	door leaf	Türblatt
	spy-hole	Spion
	flush adj	flächenbündig, glatt
	single-swing door	Drehflügeltür
	single-pane safety glass BE, tempered glass AE	Einscheibensicherheitsglas ESG
	revolving door	Drehtür
	door closer	automatischer Türschließer
	panic hardware	Panikbeschläge
	push-and-pull bar	Griffstange
	door handle	Klinke, Türdrücker
6.6.2	tilt-and-turn window	Drehkippfenster
	side-hung window	Drehflügelfenster
	top-hung window	Klapp(flügel)fenster
	sash window	Schiebefenster
	strip or ribbon window	Fensterband
	roller shutter	Rollladen
	reveal	Laibung
	shutter rail	Rolladenführungsschiene
	window sill	Fensterbank
	glazing bead	Glashalteleiste
	casement frame	Flügelrahmen
	built-in frame	Blendrahmen
	window parapet	Fensterbrüstung
	framed glazing	Pfosten-Riegel Fassade
	curtain wall	Vorhangfassade
	mullion and transom	Pfosten und Riegel
	cable net facade	Seilnetzfassade
	laminated safety glass	Verbundsicherheitsglas VSG
	spider fitting	Glashalterung
6.6.3	curtain	Gardine
	roller blind	Rollo
	Venetian blind	Jalousie
	jalousie window	Lamellenfenster
	window shutter	Fensterladen
	louvre BE, louver AE	Lamelle

6.7	corridor	Gang, Flur oder Korridor
	hall	Diele
	elevator	Aufzug
	barrier-free development	barrierefreies Bauen
	gradient	Neigung
	escalator	Rolltreppe
6.7.1	riser	Setzstufe
	tread	Trittstufe
	landing	Zwischenpodest
	handrail	Handlauf
	banister	Geländer
	half turn stair or dog leg stair	zweiläufig, gegenläufige Treppe
	stair flight	Treppenlauf
	straight flight stair or single run	einläufige gerade Treppe
	quarter turn stair with winder	viertelgewendelte Treppe
	spiral stair	Spindeltreppe
	helical stair	Wendeltreppe
6.7.2	rise and run ratio	Steigungsverhältnis
	nosing	Stufenüberstand
	stairwell	Treppenauge
	stringer	Wange

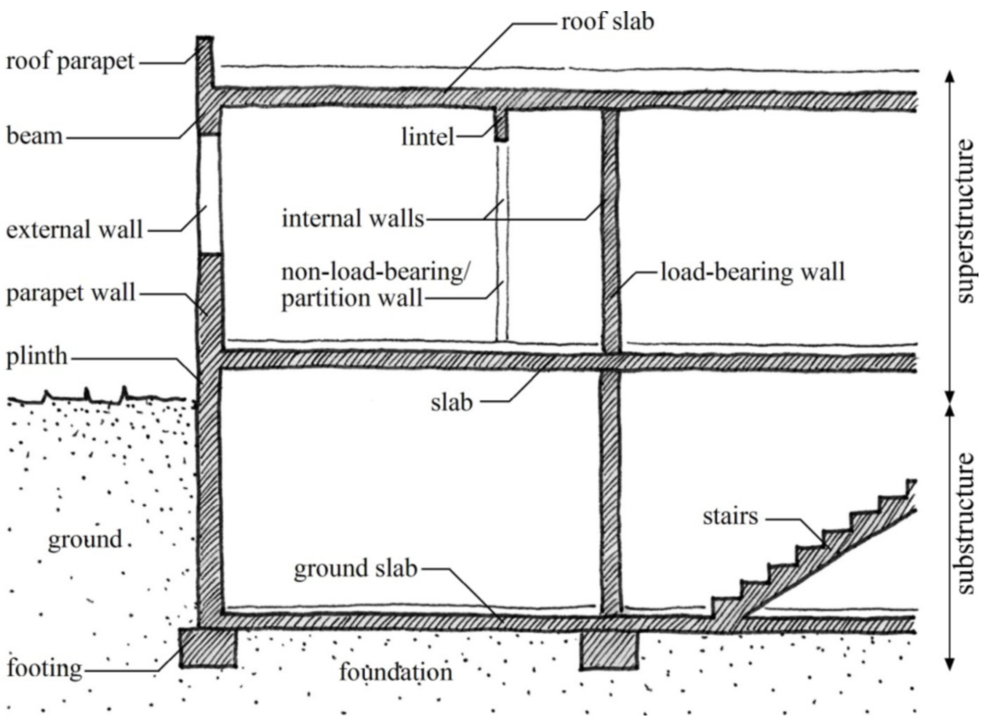
7 Structural Design

7.1 Structural systems

The structural system of a building is designed and constructed to support and transmit the applied gravity and lateral loads safely to the ground without exceeding the allowable stresses in its members. It is a configuration of components that are dependent on one another and act together in a framework.

The *superstructure* is the vertical extension of a building above the ground. It includes all *columns* and *beams* and *load-bearing walls* supporting the floor and roof structures. The *substructure* is the underlying structure forming the *foundation* of a building.

No matter whether the *carcass* is *masonry*, a timber or a steel frame, all structural elements and their interaction form the structural framework of the building. No single element alone is responsible for the supporting structure, but the combination of members together with the *configuration of joints*.



S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_7

7.1.1 Structural elements

Elements can be distinguished according to their *alignment*, vertical or horizontal members, according to their configuration, *bar structure or panel system*, or according to their *effectiveness*. The correct choice and dimensioning of elements prevent *deformation* and ensure the stability of the structure.

Vertical members

wall	a vertical panel
pillar	another word for column; usually applied for square or rectangular columns, which are integrated in walls
column	vertical member supporting a roof or beam; in Greek temples, there is a differentiation between e.g. Doric and Corinthian ones
post	a slender light support
stud	a vertical steel or timber member used in framing
pier	provides substantial support to the substructure

Horizontal members

slab	a horizontal panel
beam	a horizontal bar; these can be divided into upstand and downstand beams
truss	a framework comprising several members in triangular units to span great distances
girder	a main beam
joist	a horizontal supporting member that runs from wall to wall, or beam to beam; typically it is smaller than a beam
lintel	a horizontal beam usually supporting the masonry above a window or door
cantilever	a beam only supported on one end; it allows for overhanging structures without external bracing

7.1.2 Connections

All structural members forming *rigid* constructions have to be connected in one way or another. Depending on the method used, it is either referred to as a *bond* for *glued connections*, a joint, *hinge* or *link* for connections allowing some movement.

In steel construction, there are three main connection methods, namely *riveting*, *bolting* and *welding*. For riveting, which is the least common nowadays, a rivet is hammered into aligned holes. When bolting two members, a bolt is pushed through the aligned holes and a *nut* is *threaded* on and tightened with a *spanner*.

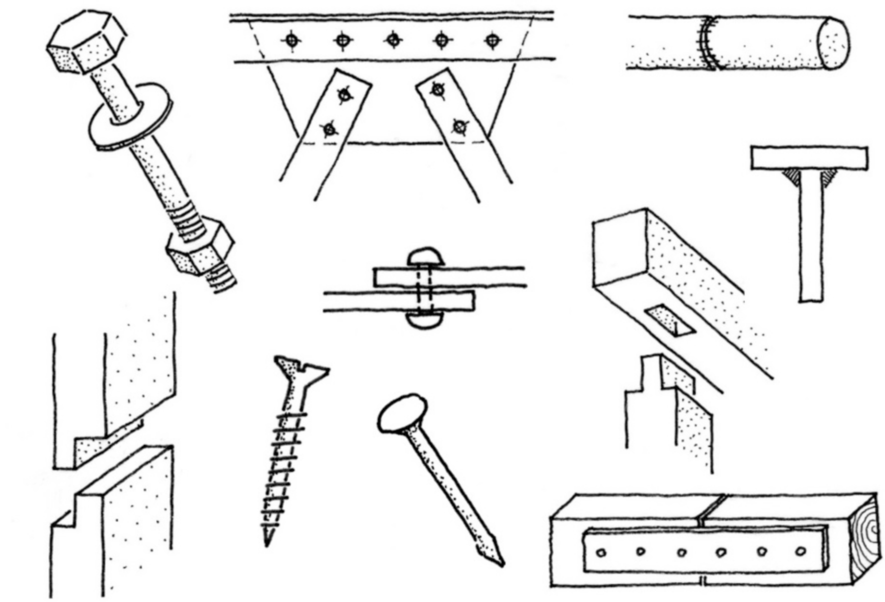
Many joints, especially those made *in shop*, are welded. Welding joins metals by melting and fusing. There are two basic types, the *butt weld*, which is employed to join parallel members, such as pipes, and the *fillet weld*, which is used to connect a vertical to a horizontal member.

Splice and *gusset plates* are used to connect timber as well as steel. More traditionally *carpentry connections* are applied in timber construction. The most frequently used are the *tongue and groove* connection for fitting boards in one plane, especially in flooring and panelling. *Mortise and tenon* is a method used to connect two timber members at an angle close to 90°. The mortise is the cavity cut into a timber to receive the tenon.

7.1.3 Exercise: Connectors

Label the following diagrams depicting methods for connecting structural elements.

nut and bolt · gusset plate · screw · nail · scarf joint mortise and tenon · butt weld · rivet · fillet weld · splice



7.2 Statics

Statics is a branch of mechanics concerned with the analysis of *forces* acting on a system. Each system has to be designed in such a way that it can withstand the forces. This state is called *equilibrium*. Buildings and structures are subject to a range of different loads – static and dynamic. The task of the structural engineer is to determine all the forces acting on the static system and to establish the *bearing pressure* in order to fulfil the conditions of equilibrium. The total of all forces and moments has to equal zero.

Building statics does not refer to the whole building, but the structural systems within. In order to calculate the *bearing capacity*, the structures are categorised and calculated according to established methods. The structural engineer also requires knowledge about the strength of materials in order to determine the right *strength properties* and the correct dimensions.

To become a structural engineer, one usually studies civil engineering, which, in addition to structural engineering, also covers *transportation engineering*, *water resources engineering*, *materials science*, *municipal* or *urban engineering*, etc.

7.2.1 Loads

Loads can effectively be divided into two categories: static and dynamic. Static loads are applied slowly to a structure without fluctuating rapidly in magnitude or position. Dynamic loads, on the other hand, are applied suddenly, often with a rapid change in magnitude and point of application. The two major types of dynamic loads are wind and earthquake loads.

The *permanent load or dead load* is the weight of the bearing structure itself including all permanently connected building elements, such as *screed* on the floor slabs or roof tiles on the *rafters*.

The *imposed load or live load* is a collection of changeable forces acting on the structure, such as the loads resulting from occupancy, which includes furniture, machinery and people, but also the loads resulting from collected snow or water, and ground pressure.

Loads can also be differentiated according to the way in which they act. A *concentrated load* acts on a very small area or particular point of a supporting structural element, e.g. a beam resting on a column or a post on its footing. A *uniformly distributed load* can either be a linear or an area load. Area loads are often applied to roofs or ceilings. Linear loads are calculated for each metre of structure, e.g. beams or strip foundations. The total load is the sum of all loads imposed on the member concerned.

The aim is to design and plan safe structures, therefore it is necessary to consider the possibility of loads developing in unfavorable ways, e.g. the self weight of a structural member can increase due to moisture. This problem can be solved by multiplying the loads with the appropriate *safety factors*.

7.2.2 Forces

All building components are designed to bear and transfer loads to the supporting elements. The reaction of the member is determined by the internal forces at a cross section:

- **Compression** is a pressing force that causes a structural member to shorten. The member, subject to the compressive load, can crush. When long, slender members are loaded in compression, they fail by *buckling*.
- **Tension** is a pulling force, which causes a member to stretch. Concrete has no reliable tensile strength. A steel bar, on the other hand, subject to a tensile load, will lengthen. Tensile stress is the opposite of compressive stress.
- **Shear** is the force acting parallel to the surface or axis of the material. Shear can be differentiated according to longitudinal and transverse shear.
- **Torsion** is the force that causes a member to twist.

Depending on the way in which theses forces act, the member deforms. Beams are designed to bear and transfer loads across space to supporting elements. Forces subject a beam to bending and *deflection*.

7.2.3 Modulus of elasticity

The modulus of elasticity, also referred to as the Young Modulus, named after Thomas Young (1773 – 1829), is a measure that indicates how a material will deform under *stress*. *Deformation* varies according to the material, the load and the stress. The ability to resist or transmit stress is important, and this property is often used to determine if a material is suitable for a particular purpose.

The modulus of elasticity defines the relationship between tensile stress and tensile *strain*. Stress is defined as a force applied over a unit area expressed as newton per square millimetre (N/mm^2), which is equal to pascal (Pa). Strain is dimensionless and a measure of the degree of deformation – change of length divided by the original length. The modulus of elasticity is based on Hooke's Law and can be calculated by dividing stress by strain.

$$\mathbf{E} = \frac{\textbf{tensile stress}}{\textbf{extensional stress}} = \frac{\sigma}{\varepsilon} = \frac{F/A_0}{\Delta L/L_0} = \frac{FL_0}{A_0\,\Delta L}$$

E is the modulus of elasticity

F is the force applied

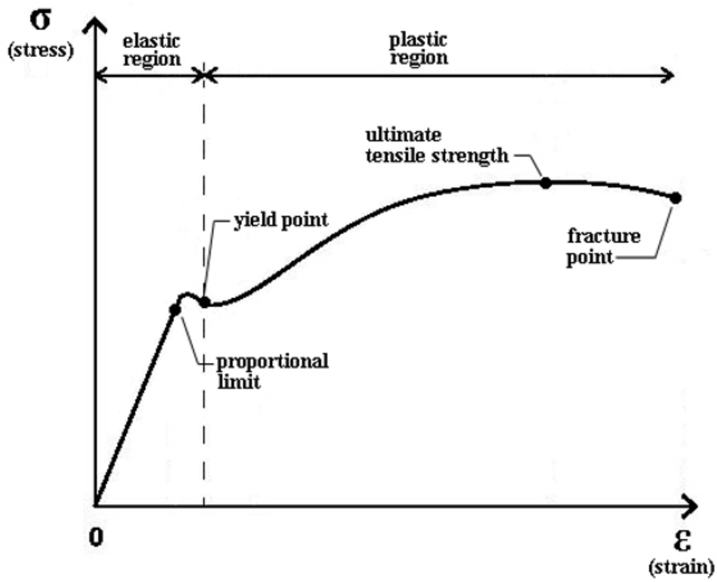
A_0 is the *cross-sectional area*

L_0 is the original length of the object

ΔL is the change of length

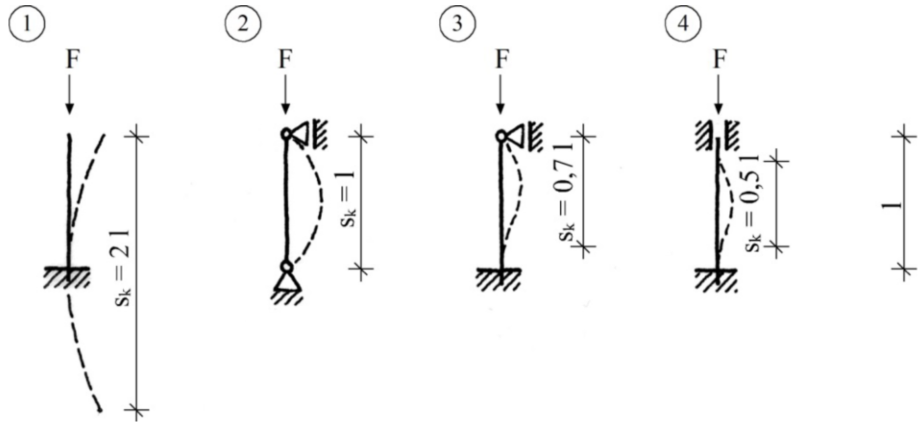
The behaviour of steel is best explained in a *stress-strain graph*. At first, when stress is increased, the object obeys Hooke's law and the stress-strain relationship is linear and elastic. Just before the plastic region is reached the *proportional limit* is met. The behaviour beyond this point is no longer linear, but the stretching is still elastic. After the *yield point*, the steel enters the plastic deformation region, which means that the deformation is permanent. At the *fracture* point the steel snaps.

Differences in the shapes and limits of the stress-strain diagram determine whether a material is considered ductile or *brittle*, elastic or plastic. The modulus of elasticity for soft-wood is 10,000 N/mm^2; that of steel is 210,000 N/mm^2.



7.2.4 Buckling

Slender posts, pillars and walls are subject to buckling. In addition to the type of section and the material, the *slenderness ratio* and the nature of the end supports are also important. The long established Euler formula for buckling stress is still in use today.



The buckling length (s_k) is calculated by multiplying the length (l) with the effective length factor (k).

Case	Column base	Column head	Factor (k)
1	fixed	free to rotate	2.0
2	pinned, hinged	pinned, hinged	1.0
3	fixed	pinned, hinged	0.7
4	fixed	fixed	0.5

This formula introduced by Leonhard Euler in 1757 gives the maximum axial load that a column can bear without buckling. If the critical load is exceeded, the column will fail by buckling.

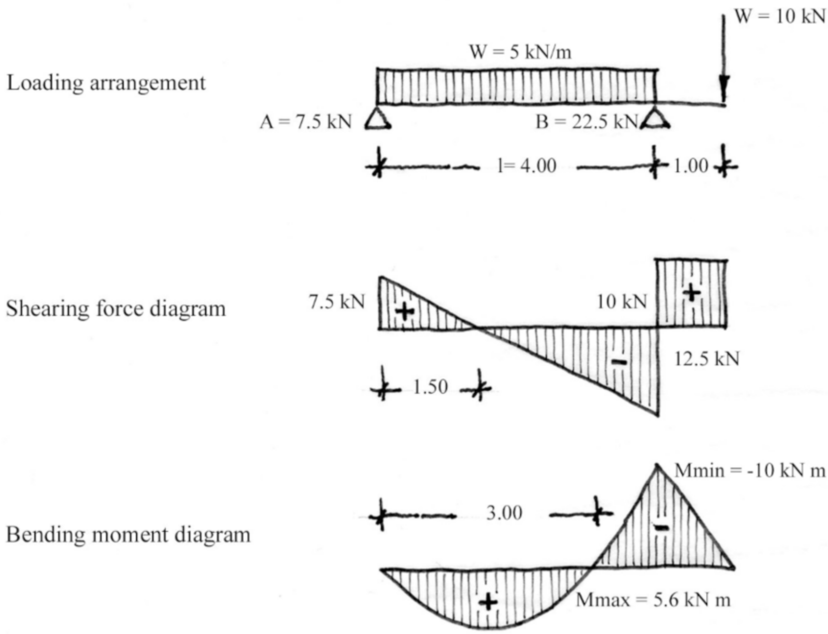
$$\mathbf{F} = \pi^2 \frac{\mathbf{EI}}{s_k^2}$$

F is the maximum or critical force (vertical load on column)
E is the modulus of elasticity
I is the *moment of inertia*
s_k is the buckling length

7.2.5 Calculations

The following diagram is an example of a structural system. It is a simple supported beam with a uniformly distributed load and a cantilever with a concentrated load imposed on the end. The *span* of the beam is 4 m; the imposed load is a uniformly distributed load of 5 kN/m; the length of the cantilever is 1 m; there is a concentrated load of 10 kN imposed on the end of the cantilever.

In order to determine the sectional area, the structural engineer will first of all calculate the reactions at the supports A and B. The loading arrangement in the following diagram shows these reaction values. Then the shear and bending diagrams are produced to identify the maximum stress. The shear force diagram indicates how shear force develops along the beam as a result of the applied load; the bending moment diagram indicates the positions of the maximum positive and negative moments. The weakest section of the beam, and therefore also the area with maximum deflection, is where the shear diagram crosses zero. Finally, the *section modulus* has to be calculated in order to determine the sectional area of the beam.



7.3 Structural frameworks

All parts of a building can be categorised according to their function. From a constructional point of view, there are horizontal elements, such as beams, lintels and floor slabs, and vertical elements, such as walls, pillars, and posts. However, in structural engineering the constructional possibilities are not of interest, far more the load-bearing elements and their structural effectiveness.

Generally we can subdivide structures according to their geometric form into *one-dimensional frameworks, two-dimensional frameworks* and *three-dimensional frameworks*.

It is not only important that a member has the necessary load-bearing capacity, it also has to prevent movement. This is fulfilled by the various supports. Symbols have been introduced to simplify difficult structural systems. They are more or less universal.


Free bearings, such as *articulated columns,* allow rotation, longitudinal and transverse movement.


Fixed bearings or *hinged supports* only allow rotation. Vertical and horizontal movements are prevented.


Fixed-end bearings do not allow any movement.

7.3.1 Beams

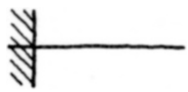
Beams are horizontal structural elements designed to carry and transfer loads across a space to the supporting elements. Beams are subject to bending; the internal strength of the material has to resist the forces. Deflection is the distance a member deviates from the true course. It increases with load and span and decreases with an increase of the moment of inertia.

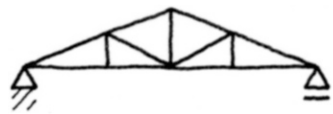
Match the following diagrams with the correct definition.

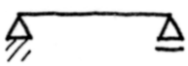
simply supported beam

truss

beam on two supports
with cantilevers

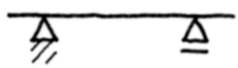






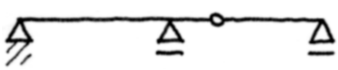
fixed-end beam

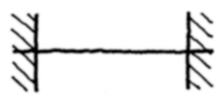
continuous girder



continuous articulated beam
also called Gerber beam

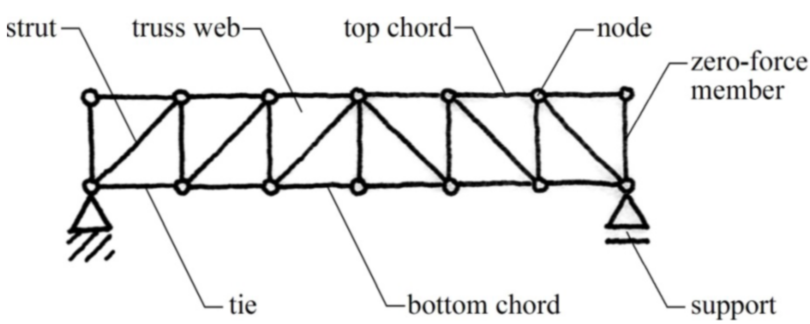
cantilever





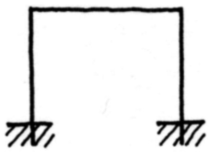
7.3.2 Truss

A truss is a structure comprising one or more triangular units constructed with straight slender members. The ends are connected at joints referred to as nodes. The external forces only act on the nodes and result in tensile or compressive forces in the members.



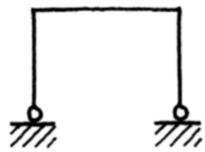
7.3.3 Frames

A beam simply supported by two columns is not capable of resisting lateral forces unless it is *braced*. If the joints connecting the columns and beam are capable of resisting both, forces and moments, then the assembly becomes a rigid frame.



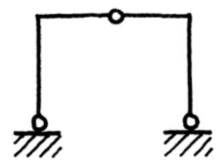
rigid frame

a statically indeterminate structure



two-hinged frame

a statically indeterminate structure



three-hinged frame

a statically determinate structure

7.4 Foundations

All the loads of a building are transferred through the building to the foundations and from there into the ground. The ground has to therefore be able to bear the load. The bearing capacity of the ground determines the type, construction and dimensions of the foundation.

The footing is extended laterally to distribute the load over a greater area of soil in order to meet the bearing capacity of the underlying soil. To minimise the effect of *frost heaving*, when groundwater freezes and expands in cold weather, building codes require that footings are placed below the *depth of frost penetration*.

- *Isolated footing* is an individual *spread footing* supporting a freestanding column
- *Strip footing* is the continuous spread footing of foundation walls.
- *Raft foundation* is a thick, heavily reinforced concrete slab that serves as a single monolithic footing for a number of columns or an entire building.

If the underlying soil is unstable or of inadequate bearing capacity, deep foundations are required. They extend down through unsuitable soil strata to transfer building loads to a more appropriate bearing stratum of rock or dense sands and gravels well below the substructure. In this case, a geotechnical engineer undertakes subsurface investigation to determine the type and scale of foundation systems required for the building design.

If the foundation system is not calculated accurately, *differential settlement* may occur. This can cause the building to shift or cracks to appear in the foundations, structure or finishes. In case of differential settlement, changes to neighbouring plots or underground, it may be necessary to *underpin* a building. Underpinning refers to the process of rebuilding or strengthening the foundation of an existing building.

When the sides of an excavation exceed the *angle of repose* for the soil, the earth must be braced or *shored* until the permanent construction is in place. Sometimes a *diaphragm wall*, a concrete wall cast in a *trench*, is erected to serve as *sheeting* or sometimes even as a permanent foundation wall. It is constructed by excavating a trench in short lengths, filling it with a *slurry* of bentonite and water to prevent the sidewalls from collapsing. Once the reinforcement has been installed the concrete is placed by using a *tremie* which displaces the slurry.

7.4.1 Lexis: Structural design

Combine a word in A with a word in B to form 10 terms used in civil engineering. Finally, choose the best definition for the term in C.

A	B	C
in	and strains	A force acting parallel to a plane.
live	capacity	Related terms defining the intensity of internal reactive forces caused by external forces.
dead	equilibrium	The active external forces are balanced with the internal forces.
stresses	force	Bending of a vertical member due to a compressive load.
bending	buckling	Load imparted by the external environment and intended occupancy or use.
shearing	concrete	The load-bearing properties of the ground.
uniformly	moment	Load generated by the weight of the structural member being considered.
bearing	distributed load	Concrete with steel mesh or bars embedded in order to increase the tensile strength.
column	load	A load imposed evenly on a load-bearing member.
reinforced	load	The result of internal forces caused by external loads.

7.5 Vocabulary

7	structural design	Tragwerksplanung
7.1	structural system	Tragsystem
	member	Bauteil
	superstructure	aufgehender Bau, Oberbau
	column	Stütze
	beam	Balken
	load-bearing wall	tragende Wand
	substructure	Unterbau
	foundation	Gründung, Fundament
	carcass	Rohbau
	masonry	Mauerwerk
	joint configuration	Gelenkausbildung
	roof parapet	Attika
	parapet wall	Brüstung

	lintel	Sturz
	slab	(Decken-)platte
	footing	Fundamentfuß
	plinth	Sockel
7.1.1	alignment	Ausrichtung
	bar structure	Stabtragwerk
	panel system	Plattenbauweise
	effectiveness	Wirksamkeit
	deformation	Verformung
	post	Pfosten, Stiel
	stud	Ständer
	pier	Pfahl
	upstand/downstand beam	Über-/Unterzug
	truss	Fachwerkträger
	girder	Träger, Binder
	joist	Deckenbalken
	cantilever	Kragarm
7.1.2	rigid adj	biegesteif
	bond	Verbund
	glued connection	Klebeverbindung
	hinge	Gelenk
	link	Verbindungsglied
	riveting	Nieten
	bolting	Verschrauben
	welding	Verschweißen
	nut and bolt	Schraube und Mutter
	thread	Gewinde
	spanner	Schraubenschlüssel
	in shop	in der Werkstatt
	butt weld	Stumpfnaht
	fillet weld	Kehlnaht
	splice plate	Stoßblech
	gusset plate	Knotenblech
	carpentry connection	Zimmermannsverbindung
	tongue and groove	Nut und Feder
	mortise and tennon	Zapfen und Zapfloch
	scarf joint	Verblattung
7.2	force	einwirkende Kraft
	equilibrium	Gleichgewicht
	bearing pressure	Reaktionskraft, Auflagerdruck
	bearing capacity	Tragfähigkeit, Belastbarkeit

	strength property	Festigkeitseigenschaft
	transportation or traffic engineering	Verkehrs(ingenieur)wesen
	water resources engineering	Wasserwirtschaft
	materials science	Werkstoffwissenschaften
	municipal or urban engineering	städtischer Tiefbau
7.2.1	loads	Lasten
	permanent load, dead load	Dauerlast (ständig wirkende Last)
	imposed load	Verkehrslast (nicht ständig wirkende Last)
	screed	Estrich
	rafter	Sparren
	concentrated load	Einzellast, Punktlast
	uniformly distributed load	gleichmäßig verteilte Last, Gleichlast
	safety factor	Sicherheitsbeiwert
7.2.2	compression	Druck
	buckling	Knicken, Ausbeulen
	tension	Zug
	shear	Scher
	torsion	Torsion, Verdrillung
	deflection	Durchbiegung
7.2.3	modulus of elasticity	Elastizitätsmodul
	stress	Spannung
	deformation	Verformung
	strain	Dehnung
	cross-sectional area	Querschnittsfläche
	stress-strain graph	Spannungs-Dehnungs-Diagramm
	proportional limit	Proportionalitätsgrenze
	yield point	Dehngrenze
	fracture	Bruch
	brittle adj	brüchig
7.2.4	slenderness ratio	Schlankheitsgrad
	effective length factor	Knicklängenbeiwert
	pinned, hinged adj	gelenkig verbunden
	fixed adj	eingespannt
	moment of inertia	Flächenträgheitsmoment
7.2.5	span	Spannweite
	section modulus	Widerstandsmoment
7.3	one-dimensional framework	Stabwerk
	two-dimensional framework	Flächentragwerk
	three-dimensional framework	Körpertragwerk
	free bearing	bewegliches Auflager
	articulated column	Pendelstütze

	fixed bearing/hinged support	gelenkiges Auflager
	fixed-end bearing	eingespanntes Auflager
7.3.1	continuous girder	Durchlaufträger
	continuous articulated beam	Gelenkträger
7.3.2	node	Knotenpunkt
	top/bottom chord	Ober- bzw. Untergurt
	strut	Druckstab
	tie	Zugstab
	zero-force member	Nullstab
	truss web	Fachwerk
7.3.3	to brace sth	aussteifen
	statically (in-)determinate structure	statisch (un-)bestimmt
	two/three-hinged frame	Zwei-/Dreigelenkrahmen
7.4	frost heaving	Frosthebung
	frost penetration depth	Frosttiefe
	isolated footing	Einzel- oder Punktfundament
	spread footing	Flächengründung
	strip footing	Streifenfundament
	raft foundation	Fundamentplatte
	differential settlement	ungleichmäßige Senkung
	to underpin	unterfangen
	angle of repose	Böschungswinkel
	to shore	aus- oder versteifen
	diaphragm wall BE, slurry wall AE	Schlitzwand
	trench	Graben
	sheeting	Verbau
	slurry	Schlemme
	tremie BE, tremmie AE	Betonschüttrohr

8 Building Materials

8.1 Structural materials

Most construction projects involve use of a wide range of different materials. The list is very extensive, but the main ones are clearly concrete, steel, brick, wood and glass. When designing a building or structure, the planning team must decide which materials are most suitable for the design and purpose. In most commercial and industrial structures, the primary construction material is either structural steel or reinforced concrete. The use of timber tends to be restricted to residential and some smaller scale non-residential buildings. Any finished structure is a combination of a large number of individual elements. Each has a particular purpose to fulfil and requires materials with properties designed to meet the need in the most effective way.

The main considerations to be taken into account when choosing a material are weight, strength, sustainability, fire resistance and, not to be forgotten, cost.

- **Strength-to-weight ratio**
  Construction materials are commonly categorized by their strength-to-weight ratio, also referred to as specific strength. This is defined as the strength of a material divided by its *density*. The SI unit for specific strength is pascal/(kg/m³) or more commonly Nm/kg (newton metre per kilogram).
  Materials that are light but also very strong have a high strength-to-weight ratio. Thus, the strength-to-weight ratio gives the planner an indication as to how useful the material is for a certain application. It also provides some information about cost and ease of construction. The strength-to-weight ratio of steel, for example, is 25 times greater than wood.
- **Sustainability**
  Sustainability is a fairly new consideration for building materials and it has to be borne in mind that particular items may be expected to last for generations. A sustainable material will be one that has a minimal impact on the environment, both at the time of installation as well as throughout the life cycle of usage. The *embodied energy* is an important consideration in this context. It is the sum of all the energy required to manufacture and put in place the product. According to the Inventory of Carbon and Energy prepared by the University of Bath in the UK, the embodied energy of *rigid foam polyurethane insulation* is 101.5 MJ/kg, whereas that of *straw bale insulation* is only 0.91 MJ/kg.
  The *deconstruction* of the building, and the reusability and recyclability of materials are factors to be considered during the early stages of every building project.
- **Fire resistance**
  One of the most dangerous hazards in a building is fire. Nowadays, fire codes specify exactly which materials are permitted where in each building. The *fire resistance rating* determines the duration a material has to withstand fire. The materials in turn are categorised according to their *class of inflammability*. Concrete characteristically does not pose a threat in the event of fire and even resists the spreading of fire. The strength and stiffness of steel, on the other hand, reduces significantly in the event of fire. International building codes therefore require that steel is enveloped in fire-resistant materials. Materials should also be assessed according to whether they produce smoke or toxic gases when exposed to heat. Plastics, e.g. floor coverings, are very dangerous in this respect.

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_8

- **Cost**
  The cost of the construction materials depends mainly on the availability of the materials chosen and the geographical location of the project site. Cement, aggregate, steel, etc. are commodities and the market price fluctuates according to supply and demand in the same way as, say, petrol. About half of the construction costs of reinforced concrete can be attributed to the setting up of the formwork. Structural steel tends to be sold according to weight so total costs depend largely on the volume used.

Further aspects which should be considered are, among other things, the resistance to water, in case a component is exposed to weather or used in damp environments, and the *thermal conductivity*, which is the property of a material to conduct heat. When the material is used to finish the surfaces of a room or the exterior, the colour and *texture* are also important considerations.

8.1.1 Material properties

As mentioned above, the physical and chemical properties of materials make them suitable to perform for specific roles in a construction. The aim is to select the most appropriate for the purpose in hand. The properties of every product vary and it is important to understand the advantages and disadvantages inherent in each.

Enter the following words to complete the sentences below in a meaningful way. Then find a suitable German translation for each.

durable · airtight · opaque · rigid · combustible · brittle load-bearing · malleable · monolithic · sustainable

1. A building that is well sealed and does not leak is ...	………………….	………………….
2. Structural elements that are able to support a lot of weight are …	………………….	………………….
3. Glass breaks easily. It is …	………………….	………………….
4. Before concrete sets, it is …	………………….	………………….
5. The opposite of transparent is …	………………….	………………….
6. A wall made of a single material, such as earth, is …	………………….	………………….
7. The opposite of flexible is …	………………….	………………….
8. If an object does not cause harm to our environment during its life-cycle, it is …	………………….	………………….
9. A material that burns easily is ….	………………….	………………….
10. The opposite of fragile is …	………………….	………………….

8.1.2 Environmental issues

The use of green, eco-friendly building materials is an important strategic option in the design of sustainable building. Whilst promoting the conservation of *dwindling non-renewable resources*, the most significant benefits for the building owner or occupants are improved health and comfort. This in turn increases user satisfaction and, especially in non-residential buildings, performance and productivity. By definition, integrating green building materials into construction projects should be good for the environment. Benefits vary from product to product, but may concern extraction, transportation, processing, installation, reuse, recycling and disposal.

When selecting the method, equipment and materials, it is necessary to consider not only cost and quality, but also the total impact on the environment. One of the indicators already mentioned is the embodied energy; another indicator, frequently used by manufacturers, is the *carbon footprint*. However, neither of these take into account *resource scarcity* or operating energy. Since the operating energy is usually a multiple of the embodied energy, the aim should be to choose materials that minimize the *lifecycle energy use*. It follows that a *holistic approach* should be taken to the selection of materials, including careful research into technical information, manufacturers' specifications, test data and assessments with regard to *durability* and lifecycle energy costs. An evaluation of the data gathered should identify the product with the greatest environmental benefits.

8.1.3 Green product selection criteria

Green building materials are generally composed of renewable rather than non-renewable resources. They tend to be environmentally responsible because their impact is considered for the total lifecycle of the product. Depending on the project-specific goals, an assessment of green materials should involve an evaluation of the following criteria:

- Resource efficiency is accomplished by utilising materials with a high recycled content, those harvested from sustainably managed sources (e.g. certified wood), materials with resource efficient manufacturing processes, regional products to save energy and resources in transportation to the site, reusable or recyclable materials, which can be easily dismantled, and those that are long-lasting.
- The indoor air quality (IAQ) is enhanced by using low or *non-toxic* materials, products that contain a minimal amount of *Volatile Organic Compounds (VOCs)*, ones that are *moisture-resistant* and resist or inhibit the growth of biological *contaminants*, and materials that can be maintained without an adverse effect on health.
- Energy efficiency is maximised by utilising materials and systems that help reduce energy consumption. Taking choice of windows as an example: krypton-filled or triple-glazed windows are more expensive to manufacture and feature a greater amount of embodied energy; on the other hand, these high-performance building elements generate savings in the energy consumption of the heating and/or cooling equipment because they reduce heat loss in winter and heat gain in summer more effectively than a double-glazed window.
- Water conservation is supported by utilising materials with a low *water footprint* and having systems in buildings that help conserve water and reduce its consumption.
- The motto "less is more", which was adopted by Mies van der Rohe (1886–1969), is an interesting tactic for reducing energy and resource consumption. Sometimes it is important to question whether a smaller, more compact building or a less elaborate fit-out would suffice to meet the requirements of the occupants or users. Multiple-use schemes and flexibility in the layout are also interesting considerations in this respect.

8.2 Concrete

Concrete is made by mixing cement, various mineral aggregates, sand and gravel, with sufficient water, pouring it into formwork and leaving it to *set*. After setting, the concrete must *cure*. This is a chemical reaction between the cement particles and the water (*hydration*), during which heat is released. The process usually takes around 28 days. Construction, however, may commence as soon as the concrete has set; typically this takes 1 to 2 days. *Additives* can be incorporated during the mixing process to alter the properties of concrete. The most common of these are:

- *accelerators* to reduce the set period and enhance early strength
- *retarders* do the opposite, which allows more time for placing and working the mix
- *damp-proofing agents* make concrete more resistant to water
- *air entraining agents* add and distribute tiny air bubbles in the concrete, which will reduce damage during *freeze-thaw cycles*
- *plasticising admixtures* increase the workability of fresh concrete.

Concrete can be formed into almost any shape by pouring the liquid mass into formwork and supporting it until it sets and eventually supports itself. Naturally the shape is dependent on the formwork. Because approximately half of the cost of using reinforced concrete is attributed to the construction of the formwork, a lot of concrete members are precast, i.e. elements are poured off site, and then delivered to the construction site and installed as and when needed. The use of *precast concrete elements* can save time and cut costs.

While concrete is strong in compression, steel reinforcement is required to handle tensile and shear stress. *Reinforcement* consists of *steel bars* and *welded-wire fabric*, which are tied together with *wire*. It is also necessary to tie vertical and horizontal elements, reinforce the edges around openings, minimise *shrinkage* and cracking and control thermal expansion and contraction. Reinforcing steel must be protected against corrosion and fire by a layer of surrounding concrete of specified minimum thickness.

The reinforcement and the *formwork* is usually designed by qualified structural engineers and pre-sented in *reinforcement drawings*, which include a *bar schedule*, and a *concrete layout drawing*.

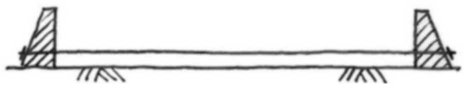
The terminology for different types of concrete is as follows:

• in-situ concrete	Delivered to the site as a mix, poured and cured on site
• precast concrete	Elements poured and cured in a controlled environment and transported to the site
• fair-faced/exposed concrete	With a visible concrete finish
• exposed aggregate concrete	Concrete with a decorative finish where the upper surface has been removed to expose the aggregate below
• shotcrete	Compressed air is used to shoot concrete onto a frame or structure; often used for rock support, especially in tunnelling

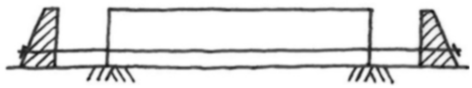
8.2.1 Stressed concrete

Pre-stressing concrete is a technique used to give concrete members greater strength. It was invented in 1886 by Henry Jackson, an engineer from San Francisco. It enables a concrete member to carry a heavier load and span a longer distance than a conventionally reinforced member of the same size, proportion and weight.

There are two different methods to create pre-stressed concrete: *pre-tension* and *post-tension*. The pretension method involves inclusion of stretched high tensile steel strands before the concrete is poured. In the post-tension method, concrete is poured around steel strands, which are *sheathed* or threaded through ducts to prevent *bonding*. Tension is then applied to the concrete member once it has cured.



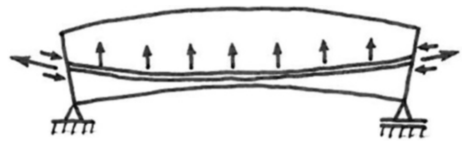
Tendons stressed between abutments



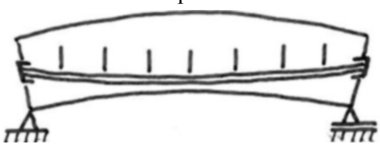
Concrete cast and cured

Tendons released and pre-stress transferred

Concrete cast and cured



Tendons stressed and prestress transferred



Tendons anchored and subsequently grouted

8.2.2 Recycled concrete

In the past, the concrete left behind after structures or roadways had been *demolished* was *disposed* of in *landfills*. By crushing the rubble and removing any steel reinforcement and *debris*, the concrete can now be reused in new projects. Larger pieces can be used for erosion control or to build privacy screens, much like a fence. Small pieces are often used as gravel, forming a base layer for roads or pavements, over which another layer of new concrete can be poured. Even smaller pieces of recycled concrete, that are free of all debris, can be mixed to a *batch* of brand new concrete.

In addition to the landfill issue mentioned above, recycling concrete is beneficial in terms of cutting costs, because less new material has to be sourced, and reducing transportation, because some of the formerly used concrete can simply remain on site. These aspects prevent the consumption of fossil fuels and, consequently, producing carbon emissions. Furthermore, new materials that might otherwise have been used in creating new concrete can now be left in place, or saved for future projects.

8.2.3 Cement issue

The production of Portland cement that binds concrete together is extremely energy intensive and emits large amounts of carbon dioxide as well as numerous other pollutants. Most of these environmental burdens arise in the *cement kiln*. This is where minerals are heated up to 1450°C and a chemical reaction takes place turning calcium and silicon oxides into calcium silicates.

Fly ash, which is a waste product from coal burning power plants, can replace a percentage of Portland cement in concrete. This reduces the negative impact of concrete on the environment and makes use of a material that would otherwise be landfilled.

8.3 Steel

Steel is the most common metal *alloy* in the world. It consists of iron and varying amounts of carbon. In the case of structural steel, this is less than 1 %.

Steel is produced in two processes. First of all a mixture of *iron ore*, *coke* and *limestone* is heated to a temperature of up to 2000°C in a *blast furnace*. The *pig iron* produced can be tapped off and is mixed with *scrap metal* in a second furnace called a converter. Limestone is added again to remove impurities. From the furnace, the molten steel is poured into moulds to form *ingots* or sent to a *rolling mill* to form wire, rods, bars, sheets and pipes.

Structural steel can then either be *cast*, hot or cold rolled. Steel sheet is produced by cold rolling. Steel sections, e.g. I-sections, are hot-rolled and then welded. Sheet material and light hollow sections are cold-rolled. Most joint fittings and connectors are cast steel products.

Because of its high strength, stiffness, toughness and ductile properties, structural steel is one of the most commonly used materials in commercial and industrial building construction. Most tall structures today, e.g. skyscrapers, have steel frames due to the good constructability and the high strength-to-weight ratio. Concrete, in contrast, while being less dense than steel, has a much lower strength-to-weight ratio. This is due to the fact that a much larger volume is required to support the same load. This advantage is less significant in low-rise buildings, where concrete is the more economical choice. In addition to use as a structural element for developments, such as buildings and bridges, steel is also used for a wide range of building products, e.g. windows, doors and fastenings.

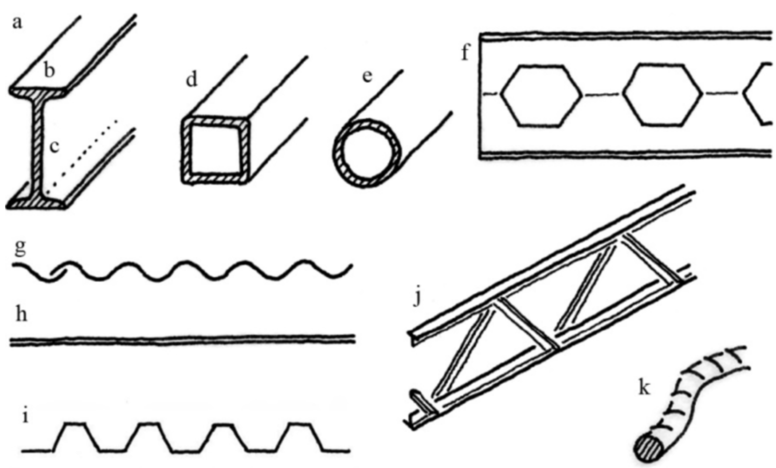
Steel loses its strength when subject to temperatures over 520°C and has to be coated, covered or enclosed with fire-resistant materials.

8.3.1 Steel members

Structural steel is difficult to work on site. It is, therefore, normally cut, shaped and drilled in shop according to the design specifications. This enables a relatively fast and precise construction of a structural frame on site. Connections are made using steel angles, tees or plates. The actual connections may be riveted, but are more often bolted or welded.

Match the terminology on the left with the appropriate diagrams.

1. open-web girder
2. I-section
3. steel cable
4. flange
5. corrugated sheet metal
6. trapezoidal sheet metal
7. honeycomb beam
8. sheet metal
9. square tube
10. web
11. steel tube



8.3.2 Recyclability of steel

Steel is unique among major construction materials in that it is completely recyclable at the end of its product life and may also be recycled an unlimited number of times without loss of quality. The recycling ratio, the ratio between the quantity of scrap recycled and the quantity of scrap arising, is around 80%.

The long life of steel construction products, together with global economic expansion, creates demand that cannot be fully met by available scrap supplies. This makes it necessary to use steel from primary ore to supplement the production of new steel.

8.3.3 Corrosion

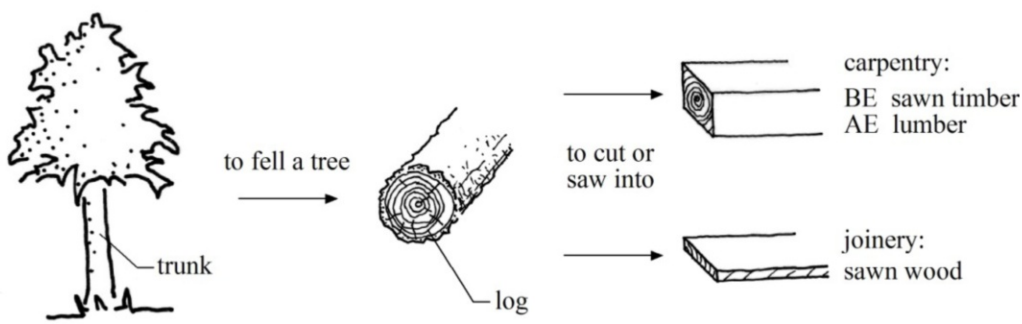
Steel is *susceptible* to corrosion. When exposed to moisture or in contact with water, structural steel undergoes a chemical reaction and rusts. This compromises the structural stability and hence poses a potential danger to persons in or close to the structure concerned. Measures must therefore be taken in structural steel construction to prevent any lifetime corrosion. For protection against oxidization, steel members can either be chemically treated, painted or *hot dip galvanised*, which involves coating the steel with a layer of zinc.

8.4 Timber

As a construction material wood is strong, durable, light in weight and easy to work. Because wood is renewable, it can be considered a sustainable construction material, if it is harvested from an environmentally-friendly source. The FSC stamp (Forest Stewardship Council) is an international trademark confirming that the wood comes from a responsible source – environmentally appropriate, socially beneficial and economically viable. The FSC forest certification system was established in 1993 as a response to global *deforestation*.

There are two major categories of wood – softwood which is from *coniferous trees* and used for general construction and hardwood from *broadleaved trees*, typically used for flooring, panelling, furniture and interior trim.

The following diagram shows the steps from a tree to wood products.



Wood is *seasoned* to increase its strength, stability and resistance to fungi, decay and insects. Further preservative methods include pressure treatment, which makes timber more durable and less susceptible to moisture. Despite these methods, it is impossible to completely seal a piece of wood and prevent changes in the moisture content. Therefore, careful attention has to be paid when detailing and constructing wood joints.

The susceptibility of wood to decay and infestation by insects requires good site drainage, adequate separation from the ground, ventilation to control condensation in enclosed spaces and the appropriate use of pressure-treated timber. Wood expands as it absorbs moisture and shrinks as it loses moisture. The possibility of shrinkage and swelling must always be taken into account.

The *grain direction* is a factor of great importance when using wood as a structural material. Tensile and compressive forces are best handled by wood in the direction parallel to the grain.

8.4.1 Engineered wood

Over recent years, engineered wood products have been introduced providing engineers with timber solutions for situations where conventional timber would not always have been viable. These products include, among others, *glulam (glue laminated timber)*, *LVL (laminated veneer lumber)* and *timber I-beams*. All offer the benefits of wood combined with greater strength. Some of these products are manufactured using chips and flakes, thus optimising the use of the tree and cutting down waste to an absolute minimum.

- **Medium dense fibreboard** (MDF) is made from very fine wood dust, which is glued together with *resin* and compressed under heat. MDF is denser and stronger than both *particle board* and *plywood*.
- **Plywood** is a structural wood panel made of sheets of cross-laminated veneer and bonded under heat and pressure. It is often referred to being the first engineered wood product.
- **Oriented strand board** is a board formed by layering strands (flakes) of wood in specific orientations. The individual strips are around 2.5 cm wide and 15 cm long. OSB is most commonly used for sheathing in walls, floors and roofs.
- **Glulam** is made from layers of parallel solid timber laminates glued together under high pressure. It is generally available in standard widths of 90 – 240 mm and lengths up to 12 metres. Thanks to the development of CNC machine tools (computerized numerical control), glulam can be cut and shaped precisely for the construction of elaborate load-bearing structures.
- **Laminated veneer lumber** (LVL) is manufactured from *veneers* glued together to form continuous panels rather like plywood. The grain of the veneers is parallel. These panels have a greater load-bearing capacity than solid timber. LVL is a suitable material for joists, beams and framework studs, but also roof, floor and wall elements.
- **Cross laminated timber** (CLT) is made of multiple layers of wood, with each layer oriented crosswise to the next. It is used for long spans in floors, walls or roofs. CLT wall, floor and roof elements can be pre-cut in the factory to any dimension and shape, including openings for doors, windows, stairs, etc.
- **Timber I-beams or I-joists** are like steel I-sections except that they are made of timber. They consist of timber flanges, typically solid timber or LVL, and a panel product web, usually OSB (oriented strand board). Timber I-beams or joists are used in roofs, floors and timber frames. They are an extremely cost-effective solution for roof, floor and timber

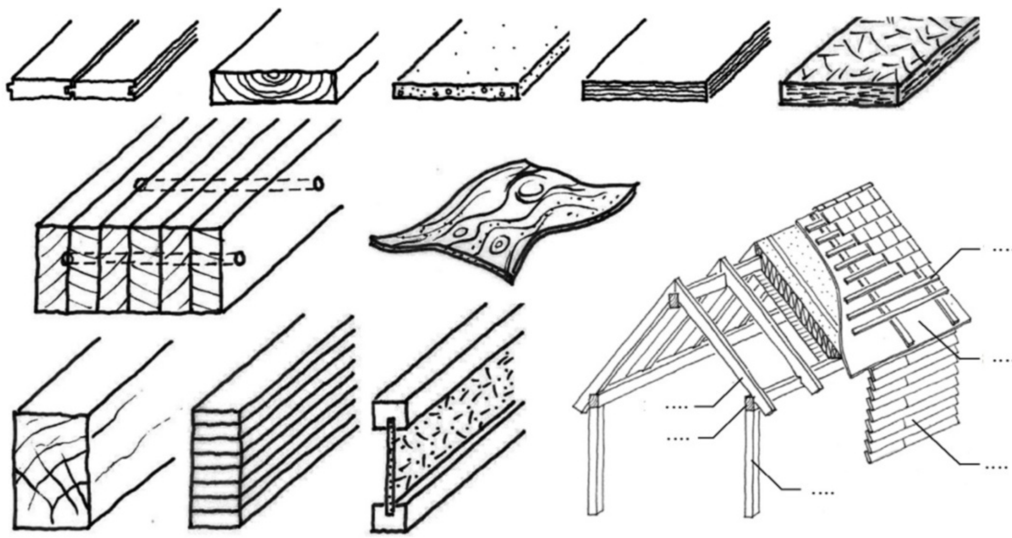
frame constructions because of their low weight, long lengths, allowing large spans, and dimensional stability. Metal web timber joists combine timber flanges with metal strutting webs.

- **Brettstapel panel** is a solid timber construction system. The panels are made by connecting low-grade softwood posts, usually *spruce* or *fir*, with hardwood timber *dowels* to create chunky thick wall or ceiling elements. It is a process that was created fifty years ago in Germany.
- **Timber frame constructions** are buildings assembled from floor, wall and roof panels that are prefabricated in a workshop and brought to the site to be erected. This is usually a cost effective solution reducing the need for elaborate on-site labour. The timber frame panels can also be pre-insulated and lined with wind and airtight barriers before being delivered to the site. In this case timber studs (I-joists, LVL or solid timber) are fitted between two panels (LVL, OSB) and the cavities are filled with insulation.

8.4.2 Timber products

Match the wood products below with the appropriate terms from the box.

glulam · parquet flooring · veneer · OSB · I-beam · rafter · sheathing · plank · post
squared timber · particle board · LVL · batten · purlin · weatherboarding · Brettstapel panel



8.5 Smart materials

Smart materials have properties that react to changes in their environment. This means that one of their features changes by external conditions, such as temperature, light, pressure or electricity. The change is usually reversible and can be repeated any number of times.

Phase change materials (PCM) can store energy in the form of heat and cold as latent energy. During hot summer periods, they can, for example, absorb heat by changing their state from solid to liquid. At night, when the interior space is cooled, the PCM product, e.g. gypsum plasterboard with PCM granules, releases the heat by returning to its solid state.

Shape-memory alloys (SMA) can be twisted and bent, but return to their original shape when heated. In the future, these memory metals could be used to protect buildings against earthquakes.

Self-healing concrete repairs itself and extends the life of a structure. Concrete is prone to cracking. When this happens, moisture penetrates and causes the reinforcing steel to corrode. The aim is therefore to address the cracking as soon as it occurs. One way to do this is to embed bacteria in micro-capsules along with nutrients into the concrete mix. When the concrete cracks and water enters, the bacteria germinate and multiply. Limestone is produced in this process, which seals the cracks before the water can do any harm.

8.6 Combining materials

As mentioned at the beginning of this chapter, building components are seldom monolithic consisting of only one material. In fact most building components are a combination of different materials each fulfilling at least one function within their spatial configuration.

Exterior walls, for example, have to fulfil several functions simultaneously. In order to protect the interior space from the effects of the weather, they should be air and wind tight. They should incorporate sufficient insulation to prevent heat loss from the building in winter and provide sufficient mass to prevent the building from overheating in summer. Furthermore, the materials should require little attention in terms of *maintenance* and last a long time without having to be replaced.

These properties affect only the configuration, not however, the appearance. It goes without saying that each component also has a function in terms of design. Depending on the size of the element, exterior walls can emphasise a certain aspect of the design and become a distinctive or even dominant feature. Although the weight properties of some materials may suggest otherwise, elements can be made to look heavy and sturdy or conversely light and fragile.

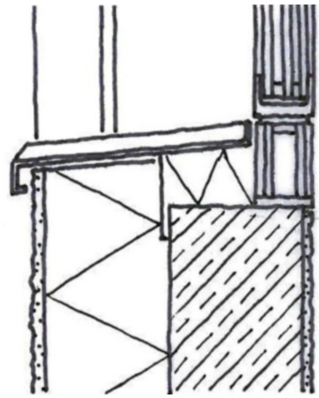
The surface treatment of a material can be definitive for the appearance of a building. Depending on the architect’s intention, the load-bearing components can be visible in the facade or hidden behind a “*curtain*”. In the latter case, walls can be *rendered* to create a smooth or textured appearance to the exterior. They can also be *clad* in a range of different ways and the wide variety of materials available extends from large metal panels through to small timber *shingles*.

8.6.1 Exercise: Wall configurations

Match the terms from below with the materials in the pictures.

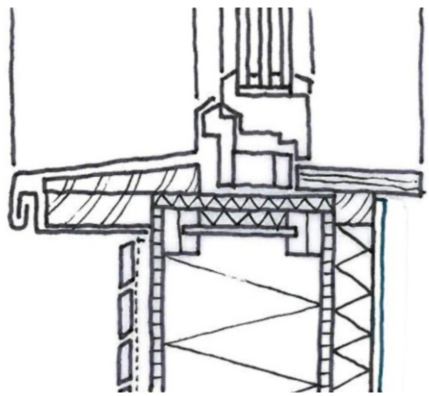
Reinforced concrete wall with thermal insulation composite system

200 mm reinforced concrete
200 mm EPS insulation
12 mm silicate render
triple glazing in aluminium frame
10 mm plaster finish



Closed timber wall system with exterior cladding

cellulose insulation
insect mesh
12.5 mm gypsum fibreboard
16 mm wood fibreboard
24 mm weatherboarding
30 x 60 mm batten/cavity
18 mm OSB panel
insulated services void
241 mm I-beam



8.6.2 U-values

The U-value, also referred to as the overall *heat transfer coefficient*, is a measure that expresses the ease with which a material or building assembly allows heat to pass through it. In other words, how good an insulator it is. The lower the U-value, the better the insulator. The U-value is used to measure how much *heat loss* there is in a wall, roof, floor or window. It is measured in W/m²·K (watt per square metre kelvin).

In practice, nearly every external building element has to comply with thermal standards that are expressed as maximum U-values. A typical U-value of a highly insulated wall is 0.13 W/m²·K, whereas that of a poorly insulated wall is approximately 1.5 W/m²·K.

In order to calculate the U-value for each material within a building element two pieces of information are needed: the thickness in mm and the *thermal conductivity* or lambda value (λ) in W/m·K, which is usually provided by the material's manufacturer. The *thermal resistance* or R-value (K·m²/W – kelvin metre squared per watt) of a layer is the thickness divided by the conductivity. The sum of all resistances gives the total resistance. The U-value is the *reciprocal* of the total thermal resistance.

8.6.3 Example: U-value calculation

This example calculation is for a cavity wall with a core of insulation. The thermal resistance of the interior (R_{si}) and exterior surface (R_{se}) also need to be entered. These values are dependent on the inside and outside temperatures.

Material	Thickness (m)	Thermal conductivity (W/m·K)	Thermal resistance (K·m²/W)
Thermal resistance coefficient of interior surface R_{si}			0.130
Plaster	0.010	0.700	0.014
Sandlime brick	0.175	0.990	0.177
Thermal insulation	0.140	0.022	6.364
Sandlime cladding	0.115	1.100	0.105
Thermal resistance coefficient of interior surface R_{se}			0.040
Total thermal resistance			6.830

The total thermal resistance of the cavity wall is 6.83 K·m²/W. Since the U-value is the reciprocal of the total thermal resistance, the U-value is 1/6.83 K·m²/W = 0.14 W/m²·K for this specific cavity wall.

(Note: The example has been simplified and does not take into account any metal connectors, air gaps interrupting the insulation or mortar joints between the bricks.)

8.7 Technical standards

A standard in this sense is basically a technical rule. It usually takes the form of a written document setting out requirements, specifications, guidelines or characteristics to ensure that materials, products, processes and services are fit for their purpose. They are designed to ensure that products are safe, reliable and of good quality. In the construction industry, they are helpful tools in the decision-making processes. They help to optimise operations, improve quality and reduce negative impact on the environment.

New standards or modifications to existing ones are drafted by a panel of experts as and when the need is identified. Technical committees then negotiate the scope, key definitions and content. By adhering to these specifications, companies expect to strengthen their competitive position in the market. Standards are designed to benefit all individuals, businesses and governments.

In Germany, DIN (Deutsches Institut für Normung) publishes and updates the valid standards. The institute is based in Berlin and administers about 29,500 DIN standards. Nearly 400 of which apply simply to mechanical fasteners! The equivalent organisation in the UK is the BSI (British Standards Institution). It was the world's first national standards body, founded in London in 1901.

To simplify the international movement of goods and prevent trade barriers, national standards are often replaced with international standards. ISO, the "International Organization for Standardization" based in Geneva is responsible for standardization at an international level.

The results of the work are published under the name "ISO". More than 157 countries are members. Many ISO standards are adopted as European standards and thus acquire the status of an EN ISO standard. Some ISO standards are directly adopted as DIN standards and referred to as DIN ISO standard.

The following is a list of the standards most frequently encountered in German/British business operations.

DIN	German national standard
BS	British national standard
ISO	International standard
DIN ISO	German edition of an unaltered ISO standard
BS ISO	British edition of an unaltered ISO standard
EN	European standard
DIN EN	German edition of a European standard
BS EN	British edition of a European standard
EN ISO	European edition of an unaltered ISO standard
DIN EN ISO	German edition of an EN ISO standard
BS EN ISO	British edition of an EN ISO standard

In conclusion, it can be said that ISO, EN ISO and BS or DIN EN ISO all contain more or less the same information. The only thing that really changes is the "*wrapping*", which has much to do with the layers of administrative processes involved in the adoption of a standard.

Example standard

The standard BS EN ISO 8970:2010 bears the title "Timber structures. Testing of joints made with mechanical fasteners. Requirements for wood density."

As the letters and numbers imply, it is a British edition of an EN ISO standard, which was first published in 2010. All British standards can be purchased in PDF format online at http://shop.bsigroup.com.

8.8 Vocabulary

8.1	strength-to-weight ratio	Kraft-Gewicht-Verhältnis
	density	Dichte
	sustainability	Nachhaltigkeit
	embodied energy	graue Energie
	rigid foam polyurethane insulation	Polyurethanhartschaum
	straw bale insulation	Strohballendämmung
	deconstruction	Abbau
	class of inflammability	Brandschutzklasse
	fire resistance rating	Feuerwiderstandsklasse
	thermal conductivity	Wärmeleitfähigkeit
	texture	Oberflächenstruktur
8.1.2	to dwindle	schwinden, sich vermindern

	non-renewable resources	nicht erneuerbare Ressourcen
	carbon footprint	CO_2-Bilanz
	resource scarcity	Ressourcenknappheit
	lifecycle energy use	Lebenszyklusenergieverbrauch
	holistic approach	ganzheitlicher Ansatz
	durability	Langlebigkeit
8.1.3	non-toxic adj	schadstofffrei
	Volatile Organic Compounds (VOCs)	flüchtige organische Verbindung (VOC)
	moisture-resistant adj	feuchtigkeitsbeständig
	contaminants	Verschmutzung
	water footprint	Wasser-Fußabdruck
8.2	to set	abbinden
	to cure	aushärten
	hydration	Hydration
	additives	Zusatzmittel
	accelerator	Abbindebeschleuniger
	retarder	Abbindeverzögerer
	damp-proofing agent	Sperrmittelzusatz
	air entraining agent	Luftporenbildner
	freeze-thaw cycle	Frost/Tau-Wechsel
	plasticising admixture	Betonverflüssiger
	precast concrete element	Betonfertigteil
	reinforcement	Bewehrung
	steel bar	Stabstahl
	welded-wire fabric/mesh/mats	Stahlgewebe, -matte
	wire	Draht
	shrinkage	Schwinden, Schrumpfen
	formwork	Schalung
	reinforcement drawing	Bewehrungsplan
	bar schedule	Biegeliste, Stahlliste
	concrete layout drawing	Schalplan
	in-situ concrete	Ortbeton
	fair-faced or exposed concrete	Sichtbeton
	exposed aggregate concrete	Waschbeton
	shotcrete	Spritzbeton
8.2.1	stressed concrete	Spannbeton
	pre-tension	Vorspannen
	post-tension	Nachspannen
	to sheath	umhüllen, ummanteln
	bonding	Verbund, Haftung
	tendon	Spannglied, -kabel

	abutment	Widerlager
	to grout	vergießen
8.2.2	to demolish	abreißen
	to dispose	beseitigen, entsorgen
	landfill	Mülldeponie
	debris	Rückstände
	batch	Charge
8.2.3	cement kiln	Zementofen
	fly ash	Flugasche
8.3	alloy	Legierung
	iron ore	Eisenerz
	coke	Koks
	limestone	Kalkstein
	blast furnace	Hochofen
	pig iron	Roheisen
	scrap metal	Metallschrott
	ingot	Rohblock, Barren
	rolling mill	Walzwerk
	to cast	gießen
8.3.1	hollow square/rectangular steel section	Stahlquadratrohr (-rechteck)
	steel tube	Stahlrohr
	open-web girder	Gitterträger
	honeycomb girder	Wabenträger
	flange	Flansch
	web	Steg
8.3.3	susceptible to sth	anfällig für
	hot dip galvanised adj	feuerverzinkt
8.4	deforestation	Abholzung
	coniferous trees	Nadelbaum
	broadleaved trees	Laubbaum
	trunk	Baumstamm (ungefällt)
	log	Baumstamm (gefällt)
	sawn timber BE, lumber AE	Bauschnittholz
	carpentry	Zimmer(manns)arbeit
	joinery	Tischler-/Schreinerarbeit
	to season wood	ablagern
	grain direction	Faserrichtung
8.4.1	engineered timber	Holzwerkstoff
	glue laminated timber (glulam)	Brettschichtholz
	laminated veneer lumber, LVL	Furnierschichtholz
	timber I-beam	Holzstegträger

	medium dense fibreboard, MDF	mitteldichte Holzfaserplatte
	resin	Harz
	particle board	Spanplatte
	plywood	Sperrholz
	oriented strand board, OSB	Grobspanplatte
	veneer	Furnier
	cross laminated timber, CLT	Kreuzlagenholz
	Brettstapel panel	Brettstapelholz
	spruce	Fichte
	fir	Tanne
	dowel	Dübel
8.4.2	batten	Dachlatte
	sheathing	Holzverschalung
	squared timber	Kantholz
	purlin	Pfette
	parquet flooring	Parkettfußboden
	weatherboarding	Stulpschalung
	rafter	Sparren
8.5	phase change material, PCM	Phasenwechselmaterial
	shape memory alloy, SMA	Formgedächtnislegierung
	self-healing concrete	selbstreparierender Beton
8.6	maintenance	Instandhaltung
	curtain	Vorhang
	to render	verputzen
	to clad	verkleiden
	shingle	Schindel
8.6.1	thermal insulation composite system	Wärmedämmverbundsystem
	insect mesh	Insektengitter
	wood fibreboard	Holzfaserplatte
	services void	Installationswand
8.6.2	heat transfer coefficient	Wärmeübergangskoeffizient
	heat loss	Wärmeverlust
	thermal conductivity	Wärmeleitfähigkeit
	thermal resistance	Wärmedurchlasswiderstand
	reciprocal	Kehrwert
8.7	wrapping	Verpackung

9 Building Services

9.1 Building services engineering

This chapter discusses the mechanical and electrical systems that are required to provide and maintain comfort, health and safety for the occupants of a building. Building services engineering may be considered under three main headings: *plumbing*, *electrical engineering* and *mechanical engineering*.

- Plumbing deals with the supply of *potable water*, which is essential for human consumption and *sanitation*. In order to maintain sanitary conditions within a building and the surrounding area, the *waste water* must be disposed of efficiently.
- Electrical systems provide light as well as heat to a building and the power to run its machines.
- Mechanical engineering deals with the heating, ventilation and air-conditioning of interior space. It also includes the planning of elevators and escalators, with the necessary operating equipment and vertical shafts.

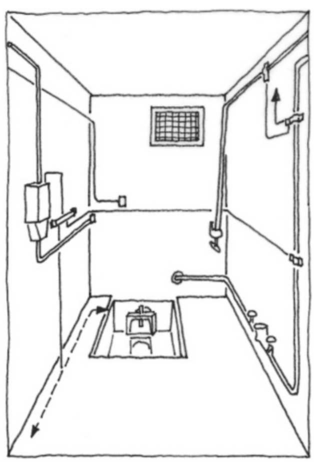
Building services engineers are responsible for the design, installation, operation and maintenance of all systems. They work closely with other construction professionals and may influence the architecture of a building. Furthermore, they play a significant role in the sustainability and *energy consumption* of a building. In recent years, new demands have emerged in this area, such as the utilisation of *renewable energies*, *low carbon technologies* and energy management.

9.1.1 Service-entrance room

Large buildings usually have a service-entrance room in a basement area, where all services enter the same exterior wall facing a road.

Connect the terms with the correct equipment.

communications cable
house connection box
power cable
building sewer
cleaning eye



gas pipe
equipotential bonding conductor
gas shut-off valve
water shut-off valve
water meter

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_9

All *service facilities* are located between the *service line*, which connects up to the *mains*, and the building's own distribution network. For water this is the water meter, for electricity the house connection box, for telecommunication services the individual terminals, for gas supply the main gas valve and, finally, for the waste water the last cleaning eye before entering the building sewer.

9.2 Plumbing

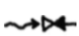
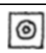
The word plumbing (the b is silent) is actually derived from the Latin word plumbum, which means *lead*, since all pipes were formerly made of lead. It is the trade working with pipes, *tubing* and *plumbing fixtures* for water supply and *drainage* systems. A *plumber* is the person who installs these systems. Lead pipes are no longer used – originally because of *toxicity* – and the materials used today include plastic, copper, steel and other non-toxic materials.

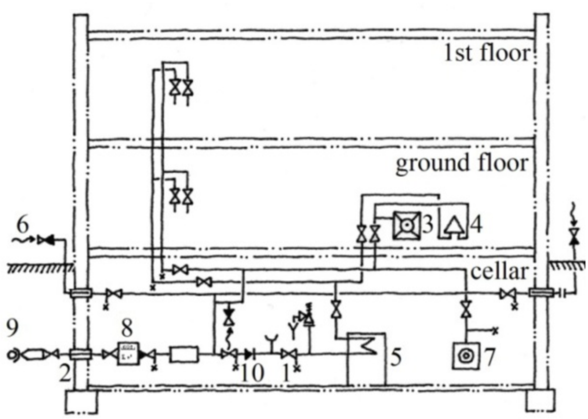
9.2.1 Drinking water supply

Water is supplied to a building for drinking, cooking and washing purposes, as well as to support *HVAC (heating, ventilating and air conditioning system) systems*, which circulate water for heating, cooling and maintaining a certain level of *humidity* within a building. In addition, water may be needed for fire protection systems in larger buildings. Water must be supplied to a building in adequate volume and at the required *flow rate*, *pressure* and temperature. For human consumption it has to be potable.

Water supply companies, also called *water utilities*, receive water from a variety of sources, such as groundwater, surface water (lakes and rivers) and the sea through *desalination*. In a *waterworks*, the water is filtered, purified and stored in a service reservoir, either an *elevated tank* or a *water tower*. The *treated water* then flows through mains pipes to the consumer.

This is a typical drawing of the water supply installations. Match the symbols with their correct meaning.

1. 	a. water heater
2. 	b. outlet valve
3. 	c. water meter
4. 	d. wall penetration
5. 	e. tapping sleeve
6. 	f. non-return device
7. 	g. shut-off valve
8. 	h. dishwasher
9. 	i. washing machine
10. 	j. mixer tap



Every mains connection has to be performed according to the applicable regulations and includes the service pipe between the utility line and the water meter, which is the transition point, with a mains shut-off valve.

As already mentioned, water pipes are usually made of copper, steel or PVC. They are *sized* according to the number and types of plumbing fixtures. If the pressure is not sufficient to cater for the building or all storeys, a *pressure increasing system* has to be installed. The pipes are usually accommodated within floor and wall construction spaces and *lagged* for insulation purposes to prevent heat loss and freezing.

9.2.2 Plumbing fixtures

A plumbing fixture is a device which receives water from a supply system and discharges the liquid waste into the sanitary drainage system. The most common fixtures are sinks in kitchens, etc., sanitary ware for toilets, washbasins, baths and showers for bathrooms and *fittings* for dishwashers, washing machines, etc.

The *tap* (AE *faucet*) is the fitting that controls the release of water. Separate hot and cold taps are still very common in the UK, especially in bathrooms. However, mixer taps, which were invented by Thomas Campbell in 1880, are normally fitted nowadays. In this case the water is mixed together before reaching the outlet. It is advisable to equip all fixtures with shut-off valves in order to enable easy repair or alteration at a future date.

Water conservation strategies include the application of water-efficient fixtures, such as the *dual flush cistern*, capture of rainwater and the use of *greywater*. Greywater is the waste water from sinks, baths, showers and dishwashers, which is treated and recycled on site for *toilet flushing* and *irrigation*.

9.2.3 Water disposal

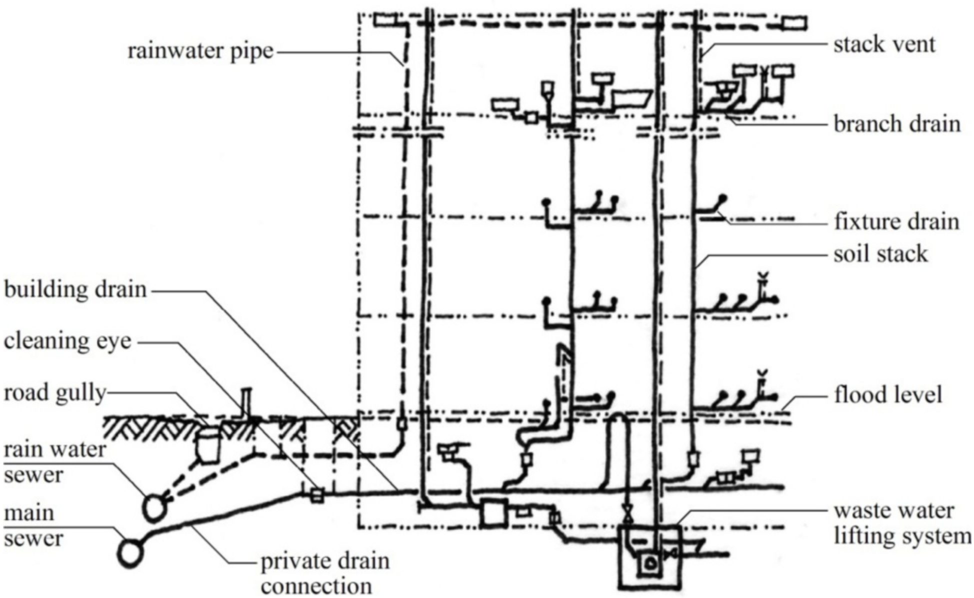
Waste water: After water has been drawn and used, it enters the sanitary drainage system. Since drainage relies on gravity for its discharge, the pipes are much larger than those of the water supply lines. Drainage lines are sized according to their location in the system and the total number and types of fixtures served. The *house drain* is the lowest part of the drainage system, receiving all the discharge from the *soil* or *waste stacks* inside the building. Outside the building, beyond the cleaning eye, the waste water passes through the *private drain connection* before it enters the municipal *sewage disposal system*.

The *venting system* is an important element of the drainage system and consists of pipes leading from the fixtures to the outdoors, usually via the roof. The vents permit *sewer gases* to escape and supply a flow of fresh air into the drainage system. The air also helps to maintain the water seal created by the *trap*. A trap is a U-shaped section of drainpipe below the plumbing fixture in which waste water remains forming a seal to the sewer gas without actually affecting the flow of waste water.

The layout of the drainage system should be as direct and straightforward as possible in order to prevent the deposit of solids and *clogging*. Especially in large buildings, the sanitary facilities, such as toilets and bathrooms, are arranged directly above those of the storey below. In this way, one soil and ventilation pipe is normally sufficient to serve all the sanitary fixtures grouped together. The tops of stacks also have to be vented. The application of *air admittance valves* eliminates the need for conventional vent stacks penetrating the roofs.

Sanitary sewers convey the sewage to a public facility for treatment and disposal. Depending on the system used, this is either performed in the same sewer as the rainwater, in this case it is a *combined sewerage system*, or separately in the case of a *separate sewerage system*. If plumbing fixtures or *floor drains* are located below *flood level*, the waste water has to be lifted above this level by a *wastewater lifting system*. Under certain circumstances, a *backflow preventer* can be installed to prevent the waste water from flowing back into the building. Where there is no public sewer, a private sewage disposal system is required. A *septic tank* is a covered watertight tank, which separates the solid organic matter to be decomposed and purified and allows the clarified liquid to discharge.

Rainwater: Rainwater does not necessarily have to be fed into the public utility's sewers. It can just as well be absorbed by means of *precipitation infiltration*. In order to utilise rainwater, its flow is directed from roofs and *gutters* into a storage tank. Once filtered, it can be used for toilet flushing, washing machines and garden irrigation.



9.3 Thermal comfort

The sensation of feeling hot or cold is not only dependent on the air temperature. Thermal comfort is more; it is an interplay of temperature, humidity and *air circulation*, the creation of a thermal equilibrium with the surroundings. This can only be achieved with a holistic approach of balancing the *thermal conductivity* of materials, *thermal convection*, *radiation* and *evaporative heat loss*.

It is the building services engineer's task not only to determine the heat loss of a building and select the equipment necessary to compensate for the discrepancies but to define and limit the energy requirements of a building. The building, as our third skin, should have a minimum of heat loss. The orientation and design of a building, as well as careful choice of materials with a low *heat transfer coefficient* (*U-value*), help to reduce the amount of energy consumed for additional heating.

Before the right heating equipment can be determined, it is necessary to calculate the *heat load*. The heat load takes account of the difference between inside and outside temperature, the location, the building's orientation, wind force, the use of space, the thermal transmittance of each material and the desired indoor temperature. Heating systems offer a wide choice with regard to energy source, type of installation and the method of heat distribution.

9.3.1 Fuel

Traditionally fossil fuels (gas, oil or coal) heat air, water or produce steam. There is a considerable difference between *non-renewable or abiotic* and renewable resources.

- Coal is rarely used nowadays, certainly as far a new buildings are concerned. The burners in this case require a *flue* to carry away smoke and fumes as well as draw air. The flue is usually situated within a *chimney* now often made of *moulded brick*.
- Oil, like coal, requires storage. While it is efficient, it is also an abiotic resource.
- Gas has the advantage that it does not have to be stored. It is cleaner than both coal and oil.
- In the building itself, electricity is a clean source of energy, which requires neither combustion nor storage. It enables a silent and very compact system demanding little space. However, the cost of electricity very often discourages its application. The energy purchased from the electricity network is not necessarily generated from green energy sources and here, of course, coal is still widely used.
- Wood is a *sustainable resource*, however, its burning can produce air pollution. Wood pellets, by comparison, burn cleanly and are a good alternative.
- Alternative energy systems, such as solar power, wind generators, geothermal energy and photovoltaic panels are smart alternatives. Unfortunately the high initial costs, despite *state subsidies*, are often a constraint.

9.3.2 Heating system

A central heating system consists of a *heat generator*, the piping, which transports the *heat transfer medium,* and the heating surfaces. The most common system uses water as the heat transfer medium. The water is heated in a heating boiler and then circulated through pipes to radiators or convectors. Radiators, which consist of a coil of pipes through which the hot water passes, warm the space by radiation. Convectors are heating units in which the air heated by contact with the radiator is circulated by convection. These systems also work with steam as the heat transfer medium.

Radiant heating systems utilise ceilings, floors and sometimes walls as radiating surfaces. The heat sources can be hot water carried through pipes or tubing, warm air or electric cable embedded in the building structure. Heat is absorbed by the surfaces and objects in the room and radiated to provide warmth. The installation is concealed except for *thermostats* and *balancing valves*. This system not only improves the thermal comfort, it also leaves walls and floors unobstructed.

Warm-air heating is a system which involves heating air in a gas, oil or electric furnace and distributing it by means of *ductwork*. Since it provides heating through circulation of (warm) air, it is usually part of a HVAC system. All of these systems can make use of a *distance heating* system. In this case, the heat generator is outsourced to a *district heating station*, which provides heat to a number of buildings via an underground *pipe network*.

9.3.3 Hot water production

Not only do we require potable water as mentioned in section 9.2, hot water is also required for numerous activities around a building. The task of a hot water heating system is to deliver hot water to the places of consumption. Quality, quantity and temperature are critical factors.

There are many different types of heating appliances and the system selected will influence the internal layout of the building e.g. location of the heating appliances, any storage tanks and related pipework. The selection will also be influenced by the initial installation cost and on-going running costs. Above all, it is vital that the expected demand for hot water is correctly assessed and that the system selected has the capacity to satisfy all requirements.

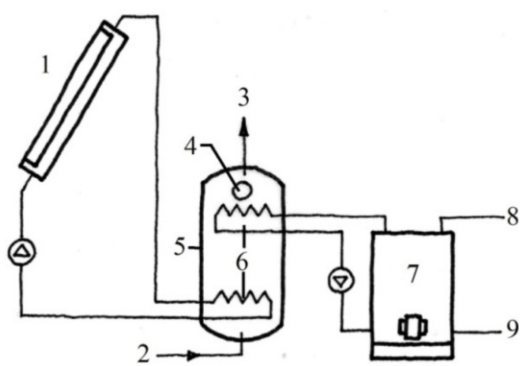
It goes beyond the scope of this chapter to describe in detail all systems and appliances available. However, they divide into two broad categories – *instantaneous water heaters* and those with storage systems. The basic difference is that an instantaneous system delivers a continuous flow of hot water, which is heated on demand, whereas in a storage system the water is heated in advance and stored ready for use in an insulated *hot water cylinder*.

Instantaneous heaters operate on gas or, more commonly, electricity. They range in size from small units, supplying to a single fixture, to larger appliances, sometimes called *geysers*, capable of serving the needs of a whole dwelling. The use can be limited to the *domestic hot water (DHW)* supply or they can take the form of combination (combi) boilers and also supply hot water to space heating systems.

9.3.4 Solar energy

Active solar energy systems absorb, transfer and store energy from solar radiation for building heating and hot water production. They consist of the main elements: solar collector panels, a circulation and distribution system for the heat transfer medium and a heat exchanger and storage facility. The solar collector panels should face south and be fitted at an angle close to 45°. For efficient implementation in residential buildings, an area of approximately 2.0 m² per person is required. The heat transfer medium may be air, water or other liquids. In the case of water, an *anti-freeze solution* has to be added.

Match the numbers in the picture with the terminology on the right.

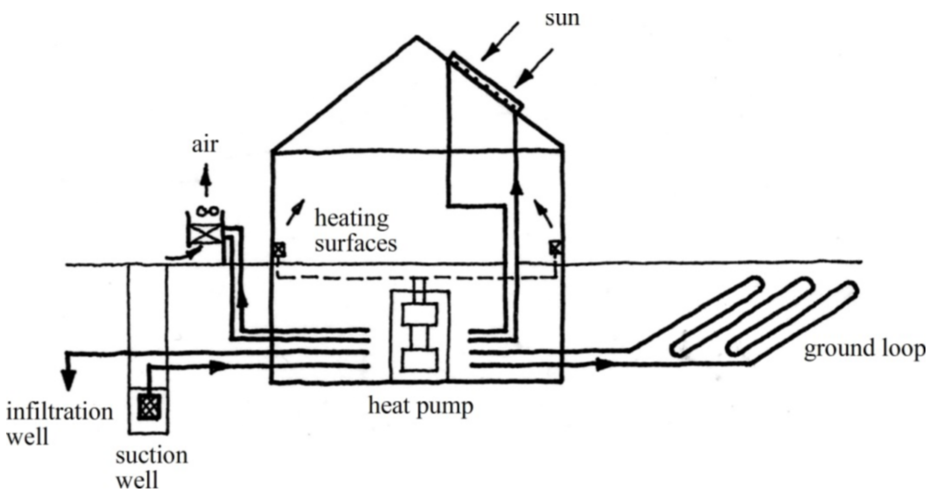


a. heat exchanger
b. water main
c. return pipe (heating)
d. hot water storage tank
e. hot water
f. flow pipe (heating)
g. electric heating element
h. solar collector panel
i. boiler

Solar heating is rarely sufficient to cover the full demand, and a facility for supplementary heating is required. In summer, when the boiler is not required, a simple electric heating element can cover the difference between the supply and demand temperature of hot water. In winter, a boiler will possibly take over as the principal supplier.

9.3.5 Heat pump systems

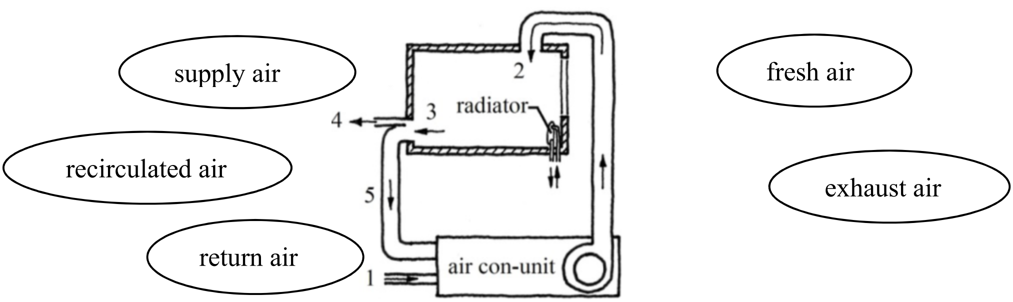
A *geothermal heat pump* (GHP) is a central heating and/or air conditioning system that actively pumps air or water to or from shallow ground. It takes advantage of the moderate temperatures in the ground and either uses them as a source of heat (in winter) or as a coolant (in summer). The heat pump works in a similar way to a refrigerator. However, the heating capacity of the condenser is of greater importance than the cooling capacity of the evaporator. There are a variety of systems, which are differentiated according to their heat source and their heat transfer medium, such as *water-to-water heat pumps*, air-to-water, air-to-air, etc. These systems may be combined with solar heating to form a geosolar system with even greater efficiency. Heat pumps can also extract heat from exhaust air and waste water.



9.4 Ventilation

Ventilating a building generally means removing the *vitiated air* from the inside and replacing it by fresh air from outside. In single family homes ventilation is usually taken care of by opening a window. However, ventilation is sometimes assisted by a *fan* or a ventilation system. The most simple system, often applied in bathrooms and kitchens, is an *extractor fan* which expels air and fumes to the outside via ducts.

There are different terms to define the type of air within an air circulation system. Connect the different air types with the air flow arrows in the diagram.



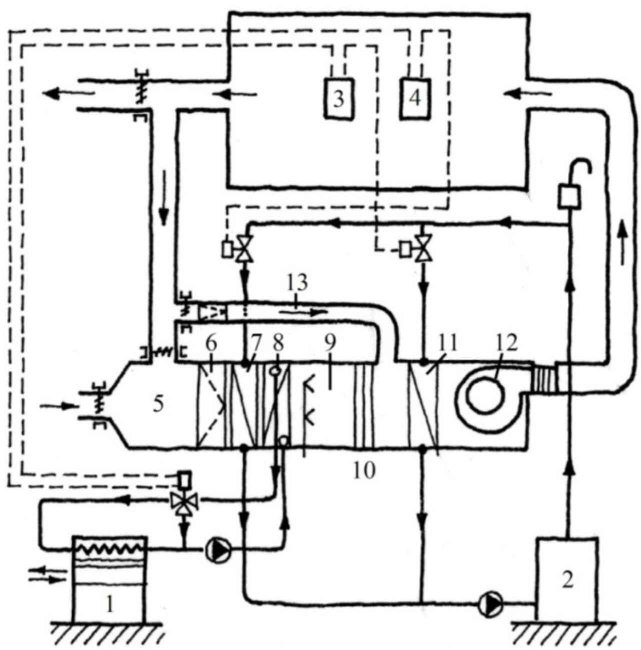
With the implementation of the new energy saving orders, which limit the *ventilation heat loss*, *mechanical ventilating installations* have to be employed to ensure a continuous air exchange. These filter and heat the supply air and extract the vitiated air in a cycle. Most of these systems are now equipped with a *heat recovery system.* By integrating a heat exchanger, the warm exhaust air preheats the cold winter fresh air. In summer the opposite procedure takes place.

9.4.1 HVAC systems

The main task of an HVAC system is not only to renew the indoor air, but to create and maintain a comfortable *indoor climate.* The systems and performance range from small decentralised units, such as *room air-conditioners*, which can be fitted into an outside wall or even a window and run off the domestic electricity supply, to large centralised plants in high-rise office buildings, assembly and common rooms, such as theatres, cinemas and concert halls. The installation of large centralised plants requires careful planning, since the ducts and the machinery take up a lot of space and the air in and outlets affect the appearance of walls and ceilings.

Sheet metal ducts with either square, rectangular or circular cross sections are normally used to transport the air. It is important that they are smooth on the inside and their dimensions comply with the system and the demand. The noise from HVAC systems can be irritating for the building's occupants. It is therefore important to install *sound attenuators* in order to avoid sound transmission from room to room. Ducts are usually concealed in suspended ceilings or raised floors. Only the *diffusers* and/or *registers* are visible in rooms. Their layout, if accommodated in the ceiling, has to be carefully coordinated with lighting, the fire protection system, etc. in the *reflected ceiling plan*.

1. chiller unit
2. warm water boiler
3. room thermostat
4. hygrostat
5. mixing chamber
6. air filter
7. air preheater
8. air cooler
9. jet chamber
10. mist eliminator
11. air reheater
12. supply air blower
13. by-pass



9.4.2 Lexis: HVAC system

Match the parts of an HVAC system with the following descriptions.

1. A proportion of the mixed or recirculated air can be fed past the air handling equipment. ....
2. Once air handling has been completed, the fresh air is forced through ducts to the appropriate rooms. ....
3. A unit that absorbs heat from the air supply whose main parts are a compressor, a condenser and evaporator coils. ....
4. A place where the remaining exhaust air meets fresh air. ....
5. Excess water is removed and fed back to the jet chamber. ....
6. It removes impurities from the air supply. ....
7. It is used in winter to heat the filtered air. ....
8. A device used to regulate the relative humidity in an enclosed space. ....

9.5 Electricity

Public utility companies provide electricity to almost all residential and non-residential buildings via the *electricity grid*. Electricity is produced in the generators of power stations which extract energy from a fuel such as coal, oil or gas, or in the case of nuclear power stations by splitting atoms.

It is then transported via *high-voltage transmission lines* to *substations* where it is transformed from high voltage of up to 380,000 V to medium voltage of 10,000 V. *Electricity distribution stations* reduce the voltage further, to between 220 and 240 V in European countries, and supply all households with electricity. In urban areas, the distribution is managed by *underground cables*, which are laid approximately 70 cm below the pavement. The economic alternative is the use of *overhead lines*.

Usually the *cable connection* is laid through the exterior wall approximately 70 cm below the ground to the house connection box. This is the transfer station from the public distribution network to the consumer. The main line is the connection between the house connection box and the *electric supply meter*. A *branch conduit* connects to the *circuit distributor,* which is housed in a *consumer unit*. This is a fireproof cabinet or box containing fuses or circuit breakers for the various circuits.

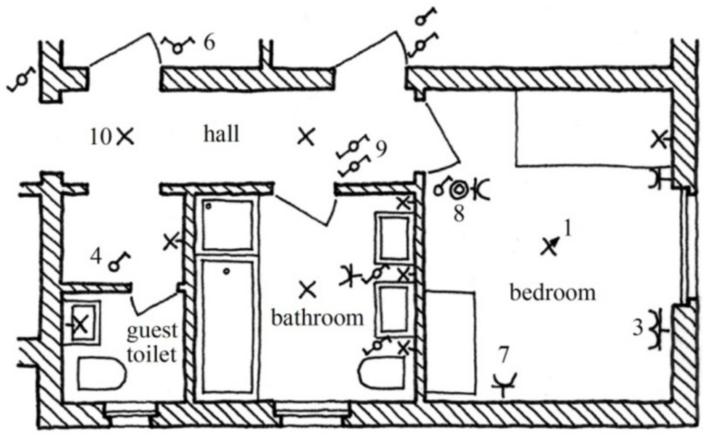
9.5.1 Wiring

A power cable is an assembly of two or more *electrical conductors*, insulation and a protective jacket to hold them together called *sheathing*. Power cables use copper as their conductor. In residential buildings and offices, the wiring is usually *concealed*. It is either laid in the plaster undercoat (in this case electricians use *flat underplaster cables*), in dry construction walls or in *cable conduits* or *service shafts*, which then often accommodate all services. In less prominent areas, such as basements, industrial buildings, etc., the wiring is often left *exposed*. This is not only cheaper, it is also more easily accessible when changes become necessary.

Offices very often install *raised flooring* or *floor ducts* to install all wiring, which is then independent from partition walls, flexible and easily accessible. In comparison to lighting and power, communication technology including *door openers* and *alarm systems* require *weak current*. The wiring is laid in the same way as *power cables*.

9.5.2 Electrical layout

The architect and the building services engineer have to plan very carefully, especially if the wiring is to be concealed. The number and arrangement of *sockets* for power and communications, *light fittings* and their *switches* have to be thought through thoroughly and, at the same time, designed to leave flexibility for future changes. The wiring originating in the consumer unit is divided into several circuits. A circuit is the *flow path of current* between the *fuse* and the connected power consumer. There are numerous ways of arranging the circuits, either common circuits for sockets and light fittings, which would then be per room or storey, or separate circuits for sockets and light fittings. Equipment with *connected loads* greater than 2 kW require their own circuit.

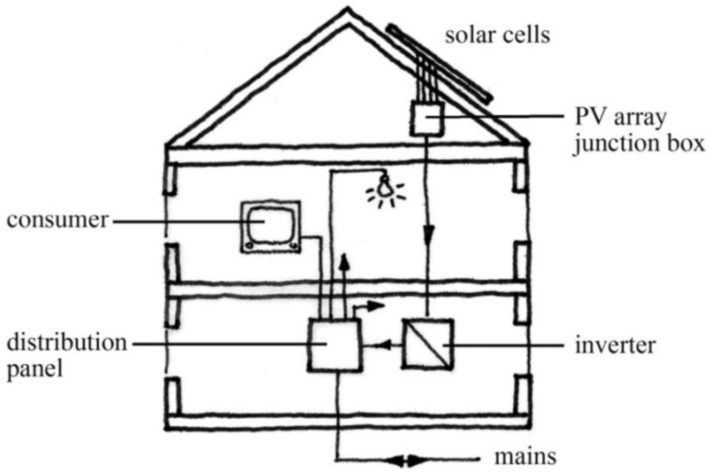


Match the electrical symbols with the correct terminology.

1.	a. on-off switch	6.	f. aerial socket
2.	b. push-button switch	7.	g. two-way switch
3.	c. double socket	8.	h. light fitting
4.	d. multi-circuit switch	9.	i. dimmer
5.	e. socket	10.	j. telephone outlet

9.5.3 Photovoltaic

Photovoltaic (PV) is a technology for generating electric power by using solar cells to convert energy from the sun into electricity. Solar cells produce *direct current* (DC) electricity, which has to be transformed to *alternating current* (AC) by an *inverter* so that it can be used by the building occupants. The cells have to be protected from the environment behind a glass sheet. To increase the power output, cells are connected to modules which are arranged in multiples as *arrays*. In buildings, arrays are incorporated into the roof or walls of a building. Any excess electricity is fed into the electricity grid. In remote areas photovoltaic panels are the preferred option for generating electricity. In such circumstances batteries are used to store the electric power.



9.5.4 Lightning protection system

Originally the idea of lightning protection was to prevent lightning from causing fire or mechanical damage to the exterior of buildings. Due to the increasing number of electrical devices sensitive to damage from *power surges*, e.g. computers, internal lightning protection is an important consideration.

The only reliable *lightning conductor* is an uninterrupted metal conductor. On the exterior of a building these appear in the form of lightning rods which arrest, limit and conduct the currents to the earthing system. In the interior, *equipotential bonding conductors* connect all pipes and cables throughout the house with the *potential equalising bar* in the service entrance room. A *connection lug* connects the potential equalising bar to the *foundation earther*.

9.6 Building services in energy-efficient buildings

There are generally two approaches to an energy-efficient building. On the one hand, the aim is to reduce the energy demand by using suitable structural measures. This means coordinating the structure, construction and building materials in such a way as to minimise the use of technical equipment. The second approach is to select and design technical equipment in such a way that the transformation and distribution of energy is performed efficiently. One might refer to these two approaches as low-tech and high-tech. In practice, a combination of the two usually leads to the best results.

In every building, there are five services to consider in terms of energy efficiency, namely heating, cooling, ventilation, lighting and electricity.

	Low-tech	High-tech
Heating	Retain heat produced by central heating, *solar irradiation* and ambient heat through insulation and *storage mass*.	Supply heat efficiently in a low carbon or even carbon-neutral way through technical equipment.
Cooling	Avoid overheating through structural measures, e.g. sun protection.	Remove heat efficiently by using *natural heat sinks* or refrigerating machines run on regenerative power.
Ventilation	Ventilate space naturally, e.g. night-time ventilation.	Supply air efficiently with mechanical support and using heat exchangers.
Lighting	Make use of daylight.	Provide artificial light with minimum energy consumption and using an automated system.
Electricity	Apply efficient electrical equipment.	Make use of the building and the site to generate power, e.g. solar panels can replace roof covering or facade elements.

9.6.1 Conversation

The preliminary design for George Brown's single-family home is almost complete. The client and the architect, Tim Smith, meet to discuss further procedures and the building services.

George Brown: Hello Tim.

Tim Smith: Hello George. It's great that you could find the time to come so quickly. We've got quite a few things that need discussing.

George Brown: The technical matters, I assume.

Tim Smith: Yes, that's right. I don't know if you're aware, but all buildings nowadays have to be built according to the new building regulations, which have been adapted to incorporate some of the clauses from the European Directive. This generally means lots of insulation and a low energy demand.

George Brown: Right. Does that mean a passive house or something like that, then?

Tim Smith: Well, a passive house is a standard which can be achieved by fulfilling certain requirements. It's a design philosophy, but you can also have it certified.

George Brown: What might I need a certificate for?

Tim Smith: Well, more than anything it might make you feel good and might encourage others to do the same. There are, however, government schemes that subsidise green building. I'd have to find out exactly which ones might be appropriate. I know though that the government is subsidising heat pumps and *off-grid power*.

George Brown: Oh, do you mean we could generate electricity with those solar panel things?

Tim Smith: Well, that's one possibility. There's also the possibility to generate electricity with a micro generator. A micro generator would produce heat and power and, if you use a renewable energy source like wood pellets or chips, it could even be *carbon-neutral*.

George Brown: Mm, interesting. So what are the requirements for a passive house?

Tim Smith: (takes a look at his notes) The annual heating demand must be no more than 15kWh/m², which can be achieved with approximately 15 cm of insulation and *triple glazing*. The total primary energy demand must be no more than 120kWh/m² per year, so this also means lots of daylight, energy-saving appliances, like the washing machine and so on, and the building must be airtight, to be precise it may not leak more than 0.6 times the house volume per hour.

George Brown: My goodness all that insulation and triple glazing. Will we be able to breathe?

Tim Smith: Actually, that is a problem in these new very airtight buildings. And if we do go down this route, we'll have to make sure the ventilation is sorted.

George Brown: Do you mean, we'll be needing an air-conditioning unit?

Tim Smith: No, we'd use a fairly simple *heat recovery* ventilation system. Basically this provides a regular exchange of air without loss of heat in winter or cool air in summer.

George Brown: What about solar panels though? It is the trend, isn't it? Couldn't we generate hot water in the summer and also electricity?

Tim Smith: The roof that we've planned is actually perfectly inclined and oriented for the use of solar panels. If we do fit them, there will be a cost saving on roof tiles.

George Brown: This is all quite complex and there are a lot of numbers involved. I presume the costs are also quite considerable, too. We'd like to *go green*, that's one of the reasons why we've commissioned you. On the other hand, our budget is limited and I'm no expert when it comes to these technical matters. Could you draw up a realistic scheme that will meet passive house or low-energy house standards for us to discuss at our next meeting?

Tim Smith: That sounds good. I'll set up a meeting with our building services engineer and together we'll draw up a plan including the necessary building services and update the cost estimate for your new home.

George Brown: Great. Thanks. Let's fix a meeting for next week then.

9.6.2 Comprehension

Are the following statements concerning the dialogue true or false.

	true	false
1. "Nice to meet you!" would have been the right expression to use at the beginning of the conversation.		
2. The building regulations in the UK have adopted the requirements of the European Directives.		

3. A green building certificate is required for every new build.
4. There are many subsidisation schemes for green buildings.
5. A passive house is an energy-autarchic house.
6. A pellet burner emits the same amount of CO_2 as absorbed during the growth of the plants.
7. The architect suggests using solar panels to create a synergy effect.
8. The slope of the roof is ideal for mounting solar collectors and photovoltaic panels.
9. Cooperation with the civil engineer will be beneficial for the green building approach.

9.6.3 Business skill: Phrasal verbs

In conversation, native speakers tend to use phrasal verbs in opposition to the more formal Latinate verb. A phrasal verb is a combination of a verb and a preposition with a different meaning from the original main verb. Instead of saying “Let’s postpone the meeting,” a native speaker might tend to say “Let’s put off the meeting”.

Some compounds are used literally, like “She looked out of the window”, which are easily understood. Others with figurative and idiomatic meaning are far more difficult to understand. The verb put, for example, can be combined with more than 20 prepositions each giving the simple verb a different meaning. Some combinations have also got several meanings, for example put up. It can mean:

- to provide food and accommodation for somebody, e.g. we can put you up for the night
- to erect something, e.g. they put up the fence
- to tolerate something or somebody, e.g. I can’t put up with this noise.

Phrasal verbs are difficult to learn and there is no real way to categorise them. There are lots of books and websites (e.g. www.phrasalverbdemon.com) to help learn and practise phrasal verbs.

Take a look at the list of phrasal verbs with their Latinate counterparts. Then complete the dialogue between the architect and the building services engineer on the following page using one of them. (The Latinate verbs could also be used, but possibly in a more formal context.) Be careful to use the correct tense.

If you would like to practise more phrasal verbs, there is a similar exercise in Unit 10 on Page 137.

to set up	= to arrange	to make do	= to manage
to bring down	= to reduce	to work out	= to calculate
to draw up	= to prepare	to look forward	= to be eager
to hang on	= to wait	to keep to	= to observe
to take on	= to employ	to add up	= to amount
to put together	= to compile	to come up with	= to produce

Tim Smith: So, that's the preliminary design. Now let's take a look at the building services.

Frank Miller: (1)…….............. ! Where did you say the plant room was?

Tim Smith: Well, it's here. Do you think you'll be able to (2)…….............. with this slightly limited space?

Frank Miller: Hmm, I'm not sure. But tell me first what you've got in mind.

Tim Smith: For hot water and heating, I'd like to suggest using solar collectors and a pellet burner to cover *peak loads*.

Frank Miller: Yes, that always works well. We've just (3)…….............. a solar expert. I'll have to ask her to put in some extra hours for this project. We'll have to (4)…….............. some new plans and (5)…….............. the costs.

Tim Smith: Talking about costs. Naturally the client is on a tight budget. I'd really like to (6)…….............. a list comparing the costs of a conventional building and what we've got in mind here. Of course, this should take into account the building's total life cycle.

Frank Miller: That's no problem at all. Let's try and (7)…….............. the budget. Eco construction doesn't have to (8) …….............. to more, quite the opposite, we could even try to (9)…….............. the total cost.

Tim Smith: Thanks, Frank. We're definitely on the same wavelength again. Let's (10)…….............. a meeting for this time next week. I'll (11)…….............. to hearing what you've (12) …….............. .

9.7 Vocabulary

9	building services	Haustechnik
9.1	building services engineering	Haustechnikplanung
	plumbing	Sanitär
	electrical engineering	Elektrotechnik
	mechanical engineering	Maschinenbau
	potable water	Trinkwasser
	sanitation	Sanitäreinrichtungen
	waste water	Abwasser
	building services engineers	Haustechnik Ingenieur
	energy consumption	Energieverbrauch
	renewable energy	erneuerbare Energie
	low carbon technology	kohlenstoffarme Technologie
9.1.1	service-entrance room	Hausanschlussraum
	communications cable	Fernmeldekabel
	house connection box	Hausanschlusskasten

	building sewer	Anschlusskanal
	cleaning eye	Reinigungsöffnung
	equipotential bonding conductor	Potenzialausgleichsleiter
	gas shut-off valve	Gasabsperrhahn
	water shut-off valve	Wasserabsperrhahn
	water meter	Wasserzähler
	service facilities	Anschlusseinrichtungen
	service line	Anschlussleitung
	mains	Hauptleitung, Versorgungsnetz
9.2	lead	Blei
	tubing	Rohrführung
	plumbing fixture	Sanitärobjekt
	drainage	Entwässerung
	plumber	Sanitärinstallateur, Klempner
	toxicity	Giftgehalt, Toxizität
9.2.1	drinking water supply	Trinkwasserversorgung
	HVAC (heating, ventilating and air conditioning) system	RLT-Anlage (raumlufttechnische Anlage)
	humidity	Luftfeuchtigkeit
	flow rate	Volumendurchfluss
	pressure	Druck
	water supply company, water utilities	Wasserversorgungsunternehmen
	desalination	Entsalzung
	waterworks	Wasserwerk
	elevated tank	Hochbehälter
	water tower	Wasserturm
	treated water	Reinwasser
	shut-off valve	Absperrarmatur
	wall penetration	Wanddurchbruch
	mixer tap BE; mixing faucet AE	Mischbatterie
	water heater	Warmwasserbereiter
	outlet valve	Auslaufventil
	tapping sleeve	Anbohrschelle
	non-return device	Rückflussverhinderer
	to size	bemessen
	pressure increasing system	Druckerhöhungsanlage
	to lag	Rohre dämmen
9.2.2	fitting, accessory	Armatur
	tap BE, faucet AE	Wasserhahn
	dual-flush cistern	Spartastenspülkasten
	greywater	Grauwasser

	toilet flushing	Toilettenspülung
	irrigation	Bewässerung
9.2.3	waste water disposal	Abwasserbeseitigung
	house drain	Grundleitung
	soil/waste stack	Abwasserfallrohr
	private drain connection	Anschlusskanal
	sewage disposal system	Abwasserbeseitigungsanlage
	venting system	Entlüftung
	sewer gas	Faul-, Klärgas
	trap	Geruchverschluss
	to clog	verstopfen
	air admittance valve	Belüftungsventil
	combined sewerage system	Mischverfahren
	separate sewerage system	Trennverfahren
	floor drain	Bodenablauf
	flood level	Rückstauebene
	wastewater lifting system	Abwasserhebeanlage
	backflow preventer	Rückstauverschluss
	septic tank	Klärgrube
	precipitation infiltration	Regenwasserversickerung
	roof gutter	Dachrinne
	branch drain	Sammelanschlussleitung
	fixture drain	Einzelanschlussleitung
9.3	thermal comfort	Behaglichkeit
	air circulation	Luftumwälzung, -bewegung
	thermal conductivity	Wärmeleitfähigkeit
	thermal convection	Wärmemitführung, - konvektion
	thermal radiation	Wärmestrahlung
	evaporative heat loss	Wärmeverlust durch Verdunstung
	heat transfer coefficient, U-value	Wärmedurchgangskoeffizient, U-Wert
	heat load	Heizlast
9.3.1	fuel	Brennstoff
	non-renewable/abiotic resources	nicht-erneuerbare Ressourcen
	flue	Rauchgaszug, Fuchs
	chimney	Schornstein
	moulded brick	Formstein
	sustainable resource	nachhaltiger Rohstoff
	state subsidies	staatliche Bezuschussung
9.3.2	heat generator	Wärmeerzeuger
	heat transfer medium	Wärmeträger
	radiant heating	Flächenstrahlungsheizung

	thermostat	Raumtemperaturregler
	balancing valve	Ausgleichventil
	warm-air heating	Warmluftheizung
	ductwork	Luftleitungsanlage
	distance heating	Fernheizung
	district heating station	Heizwerk
	pipe network	Rohrnetzwerk
9.3.3	hot water production	Warmwasserbereitung
	instantaneous water heater	Durchlauferhitzer
	hot water cylinder	Warmwasserspeicher
	geyser	Warmwasserbereiter
	domestic hot water (DHW)	Warmwasser
9.3.4	anti-freeze solution	Frostschutzmittel
	heat exchanger	Wärmetauscher
	heating element	Heizeinsatz
	flow pipe	Vorlaufrohr
	return pipe	Rücklaufrohr
9.3.5	geothermal heat pump (GHP)	geothermische Wärmepumpe
	water-to-water heat pump	Wasser-Wasser-Wärmepumpe
	infiltration well	Sickerbrunnen
	suction well	Saugbrunnen
	ground loop	Erdreich-Rohrregister
9.4	vitiated air	verbrauchte Luft
	fan	Ventilator, Lüfter
	extractor fan	Absauggebläse
	fresh air	Außenluft
	supply air	Zuluft
	exhaust air	Fortluft
	return air	Abluft
	recirculated air	Umluft
	ventilation heat loss	Lüftungswärmeverlust
	mechanical ventilating installation	Lüftungsanlage
	heat recovery system	Wärmerückgewinnungsanlage
9.4.1	indoor climate	Raumklima
	room air-conditioner	Raumklimagerät
	sound attenuator	Schalldämpfer
	diffuser	Diffuser, Deckenluftauslass
	register	Regulieröffnungsgitter
	reflected ceiling plan	Deckenspiegel
	chiller unit	Kälteaggregat
	mixing chamber	Mischkammer

	air filter	Luftfilter
	air preheater	Luftvorerhitzer
	jet chamber	Düsenkammer
	mist eliminator	Tropfenabschneider
	air reheater	Luftnacherhitzer
	supply air blower	Zuluftventilator
	circulation pump	Umlaufpumpe
	by-pass	Umführungsleitung
9.5	public utility company	öffentliches Versorgungsunternehmen
	electricity grid	Stromnetz
	high-voltage transmission line	Hochspannungsleitung
	substation	Unterwerk
	electricity distribution station	Netzstation
	underground cable	Erdkabel
	overhead line	Freileitung
	cable connection	Hausanschluss
	electric supply meter	Stromzähler
	branch conduit	Abzweigleitung
	circuit distributor	Stromkreisverteiler
	consumer unit, fuse box, cut-out box	Sicherungskasten
9.5.1	wiring	Leitungsverlegung
	conductor	Leiter
	sheathing	Kunststoffmantel
	concealed	unter Putz
	flat underplaster cable	Stegleitung
	cable conduit	Installationsrohr, Leerrohr
	service shaft	Installationsschacht
	exposed	auf Putz
	raised flooring	Installationsboden
	floor duct	Bodenkanal
	door opener	Türöffner
	alarm system	Gefahrenmeldeanlage
	weak current	Schwachstrom
	power cable	Stromkabel
9.5.2	socket BE; receptacle AE	Steckdose
	light fitting	Leuchte
	switch	Schalter
	flow path of current	Strombahn
	fuse	Sicherung
	connected load	Anschlusswert
	aerial socket BE, antenna receptacle AE	Antennenbuchse

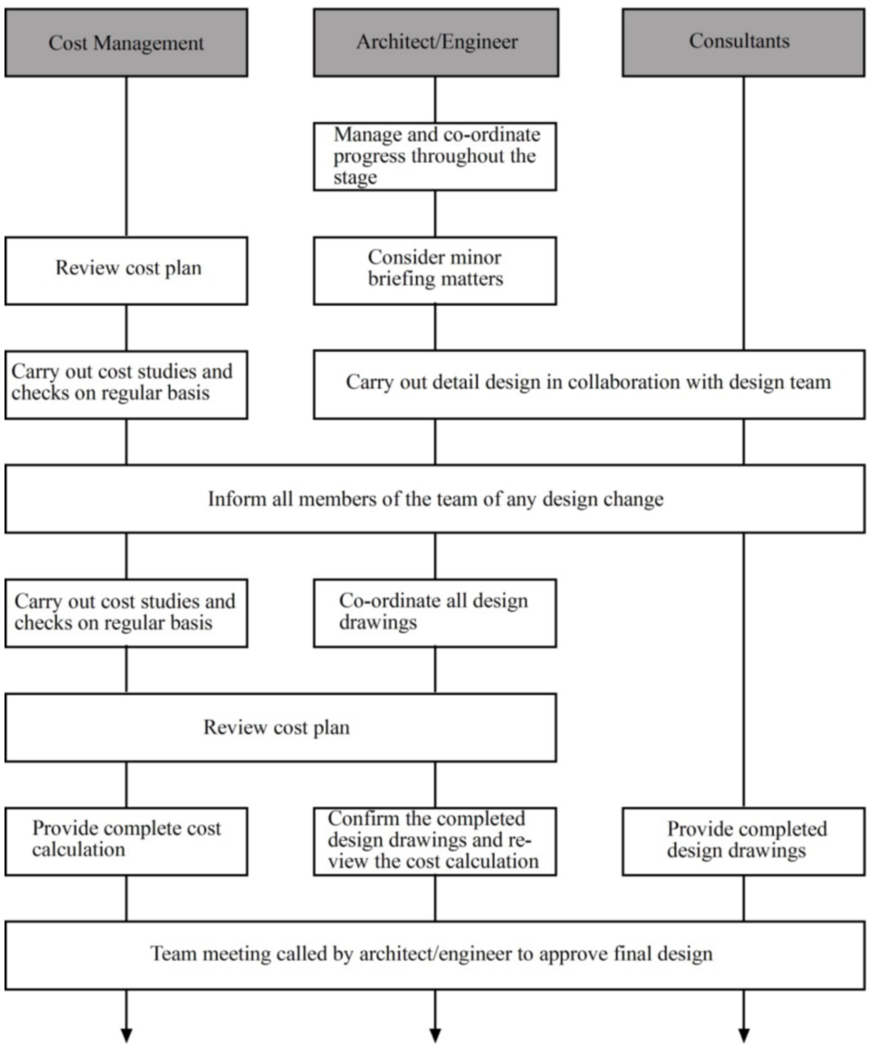
	on-off switch	Ein-Aus-Schalter
	telephone outlet	Telefonanschlussdose
	multi-circuit switch	Serienschalter
	push-button switch	Tastschalter
	two-way switch	Wechselschalter
9.5.3	direct current	Gleichstrom
	alternating current	Wechselstrom
	inverter	Wechselrichter
	photovoltaic array	Photovoltaikanlage
	junction box	Anschlusskasten
	distribution panel	Stromverteiler
9.5.4	lightning protection system	Blitzschutz
	power surge	Überspannung
	lightning conductor	Blitzableiter
	equipotential bonding conductor	Potentialausgleichsleitung
	potential equalising bar	Potentialausgleichsschiene
	connection lug	Anschlussfahne
	foundation earther	Fundamenterder
9.6	solar irradiation	solare Einstrahlung
	storage mass	Speichermasse
	natural heat sink	natürliche Wärmesenke
9.6.1	off-grid power	Netzunabhängiger Strom
	carbon-neutral adj	CO_2-neutral
	triple glazing	Dreifachverglasung
	heat recovery	Wärmerückgewinnung
	to go green	umweltfreundlich werden, hier: ökologisch bauen
9.6.3	peak load	Spitzenlast

10 Final Design

10.1 Coordination

This stage of the planner's work is the completion of the design. Ideally, there should be no major changes after this point. If the project is sufficiently large to support a design team, there has to be a constant *flow of information* between the architect or engineer and the consultants. It is the planner's task, or, if commissioned, the project manager's task, to coordinate the work of the design team and *iron out* all conflicts arising between team members.

The diagram below gives an indication of the development and the coordination during the final design planning stages.



S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_10

The aim of the final design stage is also the completion of all drawings, usually to a scale of 1:100, and documents for the future development. The drawings serve as a basis for the planning application and possibly also the procurement process.

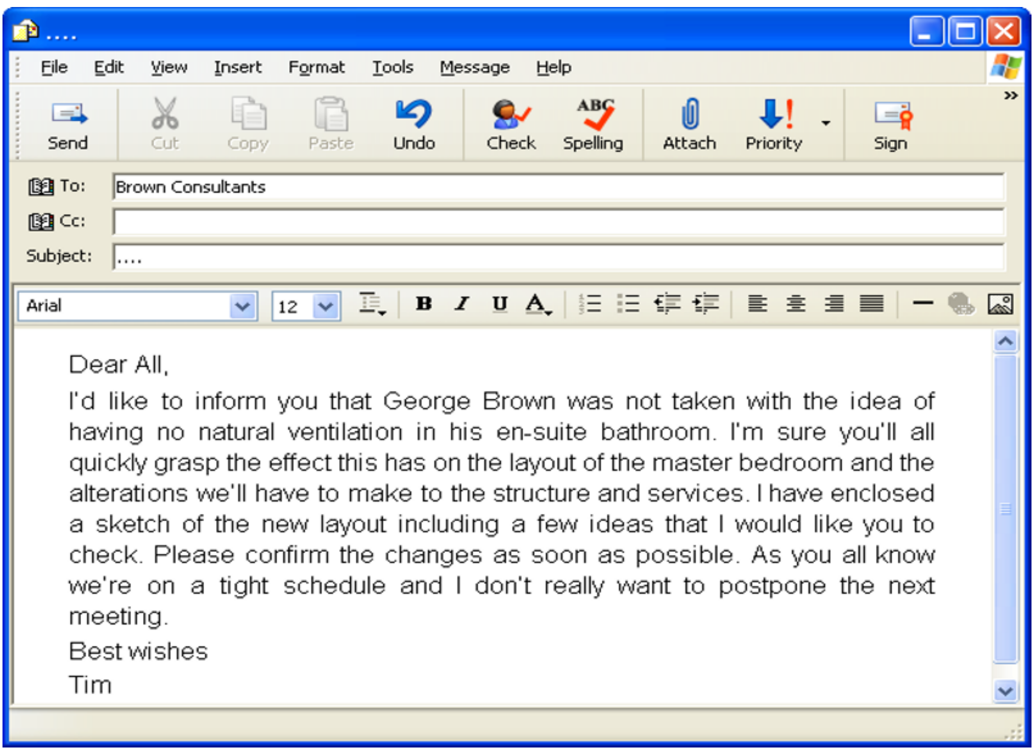
As the project has progressed, the drawings have become more precise and detailed. In a similar way, the *cost determination* should also become more refined. What was once a *cost estimate* should, during the final design stage, become a *cost calculation* reducing the variance between the estimated cost and the actual cost of the scheme. It is not until the next service phase that offers and *quotes* replace estimates and calculations. With the client's budget in mind, the cost calculations should be as accurate as possible. The figures are continuously updated during the final design phase, which is essential for monitoring on-going costs.

It is important to keep the client informed during this phase and regular meetings should take place. It may be necessary to report to the client on changes due to *incorporating* services or structural measures. The client has to approve all changes and make decisions on any *outstanding* items.

10.1.1 Informing the design team

The advantage of sending an email instead of a normal "snail-mail" letter is that it is quick and direct. It is especially useful when the contents concern all team members since they all receive the same information at the same time.

Here is an email that the architect, Tim Smith, sends to the design team informing them about a change that has become necessary after having spoken to the client. Find an appropriate subject line for the email.



To: Brown Consultants

Cc:

Subject: ....

Dear All,

I'd like to inform you that George Brown was not taken with the idea of having no natural ventilation in his en-suite bathroom. I'm sure you'll all quickly grasp the effect this has on the layout of the master bedroom and the alterations we'll have to make to the structure and services. I have enclosed a sketch of the new layout including a few ideas that I would like you to check. Please confirm the changes as soon as possible. As you all know we're on a tight schedule and I don't really want to postpone the next meeting.

Best wishes

Tim

Now take a look at the language used in the email. The salutation, the close and the body are fairly formal. If the architect had known the consultants well, he would have used “Hello” or “Hi” as the salutation and “Rgds” in the close.

Match the vocabulary used in the body of the email with the less formal vocabulary below.

1. to let you know	…………………...	5. to attach	…………………
2. to put off	…………………...	6. no time to spare	…………………
3. asap	…………………...	7. the changes	…………………
4. to agree	…………………...	8. does not like	…………………

10.1.2 Building Information Modelling

BIM is the acronym that stands for Building Information Modelling. It is a type of software that can be used to represent all details of a project in digital format from the conception through to the occupation of a development that is shared between all project participants. It replaces two-dimensional technical drawings, but extends beyond 3D by adding time as the fourth and cost as the fifth dimension. So more than just the geometry of the building, BIM enables the inclusion of spatial relationships, environmental information, quantities and properties of building components. It can be used for *quantity take-offs* and to track predicted and measured performance as well as costs.

Since a BIM model is a central store of information, any modifications to the building design will *replicate* automatically through all dimensions. As a single *interface*, it can be used by all parties throughout the entire lifecycle of the building and help reduce operation and management cost. Alongside the initial cost of the software and concerns of software failing, it is most important to establish a clear framework covering the responsibilities and *liabilities* of all persons involved.

10.1.3 Meetings

Regular meetings, which are also referred to by the French expression jour fixes, take place to discuss progress on the development and the current state of affairs. There is usually an agenda to structure the time spent together and make sure that all items are dealt with. *Minutes* are taken for later reference. More information regarding meetings can be found in Unit 15. The focus here is on the language used in meetings or simple business conversation.

As mentioned in Unit 9, we tend to use phrasal verbs in spoken and slightly less formal communication in opposition to the more formal Latinate verbs. Complete the dialogue using one of the following prepositions. Then match each phrasal verb to a more formal Latinate verb similar in meaning.

down 2x · off · into · up 3x · on 4x · without · out 2x

Tim Smith: OK, that’s the layouts. Let’s move .... to the structure.

Joe White: Hold .... a minute. What about the width of this room here.

Tim Smith: Yes, we had to change it, but I’m sure you can sort it ....

Joe White: I’ll have to look .... the problem. But you know you can count .... me to find some kind of solution.

Tim Smith: So we'll be needing some load-bearing elements here. And what about the lintels and the stair design?

Joe White: Oh dear. It's more complex than I thought it would be. We're a bit short of staff at the moment. But we're thinking of taking .... another engineer. Of course it'll put .... our expenses. But on the other hand we'll be able to cut .... on hours and everybody can calm .... a bit again.

Tim Smith: In that case let's call .... the meeting with the building services engineer. You're not going to run .... of work and we'll fix .... a new date for the following week.

Joe White: OK. Thanks for putting .... with us. I'm sure you could do .... the extra hassle.

rely	=	tolerate	= ....
finish	=	relax	= ....
solve	=	not require	= ....
investigate	=	arrange	= ....
wait	=	continue	= ....
employ	=	cancel	= ....
raise	=	reduce	= ....

10.2 Presentation material

Before preparing documents and plans for the *planning application*, the client should *approve* the final design proposal and give instructions to proceed. Any second thoughts on the scheme after this point can cause serious *disruptions* and add cost. The architect or engineer should prepare a detailed presentation including a report, a determination of cost and a *time schedule*. The information from the consultants should be carefully *cross-referenced* to the design drawings.

10.2.1 Visuals

Most presentations include visual aids to illustrate and emphasise the speaker's ideas more effectively than words alone. Naturally, the visuals used in planning and building work are usually plans. However, other visuals may also be used, especially when it comes to presenting costs, time schedules or the organisation of a company.

This book also applies a variety of visuals to help the reader to better understand the terminology. Take a look at the pages 5, 38, 56, 60, 141, 147, 160 and 191, can you find the following visual aids. Match the page numbers to the descriptions.

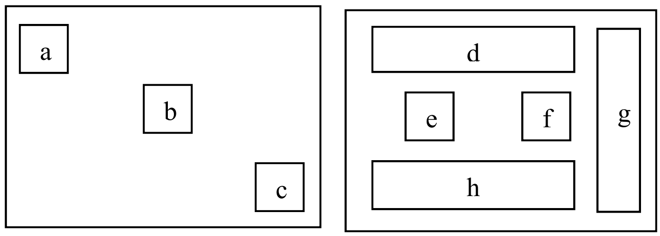
pie chart	....	table/spreadsheet	....
organigram	....	bar chart	....
sketch	....	diagram	....
flow chart	....	drawing	....

The presenter has to choose the right way to illustrate the information. This means using the right tools and the right language when referring to the contents. The means of presentation range from a simple overview or flip chart diagram to sophisticated computer-generated images. The equipment used is very much dependent on the size of the audience and the place where the presentation is being held. It is interesting to note that information *retention* from a visual and oral presentation is six times greater than when the spoken word alone is used.

10.2.2 Explaining visuals

Since it is not always possible to point to what you are talking about and say “here you can see ...”, the presenter should draw the audience eye to the item concerned by using the correct expressions. Decide which part of the visual the presenter is referring to?

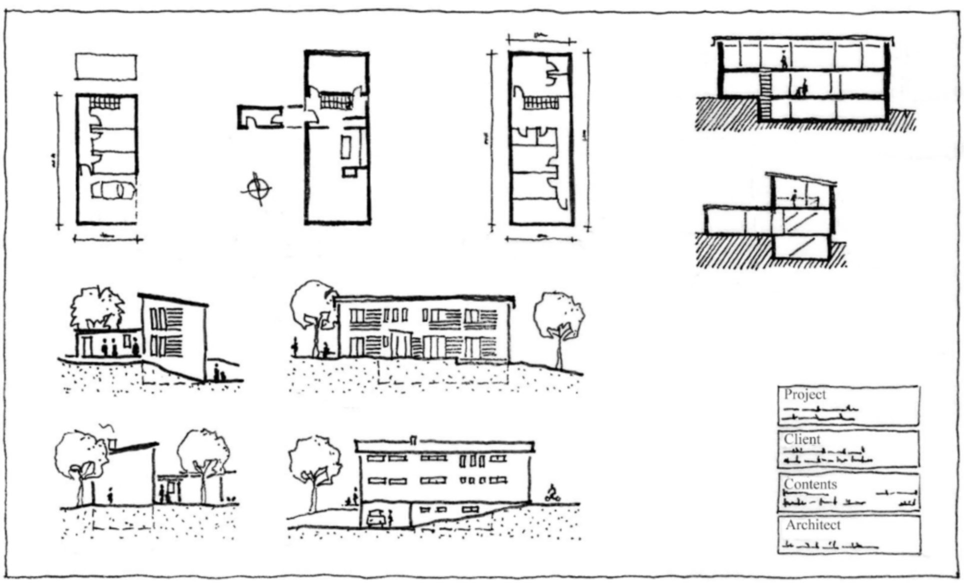
1. in the lower right-hand corner
2. in the top left corner
3. across the top
4. down the right-hand side
5. on the left
6. in the centre
7. at the bottom
8. on the right



10.2.3 Plans

The architect or engineer’s most important visual material is a plan. They are used to present the building or structure from all *angles*. Take a look at the following plan for the design of a single-family home and add the correct vocabulary to the individual drawings.

east elevation · underground floor · south elevation · cross section · west elevation · drawing title north elevation · first floor plan · north indicator · ground floor plan · longitudinal section



10.3 Presentation language

All drawings should be self-explanatory. However, when *submitting* the *proposal* to the client, the architect or engineer should take the time to present the scheme orally. In some cases, the presenter's audience may only be a single person, the client. In other cases, especially when dealing with larger schemes, the presentation may be made to a group, such as a company board or a committee. In either case, good presentation skills, including a good *command of* the presentation language, are extremely important.

Some presenters go into a presentation in a one-way communication mode, simply bombarding the client with all the details. However, it is in fact a two-way communication method, even if only one part is doing the talking. The audience's reaction and participation is vital for the successful transmission of the message. The presenter's aim is not to send the audience off to sleep or simply thrust information on them, but to convince and sell the carefully prepared scheme leaving room for the audience to form their own personal opinions.

So what makes a presentation successful? Complete the following list of features using the words from the box.

humour · voice · structure · appearance · preparation · language · contact · attitude

To be a good presenter you need …

1. a simple and clear ……………….
2. a smart and professional …………….
3. a good sense of …………………...
4. good eye ………………..
5. an enthusiastic ………………
6. a strong …………………
7. expressive body ……………….
8. careful ………………

10.3.1 Presentation structure

Most formal and informal presentations consist of three parts. Typically there will be an introduction outlining the scope of the presentation and providing an overview of the project. The central part, or body, goes into greater detail and might be structured according to building sections or phases. The conclusion should sum up the scheme emphasising the key points and invite the audience to ask questions or take part in a discussion.

What this really means in simple words is: "Tell 'em what you're going to tell 'em; tell 'em; and tell 'em what you told 'em".

The introduction is perhaps the most important part of a presentation – it is the *first impression* the audience has of the presenter. The introduction should be used to:

- welcome the audience and introduce yourself
- introduce the project
- outline the structure of the presentation
- explain why the topic is relevant for the audience

The table below lists useful expressions that you can use to introduce the various parts of your presentation.

Function	▪ **Language**	
Welcoming the audience	▪ Good morning/afternoon, ladies and gentlemen. ▪ Hello / Hi everyone.	▪ First of all I'd like to thank you for coming here today. ▪ It's good to see you all here.
Introducing yourself	▪ Let me start by introducing myself. My name is	▪ For those of you who don't know me, my name is ...
Introducing the project	▪ I'm here today to present ... ▪ The subject of my talk is ... ▪ I'd like to start by …	▪ Starting with … ▪ Let's begin by … ▪ First of all, I'll …
Moving on to next phase	▪ We'll now move on to … ▪ Another important aspect is . … ▪ I'd like to continue with …	▪ I'd like to expand on … ▪ Let's now look at … ▪ I'd like to emphasise the importance of …
Sequence of events	▪ Firstly … secondly … thirdly … lastly … ▪ First of all … then … next … after that … finally … ▪ To start with … later … to finish up …	
Referring back	▪ As I mentioned earlier ... ▪ Let's go back to what we were discussing before ...	
Reference to visuals	▪ Let's take a look at … ▪ As you can see … ▪ I'd like to point out … ▪ If you take a look at …, you will see …	▪ Here you can see … ▪ This diagram points out … ▪ This drawing shows … ▪ This diagram/line gives you an indication of …
Conclusion	▪ In conclusion, I'd like to … ▪ Let's summarise briefly what we've looked at … ▪ Finally, I'd like to point out … ▪ If I can just sum up the main points …	
Dealing with questions	▪ I'll come back to this question later … ▪ We'll be examining this question in more detail later on … ▪ Are there any questions? ▪ Would anybody like to comment on …? ▪ I'm afraid I'm not in a position to answer that question at the moment. ▪ That's a good question. So, you'd like to know whether ... ▪ Does that answer your question? ▪ I hope that answers your question.	

10.3.2 Presentation

Tim Smith presents the final design to the client, George Brown. A few changes have been made since the last meeting, and it is the first time the client receives a presentation of the project as a whole.

Put the parts of the architect's presentation into the right order.

□ If you take a look at the cross section, you'll see that the single pitched roof rises towards the garden, which emphasises the open character of the facade. The *overhang* of the roof is approximately 1m offering some structural shading to the sunny side of the house. As you can see here, the overhang is less on the north facade allowing as much light as possible to penetrate through the small windows.

□ Well, I hope the proposal meets your expectations. Have you got any questions regarding any aspects of the house?

□ It's nice to be here with you again today. I think we're nearly there, and if there are no major alterations to be made, we'll be able to submit the planning application next week.
But before we start talking about business matters, let me talk you through the design. First of all I'm going to take you through the various floors, beginning on the ground floor, and then we'll look at the sections and the elevations.

□ Ah, yes. I thought you might ask. The ground floor simply doesn't offer space close to the kitchen without totally changing the layout. What we have planned is a large kitchen and close access to the cellar. On the first floor there is a utility room next to the bathroom for storage or washing. I hope you'll be able to warm to this idea. So, if there are no further questions, let's move onto the costs and timing.

□ So, I've completed the little tour of the house. I think you can see that it is a very clear design. I know you envisioned a private adult area on a separate storey, however, the extra height would be very difficult to manage on this particular site. Nevertheless, I think we have succeeded in offering clearly separated parent and children zones by adding the spacious hall on the first floor.

□ Let's begin at the main entrance. You enter the building here and step into a large hall. Here you can see that the hall functions as both a *distributor* and as a separator. On the ground floor it separates the kitchen, dining and living area from the office, and on the first floor it separates the adult area from the children's area.
Now let's take a look at the stairs. This set takes you up to the first floor. The stairs to the cellar are behind this door.
Finally, the bedrooms on the first floor. The master bedroom with an en-suite bathroom and a walk-in wardrobe is situated above the office. The children's bedrooms are arranged in a row above the living and dining area.

□ So, what about our utility room or larder next to the kitchen?

□ Good morning everybody,

□ We'll now move onto the elevations. All bedrooms and living areas face southwest. Large windows with *movable shutters* look out onto the garden. All other facades, especially the north and east facing, are closed except for a few small windows.

10.4 Alterations

Before the architect or engineer can move on to the next phase, which is *obtaining planning permission*, the client's approval is essential. Any changes or alterations made to the design beyond this point are costly and time-consuming. If major alterations are made after receiving planning permission, a new planning application has to be submitted.

The discussion following the presentation, offers the audience an opportunity to put forward their comments or questions. It is during these discussions that the client or a person from the audience might propose an alternative or make a suggestion. A conjunction at the beginning of a phrase is an indirect way of introducing a possible situation and a careful way of making a suggestion.

Example:

If we increased the depth by half a metre, we'd *gain* a lot of extra *space* on the first floor.

The if-clause, which is the first part of the sentence above, states the possible situation or the condition; the main clause shows what the speaker thinks the result of that condition might be. The if-clause can be positioned at the beginning or at the end of a sentence. When it comes at the end, there is no comma after the main clause.

Depending on the level of possibility and the tense, we either use conditional I, II or III.

Conditional I for real, possible situations (simple present/future with will)	If the client chooses to have a photovoltaic system, we'll have to change the angle of the roof.
Conditional II for imaginary or *remote possibilities* in a present situation (past simple/conditional with would)	If the site were slightly wider, we'd locate the garage next to the entrance.
Conditional III for imaginary or remote possibilities in a past situation (past perfect/past conditional with would have)	If we hadn't submitted the planning application, we would have encountered many more changes.

It is also possible to use other conjunctions to connect two related ideas in a conditional sentence. "*Provided/providing that*" and "so long as" have a similar meaning to if. "In case" and "in the event of" indicate that a future event may or may not happen. "Unless" can be used for real possibilities with the same meaning as "on the condition that".

Exercise: Conditional sentences

Match a part from the left with a part from the right to form conditional sentences.

1. Supposing you raised the ceiling height,	a. there'll be sufficient light to work.
2. We'll cope with not having a larder	b. unless you come up with a suitable alternative.
3. So long as there is sufficient space for my car,	c. if the client hadn't appointed a quantity surveyor.
4. The architect would have had to prepare the cost estimate	d. will the access from the hall still be necessary?
5. If you add another window to the room,	e. would the beam still be sufficiently dimensioned?
6. We'll go ahead with this scheme	f. would the stairs still work in this way?
7. If you increased the distance between the posts,	g. providing the kitchen is no narrower than three metres.
8. Supposing the office has a separate entrance,	h. you may use the garage for technical equipment, too.

10.5 Vocabulary

10	final design	Entwurfsplanung
10.1	coordination	Abstimmung, Koordination
	flow of information	Informationsfluss
	to iron out	beseitigen, aus dem Weg räumen
	in collaboration with	in Zusammenarbeit mit
	cost determination	Kostenermittlung
	cost estimate	Kostenschätzung
	cost calculation	Kostenberechnung
	quote, quotation	Kostenanschlag
	to incorporate	aufnehmen, einbeziehen
	outstanding adj	ausstehend, ungelöst
10.1.1	to be taken with sth	angetan sein
	alteration	Änderung
	asap, as soon as possible	so bald wie möglich
	tight schedule	enger Terminplan
	to postpone	verschieben

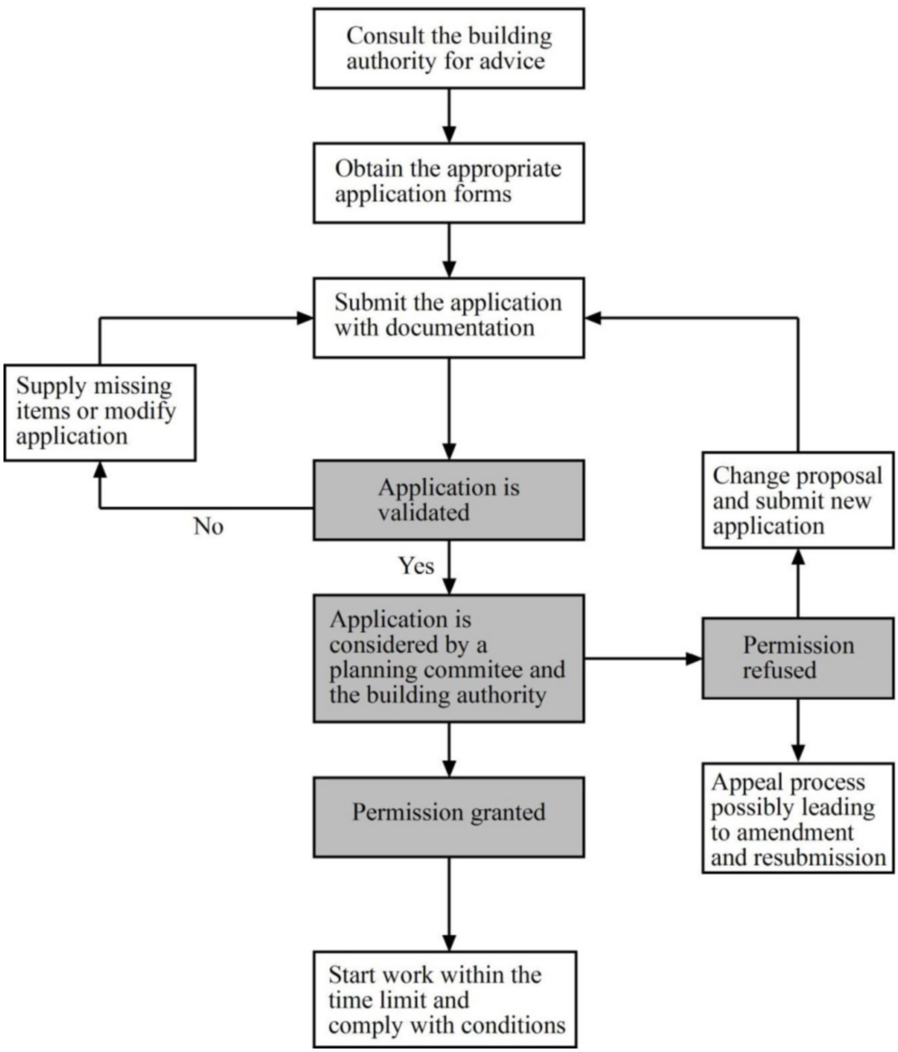
10.1.2	quantity take-off	Massenermittlung
	replicate	Kopie
	interface	Schnittstelle
	liabilities	Verbindlichkeiten
10.1.3	minutes	Protokoll
10.2	planning application	Bauantrag
	to approve	abnehmen
	disruption	Störung, Unterbrechung
	time schedule	Zeitplan, Terminplan
	to cross-reference	querverweisen
10.2.1	visual (aid)	visuelles Hilfsmittel
	pie chart	Kuchendiagramm
	flow chart	Ablaufdiagramm
	table, spreadsheet	Tabelle
	bar chart	Balkendiagramm
	retention	Behalten, Speicherung
10.2.3	angle	Blickwinkel
	elevation	Ansicht
	longitudinal section	Längsschnitt
	cross section	Querschnitt
	drawing title	Plankopf
	north indicator	Nordpfeil
10.3	to submit	unterbreiten, vorlegen
	proposal	Vorschlag
	to have a good command of sth	gute Beherrschung von etw. haben
10.3.1	first impression	erste Eindruck
10.3.2	roof overhang	Dachüberstand
	distributor	Verteiler
	movable shutters	Schiebeläden
10.4	to obtain planning permission	Baugenehmigung erlangen
	to gain space	Platz gewinnen
	remote possibility	geringe Wahrscheinlichkeit
	provided/providing that	angenommen dass
	unless	sofern nicht

11 Planning and Building Permission

11.1 Permission

A form of permission is required for most new constructions or alterations to existing properties. In many countries, this process involves an application to the local authority. The aim of the authority is to check whether the building *blends in* with its environment, is in line with the *development plan* and *complies with* general rules of construction.

Despite international differences, the procedures for obtaining permission are very similar, and every application passes through a fairly well defined sequence of stages. Take a look at the process illustrated in the flowchart below.



S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_11

In the UK, the application process is divided into two phases: planning permission and *building regulations* approval. They are separate pieces of *legislation* dealt with by separate departments within the local authority. Basically planning permission is the acceptance of the design and the permission to erect, enlarge or make alterations to a building as presented in the application, whereas building regulations define how the new building must be constructed. Usually *applicants*, who have applied for planning permission, also have to obtain building regulations approval. Both applications involve a fee, which is normally related to the value of the development. In Germany, planning and building permission are combined in one single application.

If work is carried out without the necessary *approvals*, the local authority can issue an *enforcement notice* requiring at best *retrospective approval* or at worst *demolition* of the work already completed.

11.1.1 Planning permission

Planning authorities seek to guide the way towns, cities and countryside develop. This includes the use of land and buildings, the appearance of buildings, landscaping considerations, highway access and, increasingly, the impact the development will have on the general environment. Planning applications have to be put to the authority responsible for the place of construction. Sometimes notice of the application is published in the local press and at the property. Neighbours and anybody with an opinion are able to view the plans and make comments, which the local planning authority must take into consideration when making a decision on the application.

Whether an application is approved or refused largely depends on the development plan and the written guidelines. Planning permission is officially granted by a planning committee made up of elected members of the *council*. The meeting is normally open to the public. However, a planning officer, not elected, but a paid employee of the council, will make *recommendations* to the committee. It is always worth *consulting* the official before an application is made and again before the application goes to the committee.

Certain minor works are granted automatic planning permission by the state. These developments are known as *permitted developments*. So long as the buildings are not *listed* or in a *conservation area*, for which separate pieces of legislation apply, permitted developments both in Germany and the UK include:

- Fences and walls along the plot boundary no taller than 2 m.
- The demolition of certain buildings.
- All changes concerning the exterior appearance such as paintwork, panelling, roof coverings and the replacement of windows and doors.
- *Loft conversions*; in Germany without dormer windows, in the UK subject to the additional volume, not exceeding 10 per cent of the original building's volume.
- *Non-habitable rooms* such as *conservatories*, *sheds*, garages and carports.

  In Germany, these should not exceed 50 m^3 if they are extensions and 10 m^3 for sheds; garages should not exceed an average height of 3 m and a length of 9 m on the boundary.

  In the UK the floor area should not exceed 30 m^2, it should be no higher than 4 m and at least 2 m (garages and sheds 1 m) away from the boundary.

- In the UK, it is permitted to build *habitable* extensions so long as these do not exceed the limits related to the original building's volume and are no higher than 4 m. The limit is 10 per cent for a terraced house and 15 per cent for semi-detached or detached house. All extensions, including *porches*, must be at least 2 m from the site boundary.

If in doubt about the scale of planned work, local planning authorities are always able to provide the necessary information. If planning permission is required for a new building or alteration, building regulation approval is normally also necessary. Usually architects wait until permission has been granted before proceeding with the building regulations application.

The website www.planningportal.gov.uk provides useful information and links with regard to the planning regime in the United Kingdom.

11.2 Planning application

The application should be made on a form issued by the local planning authority. It must be submitted properly completed, together with the relevant plans, documents and the fee. The application must provide details of the proposed design, external appearance, access, parking and landscaping. The application *curtilage* has to be defined on the *site location plan*.

The assessment of planning applications usually takes about 4 weeks, but depends upon the scale of the development. The authority may grant permission, grant it subject to conditions or refuse it, giving reasons for the conditions or refusal. Permission is given to the land not the applicant. It follows that when the land is sold, the permission is unaffected. In Germany, planning permission is valid for 4 years; in the UK, for 3 years. If permission is refused, the applicant has a right of appeal.

The parties involved in planning permission applications are the appropriate authority and the client. However, apart from signing the necessary documents, the client does not usually have direct involvement since the architect or engineer act on the client's behalf.

State or local government projects naturally also require planning permission. In this case, the authority planning the development submits the application to a higher authority; this especially concerns projects in civil engineering since most of the construction work in this field is a state matter. In many cases, planning approval is less dependent on the design than costs and *urgency* of the work.

In similar ways to the *private client*, the *public client* also has a budget which may be spent on construction, refurbishment and maintenance work. Usually the money is allocated according to priorities and urgency. State projects have an unfortunate habit of significantly exceeding the original cost estimate. The tendency is for authorities, when submitting applications, to pitch their estimates on the low side in order to receive planning permission and develop the scheme regardless of those who may have to cover the extra costs.

11.2.1 Exercise: Permitted development?

Not all developments require planning permission. Unfortunately it is not easy to assess whether or not permission is required, as many factors are involved. General rules such as "small house extensions are *exempt*" are misleading as they apply to some situations but not to others. It is always advisable to speak to a planning officer and allow him or her to make an assessment.

Nevertheless, take a look at this variety of projects and decide for which four developments planning permission has to be obtained in the UK. Do the same rules apply to Germany?

1. A porch with a total area of 4 m^2, approximately 1m away from the road.
2. A *greenhouse* with a floor area of 6 m^2.
3. A loft conversion for a terraced house to include new dormer windows, but adding less than 4 m^3 volume.
4. A 2 m^2 extension to a dwelling in a conservation area.
5. A 1.80 m tall wall on the site boundary.
6. A garage with a total floor area of 24 m^2 set on the site *boundary*.
7. Insulation and wood panelling to be added to exterior walls.
8. A two-storey extension adding 90 m^3 to the existing 550 m^3 of a semi-detached house.

11.2.2 Building regulations

Rules for permitted buildings in Germany are stricter than those in the UK, the reason being that in Germany only one application is required. In England, a lot of developments are possible without planning permission; however, most permitted developments are then subject to building regulations. The application for building regulations is fairly straightforward and often taken care of by the contractor; it is not always necessary to involve an architect for a building regulations application.

In Germany, aspects considered in British building regulations form part of the general planning application. The building description, for example, demands information regarding the materials and their *combustibility* as well as a description of building services, and a separate form has to be submitted for the *firing system*.

In the UK planning permission relates to the aesthetic and environmental aspects of construction work, whereas building regulations are concerned with *health and safety matters*. Generally building regulations are designed to:

- set standards for the design and construction of buildings; to secure the health and safety, *welfare* and *convenience of the public*, including those with disabilities, in or about buildings and others affected by the buildings or matters connected with the buildings
- further the *conservation of resources*
- *prevent waste*, *undue consumption*, *misuse or contamination of water*

The first building construction legislation was drawn up after the Great Fire of London in 1666, which saw a need for buildings to have some form of *fire resistance*. The regulations are constantly reviewed to meet the growing demand for better, safer and more accessible buildings.

The most recent *amendments* have been to increase *thermal insulation* in order to conserve energy and reduce global warming, providing access and facilities for *disabled people* and more comprehensive *fire protection requirements*.

An application for building regulations approval is not advertised. Only the party applying and the local authority are involved. Building regulations approval may be required even if planning permission is not. There are very few structures and alterations which require neither planning permission nor building regulations.

11.2.3 Idioms

The word idiom is derived from the Latin word "idioma", which means "special property". And this is exactly what an idiom is. It is a combination of words with a special figurative meaning, usually very different from what it would mean in a literal sense. One that most English language students seem to know is "it's raining cats and dogs". In its literal sense, this cannot be true. The figurative meaning is "it's raining very heavily". There are thousands of idioms in every language. Some of them translate quite similarly, like "it's on the tip of my tongue – es liegt mir auf der Zunge"; others are very different, for example, "to kill two birds with one stone", which, in German, is equivalent to "zwei Fliegen mit einer Klappe schlagen". There are estimated to be at least twenty-five thousand idiomatic expressions in the English language. It's good to know at least a few of them.

Read the text, which is riddled with idioms, about the process of submitting the planning application for the Browns' house.

The architect, Tim Smith, **is up to his eyes in work** (1) and struggling **to keep his head above water** (2). He therefore had to **pull out all the stops** (3) to get the planning application for Helen and George Brown completed ontime. The design process was intense and the architect wasn't always **on the same wavelength** (4) as the client, but after some **give and take** (5), they quickly reached agreement on most aspects relevant for the application. It was the roof shape they didn't **see eye to eye on** (6). The architect **went out on a limb** (7) and suggested a flat roof, but this **went down like a lead balloon** (8) with the clients. They had **set their hearts on** (9) a saddle roof. Anyway, after some **to-ing and fro-ing** (10), they **met halfway** (11) and opted for a low mono-pitched roof. These disagreements are now **water under the bridge** (12). All design elements relevant for the application are resolved and the architect submitted the planning application yesterday. Tim Smith **knows the ropes** (13) and should therefore **be on the right track** (14) for obtaining planning permission. **Keeping fingers crossed** (15) that all goes well, within four to six weeks, the approval should **be in the bag** (16). They can then **turn the first sod** (17) at the beginning of May.

Now find the idiomatic expressions in the text that have the following meanings. Do you know the equivalent expressions in your native tongue?

a. to have the same opinion
b. to fall flat; to be a total failure
c. to take a different approach, possibly not shared by others
d. to hope that plans will be successful
e. to be certain it will happen
f. to start building work
g. to make a compromise (2x)
h. to do everything right to achieve the result
i. to be familiar with the process
j. to make a great effort to achieve sth.
k. to avoid becoming overwhelmed by (work-related) problems
l. movement backwards and forwards
m. something of the past
n. to be in agreement
o. to be very busy
p. to want sth very much

11.3 Fire safety

For centuries, fire has proved to be a major *hazard* in buildings. Local building authorities enforce regulations dealing with fire safety matters and seek to ensure that adequate levels of safety are provided for people in and around buildings. All building codes include rules and regulations concerning *fire precaution* in buildings. Even though the contents of the building codes vary, there are common principles designed to ensure a means of warning and escape, limit the *spread* of fire, both internally and externally, as well as provide access and facilities for the *fire service*. The primary concern is *life safety,* rather than the preservation of the structure or the protection of the building's contents.

Fire regulations are enforced by the *fire protection authorities*, which issue a fire certificate once satisfied with the precautions taken. A fire protection plan containing a complete inventory and maintenance details of all fire protection components forms the legal basis for compliance with laws and regulations.

11.3.1 Fire protection

The fire protection system in a building is made up of three equally important components, including:

- Passive fire protection: These are planned and constructional measures intended to contain and limit the spread of fire.

  The planned measures include sufficiently dimensioned *escape routes* as well as access for fire brigades and firefighters, *compartmentalisation* of horizontal and vertical *fire sections*, with the necessary *firewalls* to prevent *flashovers* and doors.

  The constructional measures involve the selection of suitable materials and protective measures for *hazardous materials*, e.g. *encasings*. Steel is *incombustible* but deforms at high temperatures and therefore loses its load-bearing capacity. An encasing made either of concrete or fibreboard increases the *fire resistance* of structural elements.
- Active fire protection: These are technical measures including the installation of *fire-alarm and fire-detecting devices*, *fire-extinguishing systems*, such as hydrants, *fire extinguishers* and sprinkler systems, and the installation of *smoke exhausting equipment*.
- Education: Fire drills and training on what to do in an emergency are a further important aspect of fire protection. The purpose is to ensure that occupants and operators know how to handle and maintain systems. They should know how to evacuate, or where *to seek refuge*. Furthermore, they should have sufficient understanding not to disable any of the active or passive fire protection systems.

11.3.2 Fire resistance rating

The fire resistance rating indicates the duration of a passive fire protection system withstanding a standard *fire endurance test*. This is usually quantified as a measure of time. A fire door with a T90 designation is able to withstand fire and prevent fire from spreading for a duration of 90 minutes. A *certification mark* is displayed on the product to show that *product certification* was obtained in an appropriate fire endurance test. In most industrialised nations, product certification is *mandatory*.

The combustibility of materials selected depends on the *class of inflammability* required for the part of building under consideration, e.g. the walls of a staircase enclosure. The usual ratings for elements and structures range from 30 to 120 minutes. The fire rating describes the period for which the material has to maintain its load-bearing capacity and prevent fire from spreading. The minimum periods are reduced for buildings with sprinklers.

11.3.3 Escape routes

In an ideal situation, occupants of a building should be able to turn their backs on any fire and move to a place of safety. Clearly, single staircase buildings, *rooms within rooms* and *dead-end corridors* have difficulties satisfying this demand. A measure often required is that staircase enclosures, especially in single staircase buildings, should have a high fire rating and should not be used for the storage of combustible materials. The same applies to dead-end corridors.

Alternative escape routes, which are exits from the building not usually used for access, must be fitted with special locks. These include break-the-glass bolts or locks, *panic bolts* or electric locks, which release on the operation of the fire alarm. All alternative exit routes have to be clearly indicated by “Fire Exit” signs.

An *escape and rescue plan* is drawn up and displayed to inform all occupants of appropriate escape routes. These plans also mark the locations of fire extinguishers, *hoses* and all other fire prevention and extinguishing equipment.

11.3.4 Lexis: Fire safety

Match the term on the left with the correct definition on the right.

1. fire rating	a. an exit from a building which is only used in emergencies
2. combustible	b. a value describing the combustibility of a product
3. smoke exhausting system	c. an activity which divides a building into zones in order to limit the spread of fire
4. hazardous material	d. an active fire protection device to announce afire; usually a small box with a glass window which has to be broken
5. compartmentalisation	e. a phase during which materials should maintain their load-bearing capacity and prevent fire from spreading
6. escape route	f. a passive fire protection product used in ventilation ductwork to prevent the spread of fire
7. flashover	g. something that catches fire and burns
8. fire-resistance period	h. a technical device to draw smoke from an area
9. fire damper	i. dangerous or risky product
10. fire alarm button	j. fire spreading into an adjacent fire section

11.4 Vocabulary

	planning permission	Baugenehmigung
11.1	to blend in	sich vermischen, einfügen
	development plan	Bebauungsplan
	to comply with sth	erfüllen, nachkommen
	building authority	Baubehörde
	application form	Antrag
	to submit	vorlegen
	fee	Gebühr
	planning committee	Planungsausschuss
	to refuse	ablehnen, verweigern
	to grant	bewilligen, gewähren
	appeal	Berufung, Einspruch
	building regulations	Baubestimmungen, -vorschriften
	legislation	Gesetzgebung
	applicant	Antragsteller
	approval	Genehmigung, Zustimmung
	enforcement notice	Vollstreckungsankündigung
	retrospective approval	rückwirkende Genehmigung
	demolition	Abbruch, Abriss
11.1.1	planning authority	Projektierungsbehörde
	council	Gemeinderat, Stadtrat
	recommendation	Empfehlung
	to consult sb/sth	jmdn./etw. zu Rate ziehen
	permitted development	nicht genehmigungspflichtiges Bauvorhaben
	listed building	denkmalgeschütztes Gebäude
	conservation area	Denkmalerhaltungsgebiet
	loft conversion	Dachausbau
	non-habitable room	Raum ohne Aufenthalt
	conservatory	Wintergarten
	shed	Schuppen
	habitable room	Aufenthaltsraum (gemäß Bauordnung)
	porch	überdachter Eingangsbereich, Vorbau
11.2	curtilage	Hausgrundstück
	site location plan	Lageplan
	urgency	Dringlichkeit
	private client	nicht-öffentlicher Auftraggeber
	public client	öffentlicher Auftraggeber
11.2.1	to be exempt from planning approval	(genehmigungs-) frei sein

	greenhouse	Treibhaus, Gewächshaus
	boundary wall	Grenzmauer
11.2.2	combustibility	Verbrennbarkeit
	firing system	Feuerungsanlage
	health and safety matters	Gesundheits- und Sicherheitsangelegenheiten
	welfare	Wohlergehen
	convenience of the public	Wohl der Öffentlichkeit
	conservation of resources	Ressourcenerhaltung, -schonung
	waste prevention	Abfallvermeidung
	undue consumption	unangemessener Verbrauch
	misuse	Missbrauch
	water contamination	Wasserverschmutzung
	fire resistance	Feuerwiderstand
	amendment	Berichtigung, Nachtrag
	thermal insulation	Wärmedämmung
	disabled people	Körperbehinderte
	fire protection requirement	Brandschutzanforderung
11.3	fire safety	Feuersicherheit
	hazard	Gefahr
	fire precaution	vorbeugender Brandschutz
	to spread	ausbreiten
	fire service	Feuerwehr
	life safety	Lebensrettung
	fire regulations	Brandschutzrichtlinien
	fire protection authority	Brandschutzbehörde
11.3.1	escape route	Fluchtweg
	compartmentalisation	Einteilung in Brandabschnitte
	fire section	Brandabschnitt
	firewall	Brandwand
	flashover	Brandüberschlag
	hazardous material	Gefahrenstoff
	encasing	Ummantelung
	incombustible	nicht brennbar
	fire-alarm and fire-detecting device	Feuermeldeeinrichtung
	fire-extinguishing system	Feuerlöschsystem
	fire extinguisher	Feuerlöscher
	smoke exhausting equipment	Rauchabzugsvorrichtung
	to seek refuge	Schutz suchen
11.3.2	fire resistance rating	Feuerwiderstandsklasse
	fire endurance test	Feuerwiderstandsprüfung

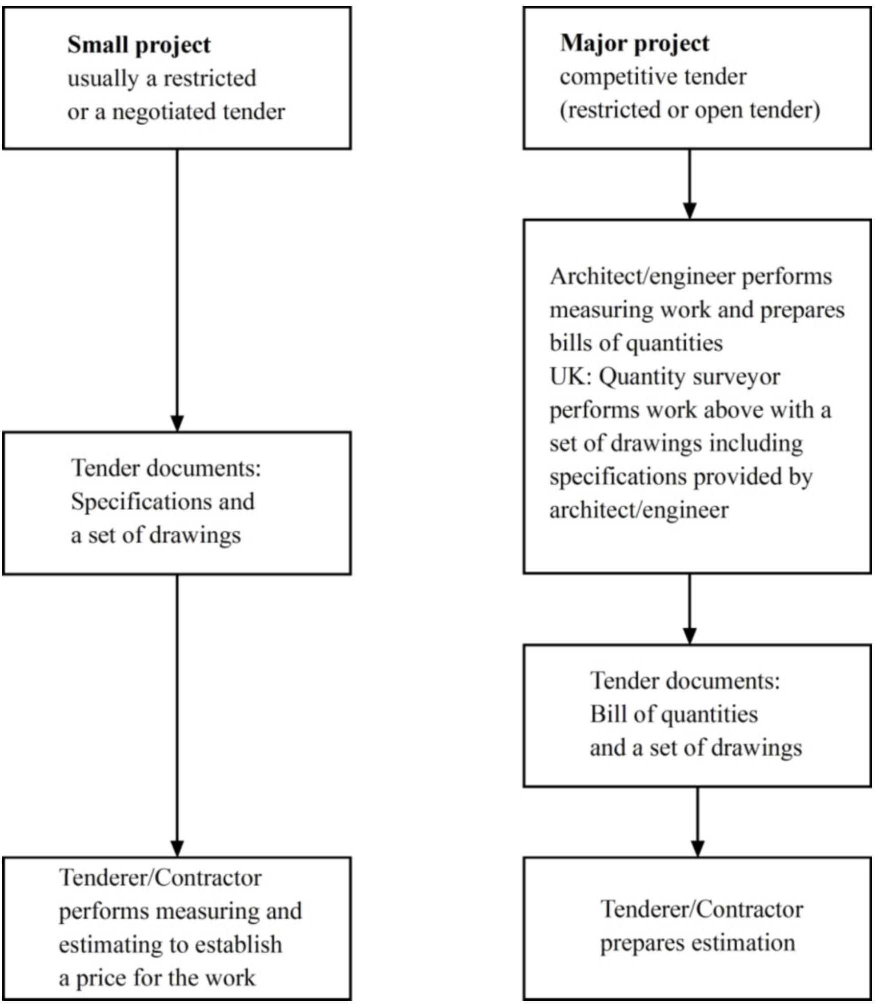
	certification mark	Zertifizierungszeichen
	product certification	Produktzertifizierung
	mandatory	obligatorisch, verbindlich
	class of inflammability	Brandschutzklasse
11.3.3	room within a room	gefangener Raum
	dead-end corridor	Sackflur
	panic bolt	Notausgangsverriegelung
	escape and rescue plan	Flucht- u. Rettungsplan
	fire hose	Feuerlöschschlauch
	fire damper	Brandschutzklappe

12 Tender Documentation

12.1 Procurement procedure

The procurement procedure is the process of selecting firms to perform the work described in the tender documents. Usually the size and/or the officialdom of the project determine which procurement path is to be taken. A common feature of procurement procedures is that all require the preparation of tender documents.

The tender documents enable the tendering contractors to price the work and *submit a tender* to complete the specified work. Whilst the composition of the documents varies, it is essential that it is in a form which enables the *tenderer* to fully understand the scope of the work. For major projects, it is common to prepare *bills of quantities (BoQ)*. In the absence of bills of quantities, the tender documents include *specifications* and drawings.



S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_12

A competitive tender can either be an open tender, which is advertised and does not limit the number of contractors participating, or a restricted tender, which limits the number of tenderers to those selected by the client and the planners. If the client wishes to have the work executed by a particular contractor, a contract sum is negotiated.

Depending on the anticipated form of contract, traditional or design and build, as described at the beginning of the book, or others, the client will either have procurement documents prepared for *partial tenders* or an *all-inclusive tender*. In traditional contracts, each trade is *tendered for individually*. The planner or quantity surveyor performs the measuring work according to trades and compiles a single bill of quantities for each trade. When dealing with a design and build contract and a *general contractor* is to be commissioned with the work, a clear definition of trades is not necessary and a global tender is issued.

12.2 Production information

The production information includes all instructions necessary to realise the project. Preparation of the production information usually takes place in stages as the project progresses. At the procurement stage, sufficient information has to have been prepared to invite tenders. At this point, the architect or engineer should have confirmed all construction details and *compiled* the information in drawings and notes.

For the development of the scheme, contractors require further, more detailed information to *amplify* the contract drawings. The production information received from the planner, enables the contractor to carry out and complete the work by the completion date and for the sum stipulated in the contract.

Under most standard forms of building contract, the responsibility for supplying the contractor with the correct information lies with the project manager, the architect or civil engineer. It is their task to carefully check drawings prepared by consultants and make *amendments* in the event of *discrepancies*. A drawing, which has been amended and then *reissued*, should clearly state the amendment and be renumbered in order to avoid misunderstandings concerning the *up-to-dateness* of a drawing.

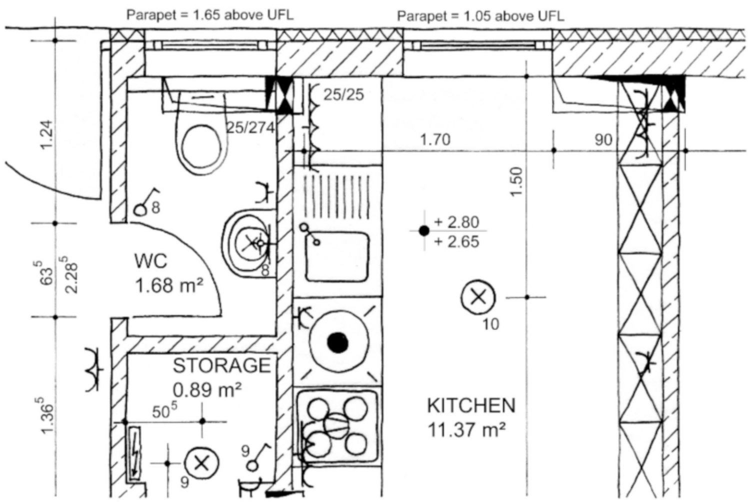
12.2.1 Working drawings

Working drawings are the drawings prepared by the planners to realise the construction work on site. They contain a wealth of information. Depending on the size of the building, all necessary information might be contained in one set of plans. This system is fairly accurate and has its advantages; the bricklayer can see what the electrician has to do and can readily appreciate the reason for any fine tolerances. However, the complexity of these drawings makes them less suitable for large buildings.

The *elemental drawing* is part of a system which gives each trade a drawing or a set of drawings. Ideally there is a set of drawings to a scale of at least 1:50 for each trade involved in the realisation. Reinforced concrete drawings, for example, show every detail of the shuttering, the steel and the concrete including dimensions, but nothing else. Further drawings, *location drawings*, to a smaller scale, 1:100 or 1:200 for very large buildings, are provided to show the way in which the elements fit together. Their intention is to show the location of the building enabling the site agent to set it out properly. Location drawings serve as an index offering reference numbers for further, more specific, drawings.

Neither system relieves the planners or the consultants from the task of preparing detail drawings. Large-scale drawings include details of specific items of construction not shown sufficiently clearly elsewhere. Details of *damp-proof courses, flashings* and *copings* need to be shown at a scale of 1:5, 1:10 or 1:20 to give those executing the work a full understanding of the construction.

This example of a traditional working drawing shows, in a single plan, the construction details for all trades involved in the project. Common symbols are necessary to communicate exactly what is required on site. There are not only standard symbols for furniture, plumbing fixtures and electrical installations, but also for the different materials, the *slab* and *wall penetrations*.



12.2.2 Dimensions

Dimensions are measurements of structural elements indicated on *dimension lines* in and around drawings. The dimensions can be indicated in metres, centimetres or millimetres depending on the level of detail. Some practices in the UK still work in feet and inches (see comment in section 3.2.3). It may be the client's request to use the imperial system.

Architects, engineers, quantity surveyors and contractors require *overall dimensions*, measurements of total lengths, to calculate the *girths* of walls. Excavations, foundations, damp-proof courses, copings, etc. are all dependent on the girths. *Internal dimensions* determine the lengths and widths of the interior layout. These measurements are necessary to position interior walls correctly and calculate the internal girths, e.g. for *plastering*, *skirting*, etc. Dimensions relating to structural elements, such as posts, doors, windows, etc., are not of interest to the person preparing the tender documents or the person estimating costs. Merely the quantity and the dimension of the structural element itself is of importance. However, these dimensions are absolutely essential for site staff positioning structural elements on site.

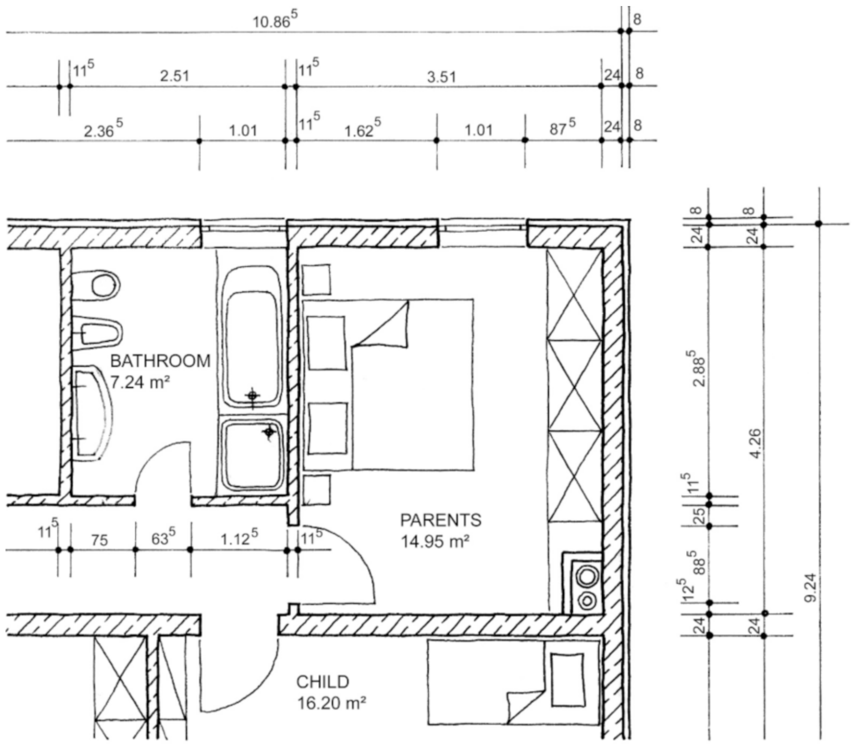
All the dimensions on plans refer to the *shell of the building*; this means the lengths between wall faces before plastering. The *author of a plan* should make quite clear whether the heights indicated in sections are finished levels (FFL = *finished floor level*) or unfinished levels (UFL = *unfinished floor level*). *Allowances* have to be made for the thickness of *finishes*, especially concerning minimum heights and widths. The dimensions on plans and drawings should be comprehensive and correct.

12.2.3 Exercise: Dimensions

There are three categories of dimensions:

- Overall dimensions, the total lengths of building elements
- *Structural dimensions*, a subdivision of overall dimensions indicating structural elements, such as doors, windows
- Internal dimensions indicating lengths and positions of internal walls

Identify these three types of dimensions in the drawing and fill the gaps in the text below.



The width of the bathroom is ……….; the depth is ………. leading to a total floor area of ………. . A window, ………. wide, is positioned above the bath. The master bedroom is located at the end of the hall, which is ………. wide. Wardrobes are located against the longer exterior wall measuring ………. . The bed could be placed against the bathroom wall. ……….. should be sufficient for a king-size bed and two bedside cabinets. The total floor area of the master bedroom is ………. . Whereas the door to the master bedroom is ………. cm wide, the door to the bathroom only measures ………. cm. The external walls are made of ………. mm brickwork and a further ………. mm of insulation material. It goes without saying that all dimensions refer to the *carcass*.

12.3 Tender documents

Tender documents include all the information necessary for tenderers, a company wishing to or requested to submit a tender for construction work, to estimate the costs of building work. The composition of such documentation differs. However, it is essential that it is in a form adequate for the tenderer to fully understand the scope of the work. As already mentioned, it is often the size of the project which determines the contents of the documents. A *form of tender*, which is returned to the architect with the *tender price*, is always included.

During the preparation work for tendering, the quantities have to be determined. The person responsible for this task varies. It may be performed by a member of the planning team or, when merely supplying plans and specifications, by the tendering contractors themselves.

In the UK, the planner is often relieved of this task through the appointment of a quantity surveyor; even when the project is relatively small. Quantity surveyors prepare bills of quantities based on the information provided by the architect or engineer. They are either commissioned by the client or, on some occasions, by the planner. The information required by the quantity surveyor to complete this task includes a full set of drawings and specifications. Since the specifications are not part of the tender documents, they may be in the form of notes. The bills of quantities itemise all the work necessary to complete the project. They are usually prepared in accordance with s*tandard methods of measurement*.

12.3.1 Specifications

Specifications contain descriptive information, which together with the drawings, form the basis for all construction work. In small contracts, the contractors prepare their tender from drawings and specifications only. The contractor's estimator takes measurements from the drawings and relies on the specifications for a full description of quality, materials and *workmanship*. Whereas quantities and materials are fairly easy to define, workmanship is not. If something is not mentioned in the specifications, but is required during construction, the contractor is entitled to additional payment. In this case the specifications are a contract document, which precisely convey what the client wants.

If a bill of quantities is prepared by a quantity surveyor, the specifications are not a contract document. The descriptions can be less formal and could appear in the form of notes on the drawings. Whereas in the previous case the contractor's *estimator* was responsible for the measuring work, it is now the quantity surveyor's task to take the measurements and prepare the bills of quantities.

When construction work commences, the *site agent* and *forepeople* require instructions in greater detail than available in the contract documents. The architect and engineer therefore produce working drawings and forward them to the contractor in good time. Despite the supply of these detailed drawings, the specifications remain a fundamental document incorporating the planner's instructions and are frequently referred to on site.

12.3.2 Bill of quantities

A bill of quantities is a set of descriptions defining the quantity and quality of construction work. It is required to provide sufficient information for the contractor to tender efficiently and accurately. Once the contract has been entered into, it functions as a *priced bill*, which is used for the *periodic valuation* of completed work.

Quantity take-off is the process of reading the plans and establishing the quantities. All the components are listed with a unit, which is either a dimension (metre, square metre, cubic metre), a time (hour, day, week) or a weight. The work must be itemised in sufficient detail to distinguish between the different classes of work or between work of the same nature carried out in different locations or circumstances. The layout and content of a bill of quantities should be as simple and brief as possible.

Nowadays, planning practices use software to produce bills of quantities and other procurement documents. The software provides access to databases with standardised text modules for the description of work processes. After selecting the appropriate text modules, the programme combines the individual elements with the corresponding quantities to create a project-specific set of specifications. The software can also be used to perform additional tasks, such as comparative analyses of tenders and *cost tracking* during the construction period.

A bill of quantities often includes *prime cost sums* for work or services to be executed by a *nominated subcontractor* or for materials to be obtained from a *nominated supplier*. A separate procurement procedure is normally carried out by the employer to select such specialised contractors. These sums are followed by an item inviting the tenderer *to quote* a *price* for any facilities, *amenities*, attendance, etc. required. *Provisional sums* are provided for work lacking sufficient information for proper measurement and/or pricing at tender stage. A bill of quantities may also include *contingency items* and *alternate specification items*. The inclusion of such items, provisional sums and prime cost sums, facilitates *budgetary approval* and avoids the need to obtain prices for alterations and modifications during the project development.

Bills of quantities, like specifications, incorporate contract particulars, employer's requirements and contractor's liabilities as well as a full specification of materials and workmanship. Unlike bills of quantities, specifications never contain quantities.

12.3.3 Lexis: Tendering

Match the terms 1 – 10 with the correct descriptions a – j.

1. tender	a. somebody who prepares bills of quantities instead of the planner
2. quantity take-off	b. the scheme is advertised publicly and any contractor may tender
3. bill of quantities	c. the whole act of obtaining a service, from selecting a suitable contractor, negotiating the price to signing the contract
4. competitive tender	d. descriptions of quality, material and workmanship; they do not contain any quantities
5. open tender	e. procedure involving the pricing of quantities
6. negotiated tender	f. document containing the price offered by a contractor for the work specified in a bill of quantities
7. procurement	g. the contractor with the lowest offer is *awarded the contract*
8. to estimate	h. an itemised list of all construction work including quantities
9. quantity surveyor	i. a specific contractor is selected and a price for the construction work is agreed upon between the client and contractor
10. specifications	j. the process of obtaining dimensions and calculating quantities based on the drawing contents

12.4 Language in tender documents

The language used in tender documents, *site diaries*, *minutes*, etc. describing activities of construction work is very specific. If you take a close look, you will realise that the person performing the action is not mentioned. Most activities are described either by using passive voice or the imperative. Take a look at the following example.

L 05 Suspended ceilings

False dry-construction ceilings comprising a membrane of tiles are supported by concealed suspended metal grids. The membrane is *demountable*, in part or in whole, to give access to the ceiling space. Lighting, ventilation and other services are integrated in the suspended ceiling.

Now compare the following sentences:

Passive voice:	Ventilation ducts are integrated in the suspended ceiling.
Imperative:	Integrate ventilation ducts into the suspended ceiling.
Active voice:	The contractor integrates ventilation ducts into the suspended ceiling.

Whereas the person performing the action is not mentioned when using passive voice or the imperative form, the third example above (active voice) names the obvious person, the contractor, as the person performing the work. This information is unnecessary and inappropriate in specifications and bills of quantities.

12.4.1 Grammar: Active versus passive

Passive voice is formed by using the verb “to be” in its correct form plus the past participle. Passive voice can be used in all tenses. The use of modal verbs in passive sentences is very useful for descriptions and instructions.

Tense	**Active**	**Passive**
Present Simple	The contractor removes the existing structures.	The existing structures are removed.
Present Continuous	The contractor is performing excavation work.	Excavation work is being performed.
Past Simple	The contractor laid the foundations.	The foundations were laid.
Past Continuous	The contractor was pouring concrete for the slab.	Concrete was being poured for the slab.
Present Perfect	The contractor has prepared the *formwork* for the ceiling.	The formwork for the ceiling has been prepared.
Going to future	The contractor is going to start the brickwork tomorrow.	The brickwork is going to be started tomorrow.
Future Simple	The contractor will finish the ground floor walls next week.	The ground floor walls will be finished next week.
Modal verbs (shall, must, may, etc.)	The contractor must complete the construction work by 30 April.	The construction work must be completed by 30 April.

12.4.2 Exercise: Active versus passive

Insert the correct verb form into the description of a cavity wall.

The external walls …………………. (to make up) of several layers. The load-bearing wall, on the inside, …………………. (to make) of 240 mm *vertically perforated brickwork*. It …………………. (to *plaster*) creating a smooth surface in the interior. The exterior surface of the load-bearing wall …………………. (to not *render*), but a second *fair-faced brick wall* …………………. (to place) at a distance in front of it. The two *leaves* …………………. (to enclose) a partially filled *cavity*. The cavity …………………. (to consist) of a rear ventilation and insulation, which is fixed to the inner leaf. *Wall ties* …………………. (to require) to provide structural stability. They …………………. (to embed) in the brickwork at regular intervals. *Perpends* in the exterior leaf …………………. (to leave open) in order to secure ventilation and control moisture.

12.5 Selection of contractors

The selection of contractors should be made in consideration of the nature and the size of the project. In order to obtain comparable offers with realistic prices, the contractors invited should be of similar standing. Contractors suitable to build a complex shopping centre may not be suitable to build an extension to a small house. It is therefore necessary to consider the contractors' experience and reputation, as well as their workforce and financial capacity.

The result of open tenders, which are advertised publicly, is often a very mixed list of firms, many of which might be unknown to the client. It is therefore not uncommon for the client to request that the successful contractor provides a *guarantee bond*. If the contractor fails to fulfil obligations, the bond would become available to the client to cover any additional expenses. Guarantee bonds are usually 10% of the contract value; they can be obtained from banks or insurance companies.

Public sector construction contracts exceeding a specified *threshold value* have to be advertised within the European Union. The procurement process has to be performed according to the procedures laid down in the Directive 89/440/EEC (EEC – European Economic Community). According to the directive, contractors have to apply to advertisements in the official journal of the European Union if they wish to be on the list of tenderers. The firms selected during this process are then officially invited to tender.

12.5.1 Advising the client

During the preliminary design phases of the project, used as an example in this book, the architect advised the client not to appoint a general contractor to develop the entire scheme, but to commission a main contractor for the *carcass work* and several smaller companies for the *interior construction work*. The architect, Tim Smith, is in the process of preparing the tender documents.

Before sending the documents out to a selection of contractors, the client should confirm the list of possible tenderers. Read the following letter addressed to the client requesting the confirmation of the list of contractors.

Tim Smith & Partners

Mr George Brown
Pepper Road
Great Missenden
Bucks HP6 2BP

2 April 2019

Re: Confirmation of list of contractors

Dear George,

As you are aware, I am currently preparing the tender documents and would like you to confirm the list of companies to be approached.

As discussed in previous meetings, the idea is not to appoint a general contractor to undertake all aspects of the work, but to have a main contractor for the carcass work and a selection of contractors for the interior construction work, sanitary installations, electrics and finishes.

The quantity surveyor is going to prepare bills of quantities for the carcass work and the sanitary fittings, and I hope to meet him on 4 April to hand over the drawings and specifications. With regard to the other trades, we will prepare some detailed specifications and send these to the firms together with drawings for them to make estimates.

I have enclosed a list of contractors with some comments. As you will see, I have worked with some of the companies before, others have been recommended. All in all, I feel it is a good selection, which will hopefully get us the price we are looking for. If you would like to make any changes or add some further contractors, please feel free to do so. I would like to contact the selected companies next week. I am hoping that most of them will be prepared to submit a tender.

I would be grateful if you could confirm the list by next Tuesday.

Yours sincerely

Tim Smith

Encl.: List of contractors

Tim Smith & Partners 6 Willow Road Chorleywood Herts WD4 3RS
Tel 01494 37894 Fax 01494 37895 e-mail timsmith@btconnect.com

12.5.2 Business letters

A business letter is more formal than an email or a phone call. It is used to highlight the official character and the importance of a certain topic. A letter enables the sender to enclose further documents, which are immediately available to the recipient. Even though the contents of each letter differentiate, the structure remains the same.

The sender's and recipient's address as well as a date and a reference should be positioned at the top of the letter. The salutation follows. In English, "Dear" is suitable for everybody. Whether you use Mr or Ms (only use Mrs if you know the person would like to be addressed in this way) or first names, depends on how well you know each other. If the name of the recipient is unknown, address the letter to "Dear Sir or Madam".

The actual contents of the letter are made up of an introduction, the body and an ending. The introduction should accomplish three aims: It should attract the readers' interest, explain the purpose for writing and provide a preview of what follows in the body of the document. Unlike in German the letter begins with a capital letter.

- Purpose of letter: With reference to your phone call/your letter of 20 March, I would like to ….
  I am writing to enquire about/inform you/apologise for/confirm/ remind you that …
- Adding enclosures: Please find enclosed …/I have enclosed …

The ending should state your conclusions or recommendations. It is also typical to close a letter with an action step or a feedback mechanism.

- Action step: I'll call you next Thursday to discuss this matter.
  Once I have your approval, I will proceed with the plan to …
- Feedback mechanism: I would be grateful, if you could…
  Please let me know if I can be of any further assistance.
  I look forward to hearing from you.
  I look forward to meeting you on …/at …

To ensure that your document flows use appropriate transitions like:

- First … second … third …
- First of all … then … finally …
- Furthermore, …
- On the one hand … on the other hand …

There are numerous possibilities to end a letter in English. The close "Yours faithfully" is very formal and slightly old fashioned. "Yours sincerely" is still formal, but works for people you know as well as people you have never met. "Best regards" and "Best wishes" are less formal and should only be used in business letters if you are using first names. Even if you have referred to enclosures in the letter, it is wise to add a list of enclosures after the close.

Remember to use the spell-check before printing the document. A spell-check is not *foolproof*; misspelled words could be correctly spelt, but have a different meaning, e.g. form and from. In order to ensure correct spelling and overall accuracy, it might be necessary for somebody to *proofread* the document. Active speech, rather than passive speech, makes your letter more interesting and livelier. Passive speech in a letter addressed to somebody personally is impersonal and makes it sound quite clumsy.

Don't forget to sign your letter.

12.5.3 Exercise: Business letter

The letter below contains numerous mistakes regarding the style. Correct the letter from the client addressed to the architect.

Tim Smith & Partners
6 Willow Road
Chorleywood
Herts WD4 3RS

Pepper Road
Great Missenden
Bucks HP6 2BP

5th April 2019

Hi Tim!

I received your letter with the list of contractors. Your selection looks fine to me. Some of the names ring a bell, but most companies are unknown to me. A friend of mine has used Company X on your list and had great difficulties with the quality of workmanship and meeting deadlines; therefore I would like to take them off the list. I have added two further companies: Company Y, for whom my brother-in-law works and Company Z, who built our current neighbour's house. If you have no objections to these changes, I suggest you go ahead and we get this tendering business sorted out as soon as possible. Please don't ask any more questions.

Cheers, George

List of contractors

12.6 Vocabulary

	tender documentation	Ausschreibungsunterlagen
12.1	procurement procedure	Vergabeverfahren
	to submit a tender	ein Angebot abgeben
	tenderer	Anbieter, Bieter
	bill of quantities, BoQ	Leistungsverzeichnis
	specifications (of works)	Baubeschreibung
	restricted tender	beschränkte Ausschreibung
	negotiated tender	freihändige Vergabe, bzw. Verhandlungsverfahren

	competitive tender	öffentliche Ausschreibung
	open tender	offenes Ausschreibungsverfahren
	estimation	Schätzung
	partial tender	Einzelvergabe
	all-inclusive tender	Gesamtvergabe
	to tender for trades individually	gewerkeweise Angebotseinholung
	general contractor	Generalübernehmer
12.2	production information	Ausführungsplanung
	to compile sth	etw. zusammenstellen
	to amplify sth	etw. ergänzen, ausführlicher erläutern
	discrepancy	Unstimmigkeit
	amendment	Berichtigung
	to reissue	neu herausbringen, -geben
	up-to-dateness	Aktualität
12.2.1	working drawing	Werkplan
	elemental drawing	Teilzeichung
	location drawing	Übersichtsplan
	damp-proof course	Feuchtigkeitssperre
	flashing	Blecheinfassung, Anschlussblech
	coping	Attikaabdeckung
	slab penetration	Deckendurchbruch
	wall penetration	Wanddurchbruch
12.2.2	dimension line	Maßkette
	overall dimension	Außenmaß
	girth	Abwicklung, Umfang
	internal dimension	lichtes Maß
	plastering	Putzarbeiten, innen
	skirting	Sockelleiste
	shell of the building	Gebäudehülle
	author of a plan	Planverfasser
	FFL finished floor level	FFB Fertigfußboden
	UFL unfinished floor level	RFB Rohfußboden
	allowance	Spielraum, Toleranz
	finishes	Oberflächenbehandlung
12.2.3	structural dimension	Rohbaumaß
	carcass	Rohbau
12.3	form of tender	Angebotsformular
	tender price or amount	Angebotssumme
	standard method of measurement	Aufmaßnorm
12.3.1	workmanship	Ausführungsqualität, Bearbeitungsgüte
	estimator	Kalkulator, Baukalkulator

	site agent	Bauleiter (der ausführenden Firma)
	foreperson, pl forepeople foreman, pl foremen forewoman, pl forewomen	Polier/in
12.3.2	priced bill	ausgefülltes Leistungsverzeichnis
	periodic valuation	fortlaufende Kostenkontrolle
	quantity take-off	Massenermittlung
	cost tracking	Kostenüberwachung
	prime cost sum	Selbstkostenbetrag
	nominated subcontractor	benannter Subunternehmer
	nominated supplier	benannter Lieferant
	to quote a price	anbieten, einen Preis angeben
	amenities	nützliche Anlagen
	provisional sum	vorläufiger Betrag
	contingency item	Eventualposition
	alternate specification item	Alternativposition
	budgetary approval	Kostengenehmigung
12.3.3	to award a contract	einen Auftrag vergeben
12.4	site diary	Baustellentagebuch
	minutes	Protokoll
	suspended ceiling	abgehängte Decke
	demountable adj	demontierbar, abnehmbar
12.4.1	formwork	Schalung
12.4.2	vertically perforated brick	Hochlochziegel
	to plaster	Innenwände verputzen
	to render	Außenwände verputzen
	fair-faced brickwork	Sichtmauerwerk
	leaf, pl leaves	Mauerwerksschale (einer zweischaligen Wand)
	cavity	Hohlraum
	wall tie	Maueranker
	perpend	Stoßfuge
12.5	guarantee bond	Bürgschaft
	public sector construction contract	öffentlicher Bauvertrag
	threshold value	Schwellenwert
12.5.1	carcass work	Rohbauarbeiten
	interior construction work	Ausbau
12.5.2	foolproof	absolut sicher, narrensicher
	to proofread	Korrektur lesen

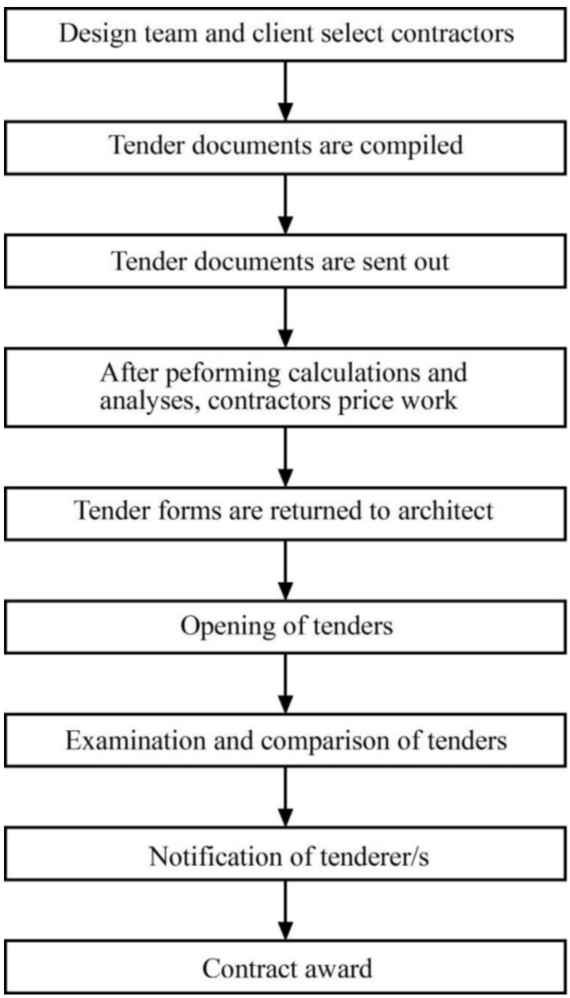
13 Tender Action

13.1 Tendering

Tendering is the activity which eventually determines the three factors of principal interest to the client: cost, quality and time. The contractor is the party offering the services to meet the demands of the client, who ultimately pays the bills. The contractor needs to be able to source *labour*, materials, capital and *plant* before he is able *to bid* for work.

The process of tendering involves a complex arrangement of stages. In the case of public authorities, which have to advertise their contracts publicly, these stages are very formal and have to be strictly observed. However, even when dealing with small projects, tendering contractors should be treated in the same way, receiving the same information at the same time.

Tendering process:



S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_13

Once all the documents have been completed, the *invitations to tender* are sent out to the firms wishing to participate. The invitation to tender is the title page of this sometimes very extensive compilation of information. It should state clearly the project name and the work which is to be completed. In the invitation to tender, the tendering firms are frequently requested to return a *letter of acknowledgement*, a document attached to the invitation. The acknowledgement enables the tendering firm to confirm the receipt of all enclosed documents and state whether they will be submitting a tender or not.

The invitation to tender should always include the date and place for delivery of the completed tender. If plans are not included in the documents, it may be necessary to specify a time and place for their inspection. Furthermore, if the place of construction is not easily accessible – this especially applies to extensions and refurbishments – information has to be added concerning necessary arrangements to view the site. Every invitation to tender contains a statement regarding the *confidentiality* of information.

13.2 Estimating

The estimator of a construction company is responsible for pricing work and securing contracts *in competition with* others. The *tender sum* is usually the result of careful analysis.

A lot of factors influence the price, and, before estimators actually set to work, they usually investigate the likely competition from other interested contractors. Depending on the *current workload*, the tendering contractor might try to keep the price as low as possible in order to secure work or hold on to its close association with a particular client or architect. On the other hand, if the competition is not likely to be fierce, the estimator might choose to price the job deliberately high. Should the contractor be awarded the contract at a high price, the *margins* allowed could well compensate for the problems of taking on unattractive work.

The preliminary research prior to compiling the tender figure involves enquiries to various suppliers for the current prices of materials and decisions on which sections of work should be *sublet* to sub-contractors.

13.2.1 Pricing

Whatever the basis is for pricing, the fundamental principles of estimating generally remain the same. First of all *lump sum prices* are determined for the items listed in the opening bill or the early section of the specification headed "*Preliminaries*". These items do not describe the actual work, but *associated works* including insurances, site offices, storage sheds, *temporary water and electricity supply*, *scaffolding* etc.

The next stage is to *break down* the work and price individual items. *Unit rates*, which are the prices for either a cubic metre, square metre or linear metre or single unit, are inserted against each item description. The *extended price* for each item is arrived at by multiplying the quantity by its unit rate.

As mentioned in 12.3.2, the contractor is also requested to quote prices for alternate specification and contingency items. Alternate specification items provide a second price for a single item, enabling the person performing the *comparative analysis of tender items* to select the most reasonable one. A priced bill, which already lists prices for possible contingency items, enables the architect to *authorise variations* without having to obtain client approval.

13.2.2 Unit rates

Unit rates are a combination of costs for labour, material, plant, *overheads* with an additional profit margin.

- The labour constant is the anticipated length of time that a craftsman or labourer will require to complete a unit of a particular item, for example laying a square metre of 240 mm brickwork in cement mortar.
- The material content is straightforward and simply consists of the basic material cost including delivery to site.
- The plant content includes all the equipment required to fulfil the item described. Very often the overall cost of plant is covered by a lump sum in the prelims. If additional equipment is required to perform a particular task, e.g. a mobile crane to lift and place a very heavy component, it should be included in the unit rate.
- The contractor's overheads include the cost of running the head office, staffing the site, paying directors' fees and expenses, taking out certain *blanket insurances*, financing, *back-up services*, like a *joinery shop*. It is important not to allow overheads to become disproportionate to the company's workload. If the organisation is *top-heavy*, the contractor cannot expect to be competitive since overheads have to be borne by the contracts.
- The *profit margin* is sometimes the deciding factor in the winning or losing of a contract. In difficult economic times, the profit margin may have to be reduced in order to secure work.

13.3 Opening of tenders

Tenders must be opened at the time appointed in the tender form; those arriving late must be excluded. The author of the tender documents, the architect, engineer or quantity surveyor, checks the tenders making sure that the contractors arithmetic is correct, that the rates for labour and materials are reasonable and that they compare favourably with the *target costs*.

Tenderers may have to be approached to correct errors before compiling a report on the tenders for the client. If all the tenders are higher than anticipated, the design team has to either rethink the design or contact the contractor who submitted the most favourable price and *negotiate*. In order to meet the target, it may be necessary to remove certain items from the bill or *downgrade* the specifications. It should be noted that there is seldom an obligation to select the cheapest offer; value for money is the overriding criterion.

If the priced bill has not already been submitted with the tender, the tenderer whose offer is under consideration is asked to supply a copy of the bill of quantities. The items in the bill of quantities are then checked, and, if there are no serious errors, the tender is recommended for acceptance.

All the tendering contractors should be notified as soon as a tender has been accepted. For future pricing and policy purposes, all tendering contractors like to know what margin there was between their bid and the next lowest. It is common practice to publish a list of the prices received. However, for reasons of confidentiality, the amounts should be published without the firms' names. Tendering contractors will recognise their price and will be able to judge their position in relation to the accepted tender price.

13.3.1 Comparative analysis of tender items

When evaluating tenders, architects, engineers and quantity surveyors will usually draw up a chart enabling them to compare unit, item and total prices. The procedure selected should also include aspects such as the bidder's financial, economic, technical and professional capacity. The persons making the evaluation should also list their estimated price in order to see whether they are in line with the offers or whether any measures need to be taken to obtain lower prices.

The following chart is a comparison of three tenders for carpentry work. It compares the unit and extended prices as well as the overall price offered by companies A, B and C.

Trade: 05 Carpentry work								
Bidder:			Company A		Company B		Company C	
Item	Text	Quantity	Unit price in £	Total price in £	Unit price in £	Total price in £	Unit price in £	Total price in £
5.1	Structural solid timber	0.50 m³	670.00	335.00	745.00	372.50	930.00	465.00
5.2	Roof sheathing	62.00 m²	16.95	1,050.90	19.10	1,184.20	25.20	1,562.00
5.3	Parapet of main roof	60 m	14.60	876.00	16.60	996.00	18.50	1,110.00
5.4	Extra for corners	8	5.40	43.20	4.30	34.40	6.00	48.00
5.5	Parapet of roof overhang	15 m	11.30	169.50	8.00	120.00	14.10	211.50
5.6	Extra for corners	2	4.00	8.00	2.70	5.40	4.70	9.40
5.7	Underside sheathing	15.00 m²	16.95	254.25	23.50	352.50	27.90	418.50
Total				**2,736.85**		**3,065.00**		**3,824.80**
			1st	100%	2nd	112%	3rd	140%

13.3.2 Exercise: Comparison of tendered prices

No two prices are the same and careful comparison is important. Add the correct adjectives to the text below to describe the information from the comparative analysis in 13.3.1. You may like to consult section 6.3 for the comparative and superlative forms of adjectives.

Company A has submitted ………..……….. (favourable) tender with ……..……….. (low) total amount. It is in line with the offer made by Company B. Company C's tender is by far ……..……….. (high). The unit prices submitted by Company C are all ……..……….. (high) than those of Company A and B – they are obviously not interested in submitting a competitive tender. Company A's unit prices are all ……..……….. (low) than those of Company B except for the items 5.4, 5.5 and 5.6. In the tender of Company A, the unit price for roof sheathing is ……..……….. (high) the unit price for the sheathing of the roof overhang's underside. Company B, on the other hand, regards the sheathing of the underside as being ………..……….. (labour-intensive) and therefore ………..……….. (expensive) than the sheathing of the roof. Since Company A has submitted ……..……….. (reasonable) offer, they will most probably be commissioned with the carpentry work.

13.4 Negotiations

A negotiation is a discussion aimed at meeting an agreement for better conditions. This form of communication is used to resolve disputes between parties or to *bargain for an advantage* over an individual or a group. Negotiations involve two basic elements, process and substance. The process refers to how the parties negotiate, whereas the substance refers to what the parties negotiate over.

Negotiations can take place at any time during the lifetime of a construction project. However, they frequently take place when finalising business matters prior to the signing of contracts. The content and objectives of negotiations vary, but will often be concerned with price, length of construction period or simply better contract terms and conditions.

In the 1960s and 1970s, practitioners and researchers started to develop *win-win approaches* to negotiations. In contrast to the *winner-take-all approach*, the philosophy of the win-win approach assures that all parties *benefit* from the negotiation process. Win-win negotiations are aimed at finding solutions which are acceptable to both parties and leave them both feeling that they have an advantage.

More than any other form of communication, negotiations are very much dependent on tactics. The choice of tactic is not only a matter of personal preference, but also cultural background. On which side of the line below would you place people from your own culture? What about you personally, how direct is your approach to negotiation?

Negotiator prefers diplomatic approach ⟷ Negotiator prefers *straight-talking*

It is important that the person *conducting the negotiation* is aware of any cultural differences, particularly when dealing with companies from abroad. If the aim is to build a long-term business relationship, it may be necessary to adopt a negotiation approach suited to the *counterparty*'s character or his/her country of origin. Only consider a *win-lose negotiation* if there is no intention of an ongoing relationship with the other party.

13.4.1 Preparation

Depending on the nature of a difference or the scale of a *disagreement*, good preparation may be key to a successful outcome. The negotiators need to define their own objectives and be aware of the aims of the other parties. Negotiations will lead to one of the parties making a *proposal* with an *initial offer*. The other side may then react with a *counter proposal*. During the bargaining phase, which hopefully leads to an agreement, each party needs to be aware of its *walk-away position*, which is the point at which a negotiation would break down, the *fall-back position* and the *best alternative to a negotiated agreement (BATNA)*.

The choice of words and the grammar used can have a powerful effect on the outcome of a negotiation. Compare the following sentences:

- We *reject your offer*.
- Unfortunately we are unable to accept your offer.

The first sentence is direct, leaving no *margin for negotiation*. The second sentence uses the softener "unfortunately" and the rephrased negative "unable to accept". Both features make the statement sound more diplomatic and less final.

The following table offers an overview of the possibilities for a more diplomatic approach.

Function	**Expression**	**Example**
Softeners	unfortunately; I'm afraid; to be honest	I'm afraid your offer doesn't meet our expectations.
Modal verbs	Modal verbs sound less direct. would, could, may, might	We might have to look for an alternative.
Qualifiers	Qualifiers soften the impact of an argument, but don't actually change the content. slight, a bit, rather, quite, fairly, etc.	We're fairly close to reaching a *breakthrough*.
Restrictive phrases	A restrictive phrase does not exclude the possibility of future movement. at the moment, at this stage, so far, etc.	That's our position at the moment.
Rephrased negatives (adjective)	Even when used with a negative, positive adjectives sound more diplomatic. unhappy – not very happy; unconvinced – not totally convinced, etc.	We're not entirely happy with the proposal you made, but …
Rephrased negatives (verb)	Avoid direct negatives; rephrased negatives sound less final. can't accept – unable to accept; can't agree – not in a position to agree, etc.	We're not in a position to meet your expectations.
Question forms	Questions can be used to make suggestions and warn the opponent. They are more powerful and persuasive than statements. shouldn't we …; wouldn't it …;	Wouldn't it be better to resume negotiations tomorrow?

13.4.2 Exercise: More diplomatic?

Rephrase the following sentences to make them sound more diplomatic.

1. Your tender price is not in line with our estimate. ....
2. The unit price for a square metre of raised flooring is too high. ....
3. You'll have to downgrade the quality of the plumbing fixtures. ....
4. Remove the solar panels. ....
5. Can you send us an updated schedule immediately? ....
6. We can't guarantee we'll meet the deadline. ....
7. This is our last offer. ....

13.4.3 Price negotiation

The architect, Tim Smith, meets the company which submitted the lowest bid for carcass work. The contractor, Michael Stone, offered to perform the job for £124,000.00. The architect had estimated £110,000.00. They meet to discuss the tender.

Michael Stone: Hello Tim, nice to see you again. When did we complete that office in Aylesbury? It must be 18 months ago, mustn't it?

Tim Smith: Yes, you're right. It was in February last year. Time flies, doesn't it?

Anyway, thank you for submitting a tender. Unfortunately, it's not quite as straightforward this time, and there are a few aspects I would like to take a look at with you.

Michael Stone: Yes, certainly.

Tim Smith: Well, for a start, you'll be pleased to hear that yours is amongst the lowest tenders. However, the price you quoted is unfortunately still quite a bit higher than our estimate. To be precise, you're still £14,000.00 above our target price.

Michael Stone: As much as that? Are you sure that the contents of the bill are in line with your estimation?

Tim Smith: We're quite sure. The quantity surveyor has checked; £110,000.00 is the price we're looking at. Is your quoted price your final offer?

Michael Stone: Well, to be honest, I'm very interested in the work, and considering it's so close to our shop, I suppose we could offer 120.

Tim Smith: That's better, but it still causes us a problem. Do you see any possibility to bring the price down a bit further?

Michael Stone: You requested *sandlime* be used for the brickwork. A thought that did cross my mind during the estimation work was that we could save a few thousand by using vertically perforated brick instead of the sandlime.

I'd have to check this exactly, but it would make a difference of, let me think, at least two thousand. But really that's as far as we can go without making any major changes.

Tim Smith: So that puts you at £118,000.00. We had hoped for rather more. Might there be a *discount for early payment*?

Michael Stone: Yes, I'll offer you a 3 % discount for payment within 10 days. And you know you can *rely on us* to meet your deadlines and perform high-quality workmanship.

Tim Smith: Yes, I know, thank you. Anyway, I'll be speaking to the client this afternoon, and I'll let you know the outcome once we've reached a conclusion. Hopefully, I can get back to you tomorrow morning.

13.4.4 Comprehension

Are the following statements concerning the dialogue above true or false.

	true	false
1. Michael Stone and Tim Smith have never worked together before.		
2. Michael Stone submitted the lowest tender.		
3. The contractor is prepared to negotiate.		
4. Michael Stone immediately gives in to the architect's pressure.		
5. The architect accepts the contractor's first proposal.		
6. The contractor makes a suggestion to reduce the price.		
7. A 3 % discount is agreed for early payment.		
8. The final offer is approximately halfway between the architect's target price and the contractor's originally quoted price.		

13.5 Building contract

A building contract is a written agreement between two parties, the client, often referred to as the employer in contracts, and an individual or an organisation. It is a consent to *undertake* an agreed amount of work, to an agreed standard for an agreed sum of money. The size and nature of contracts varies widely, but there are common elements, which all agreements should include.

- Provisions for all parties to deal fairly with each other and for mutual co-operation.
- A fair *distribution of risk*
- A clear separation of the roles and responsibilities of all persons involved
- Established methods of payment
- Clear description of the work involved
- An agreed timescale for *commencement* and *completion*
- An *adjudication system* acceptable to all parties

Standard forms contain a wide range of clauses designed to ensure protection to both the client and the contractor, which can be modified or deleted as necessary. Whereas the UK lacks a single set of contract conditions like the VOB (Vergabe- und Vertragsordnung für Bauleistungen) in Germany, state-run organisations, engineering associations and institutes publish a large range of contracts to meet all types and scales of engineering work.

The most widely used forms of contract in the UK are issued by the following organisations or associations:

- JCT (Joint Contract Tribunal) Standard Form of Building Contract for building works
- ICE (Institution of Civil Engineers) Conditions of Contract for civil engineering works
- NEC/EEC (New Engineering Contract/Engineering and Construction Contract) for both, building works and civil engineering works

Each one of these contract providers issues families of building contracts for each possible situation, such as Minor Works Building Contracts or Repair and Maintenance Contracts. The contents correspond with the rules and regulations contained in the VOB in Germany.

13.5.1 FIDIC

In order to create common international contract terms for engineering work, FIDIC, the International Federation of Consulting Engineers (Fédération Internationale des Ingénieurs-Conseils), was founded in 1913. The aim of the cooperation is to eliminate the national differences and create standard contract forms and conditions to be used in *cross-border operations*. Peter L Booen has been actively involved in the preparation of standard terms since 1993. He is the principal drafter of the following four books, which are suitable for virtually any type of construction contract. Care must be taken in the selection since the correct choice is dependent on the method of procurement and the division of responsibilities between the parties. The Conditions of Contract for international construction projects between the employer and the contractor comprise:

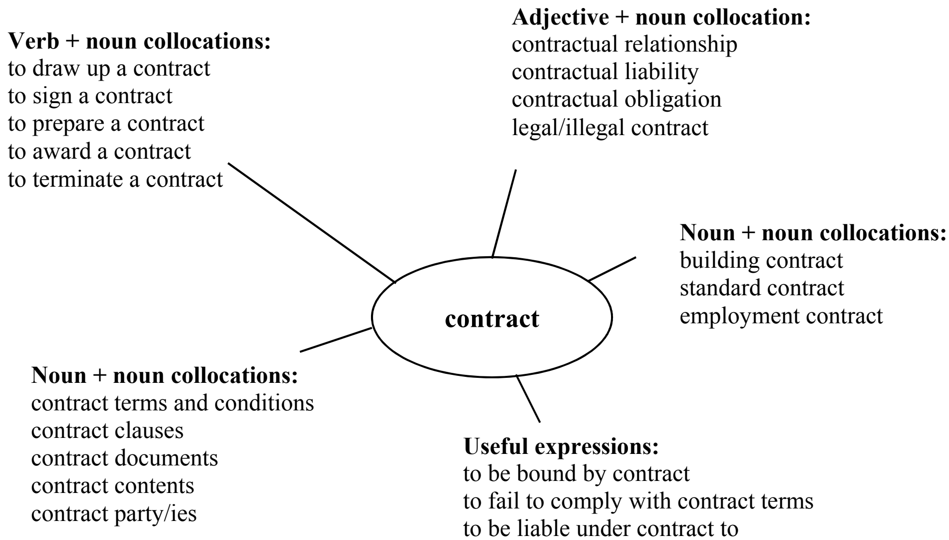
- CONS: Conditions of Contract for Construction, which is commonly referred to as Red Book. These conditions are recommended for building works designed by the Employer or by his representative, the Engineer.
- P&DB: Conditions of Contract for Plant and Design-Build, which is commonly referred to as Yellow Book. These are recommended for the *provision* of electrical and/or mechanical plant, and for the design and execution of building or engineering works. In this case the contractor is responsible for the design and the development of the project.
- EPCT: Conditions of Contract for EPC/*Turnkey Projects*, which is commonly referred to as Silver Book. These are recommended when one party bears the total responsibility for the design and development of an engineering project and takes a greater share of risks.
- Short Form of Contract (Green Book): This is recommended for building or engineering work with relatively small capital value and short duration, or relatively simple repetitive work.

FIDIC contracts and conditions are becoming more widely known. Especially since the opening of the East European markets, there is a growing need for contracts and conditions independent of *national jurisdiction*. The contract language is generally English. If you would like to find out more about FIDIC, take a look at the website www.fidic.org.

13.5.2 Contract award

The contract documents are prepared as soon as the client has approved the *tender report*. It is usually the architect or engineer's task to prepare the contract documents by completing the various blanks in the *articles of agreement*. It may be necessary to *add* special *clauses* to the conditions of contract, to *delete* or *amend* them. All documents contained in the contract (drawings, bills of quantities, specifications) should be marked as contract documents and signed by the contract parties. It is important that all the contract documents are consistent with each other.

Take a look at the term contract with some collocations and useful expressions.



13.5.3 Contract termination

Most contracts are concluded when both parties have completely fulfilled their obligations. The contract simply *ceases* to have a purpose and comes to an end. However, there are events which require the contractor's employment be brought to an end prior to completion. Most building contracts include provisions for termination of a contract. In addition to the natural ending according to performance, termination may be by mutual or negotiated *agreement*, or result from *frustration* or *breach*. In all cases the parties to the contract are released from their *contractual obligations*. Although in the case of breach, there may be outstanding questions of damages.

Agreement: The parties of a contract may agree at any time to end the contract. It is wise to record the agreement in writing.

Frustration: If a contract becomes fundamentally different due to events completely outside the control of the parties, the contract is said to have been frustrated. A good example of frustration would be if the contractor were unable to perform a refurbishment because the building was destroyed by fire, earthquake, etc. Death of either party is also a reason for frustration.

Breach: A breach of contract takes place when parties fail to perform their contractual obligations. Breach entitles the *innocent party* to either treat their obligations as ended or *sue for damages*. The party wishing to terminate must comply with the contractual terms governing termination. Notice of termination of a contract usually has to be given in writing and may be subject to a notice period.

Typical reasons for the employer to terminate the contract are:

- in the event that the contractor does not perform or fails to perform according to the programme
- in the case of defective work due to poor workmanship and failure to rectify appropriately
- if the contractor fails to comply with regulations
- in the event of the contractor's insolvency

The situation can be more serious when the contractor terminates the contract. In this case the contractor may *claim for the loss of profit*, which would have been made if the contract had continued. It is the project manager's responsibility to prevent such an occurrence. Possible trigger points are:

- if the employer fails to pay certified sums within the period stated
- *suspension* of the work due to actions, inactions or *defaults* by the employer
- in the event of the employer's insolvency

13.5.4 Lexis: Contracts

Combine a word in A with a word in B to form 9 terms dealing with contracts. Finally, choose the best definition for the term in C.

A	B	C
contract	report	a document put together by the architect enabling the client to award a company with a contract
risk	analysis	companies or individuals signing an agreement
terms and	method	responsibility for dangers is shared between contract partners
breach	project	agreement concerning the details of *remuneration*
tender	of contract	all agreements making up the contents of a contract
contract	distribution	a service including everything, from the design to the pictures on the wall
payment	award	overview of prices offered by tenderers as a basis for comparison
turnkey	parties	contract termination due to failure of performing contractual obligations
comparative	conditions	decision on which company will be performing the work

13.6 Vocabulary

13.1	tendering	Angebotseinholung
	labour	Arbeitskraft, -kräfte
	plant	maschinelle Einrichtung, technische Ausstattung
	to bid for sth	ein Angebot machen
	opening of tenders	Angebotseröffnung
	contract award	Auftragsvergabe, - erteilung
	invitation to tender	Angebotsaufforderung
	letter of acknowledgement	Empfangsbestätigung
	confidentiality	Vertraulichkeit
13.2	estimating	Preisermittlung, (Baukosten-) Kalkulation
	to be in competition with sb	mit jmdm. konkurrieren/im Wettbewerb stehen
	tender sum	Angebotssumme
	current workload	momentane, aktuelle Arbeitsbelastung
	margin	Spanne
	to sublet	untervergeben
13.2.1	lump sum price	Pauschalbetrag
	Preliminaries, short form: prelims	Vorbemerkungen
	associated works	Nebenleistungen
	temporary water and electricity supply	Baustrom u. -wasser
	scaffolding	Gerüst
	to break down sth	etw. aufschlüsseln, -gliedern
	unit rate	Stückpreis
	extended price	Gesamtpreis einer Position
	comparative analysis of tender items	Preisspiegel
	to authorise a variation	eine Änderung genehmigen, billigen
13.2.2	overheads	Gemeinkosten, indirekte Kosten
	blanket insurance	allgemeine Versicherung
	back-up services	Hilfsbetriebe
	joinery shop	Tischlerwerkstatt
	top-heavy, adj	kopflastig
	profit margin	Gewinnspanne
13.3	target costs	Zielkosten
	to negotiate	verhandeln
	to downgrade	niedriger einstufen, niederstufen
13.4	to bargain for an advantage over sb	sich einen Vorteil über jmdn. erschaffen
	win-win approach	Doppelsieg Strategie
	winner-takes-it-all approach	Einzelsieger Strategie

	to benefit from sth	von etw. profitieren
	negotiator	Verhandlungsführer/in
	to do some straight-talking	Klartext reden
	to conduct a negotiation	eine Verhandlung führen
	counterparty	(Verhandlungs-) Gegner
	win-lose negotiation	Gewinner-Verlierer Verhandlung
13.4.1	disagreement	Meinungsverschiedenheit, Uneinigkeit
	proposal	Vorschlag
	initial offer	erstes Angebot
	counter proposal	Gegenvorschlag
	walk-away position	Verhandlungsabbruch
	fall-back position	Kompromiss
	best alternative to a negotiated agreement (BATNA)	Nichteinigungsalternative
	to reject an offer	ein Angebot ablehnen
	margin of negotiation	Verhandlungsspielraum
	breakthrough	Durchbruch
13.4.3	sandlime	Kalksandstein
	discount for early payment	Skonto
	to rely on sb	sich auf jmdn. verlassen
13.5	building contract	Bauvertrag
	to undertake an obligation	Verpflichtung übernehmen, sich verpflichten
	distribution of risk	Risikoverteilung
	commencement	Baubeginn
	completion	Fertigstellung
	adjudication system	Rechtssystem, Gerichtbarkeit
13.5.1	FIDIC (Fédération Internationale des Ingénieurs-Conseils)	Internationale Vereinigung der Beratenden Ingenieure
	cross-border operations	grenzüberschreitende Tätigkeiten
	provision	Versorgung, Bereitstellung
	turnkey project	schlüsselfertiges Projekt
	national jurisdiction	nationales Recht
13.5.2	tender report	Ausschreibungsbericht, Vergabeempfehlung
	articles of agreement	Vertragsklauseln
	to add, delete, amend a clause	eine Klausel ergänzen, entfernen, modifizieren
13.5.3	contract termination	Vertragsbeendigung
	to cease	aufhören zu
	agreement	Übereinkommen, Vereinbarung
	frustration	Wegfall der Geschäftsgrundlage

	breach	Vertragsbruch, -verletzung
	contractual obligation	vertragliche Verpflichtung
	innocent party	unschuldige Vertragspartei
	to sue for damages	auf Schadensersatz klagen
	notice period	Frist
	to claim for a loss of profit	Anspruch auf entgangenen Gewinn erheben
	suspension	Aufschub, Verschiebung
	default	Nichterfüllung, Versäumnis
13.5.4	remuneration	Bezahlung, Entlohnung

14 Pre-Construction Phase

14.1 Background to building operations

As explained at the beginning of the book, a building project may begin fairly simply, perhaps merely with a conversation between a client and an architect or a civil engineer. Over the ensuing months, the project team grows as other services and advisors, such as structural and mechanical consultants, are brought in and the cost commitment builds rapidly. The run-up to the construction phase is especially critical. It is a time when a number of new companies are contracted to offer advice, to supply specialist services, materials or components. Very often this number has to be further increased in order to ensure an appropriate level of competition. At the time of the contract award, a project of even modest proportions can involve dozens of people. For this reason, it is absolutely necessary for team members to understand each other's area of responsibility and for *contractual obligations* to be clearly defined.

As soon as the contract is signed, the roles of those involved change. The contractors and the sub-contractors, who up until this stage have only given advice, become the constructors; the architect, engineer and the consultants, who have been responsible for the design, become *inspectors*. It has to be acknowledged that the creative part of the planners' work, except for detail planning and finishes, is virtually complete when the job starts on site.

According to German practice, the architect or engineer is the *client's representative*. In the event of disputes regarding contractual obligations, it is their task to represent the client's interests. In contrast, British guidelines, which have been adopted in some of the FIDIC books, see the architect or engineer not only as the client's representative but also as a *mediator* charged with balancing the interests of both parties.

14.1.1 Responsibilities

The client will have worked closely with the planning team up until the contract stage. The contract documents define the client's requirements and expectations and the amount that will have to be paid. Once the contract is signed, the client's functions are limited. Nevertheless, the client will be curious to see the project taking shape on site and, depending on proximity to the site and time available, the client may pay visits to the construction site to visualise what has so far only been on paper. If the client sees something not corresponding to plans or desire, he/she should refrain from instructing the executing craftsperson directly, but contact the responsible person, i.e. the *construction manager*, the *site agent* or the *foreperson* for that particular trade. If an architect or engineer has been commissioned to perform all the service phases, he or she continues to be the agent and will act on behalf of the client.

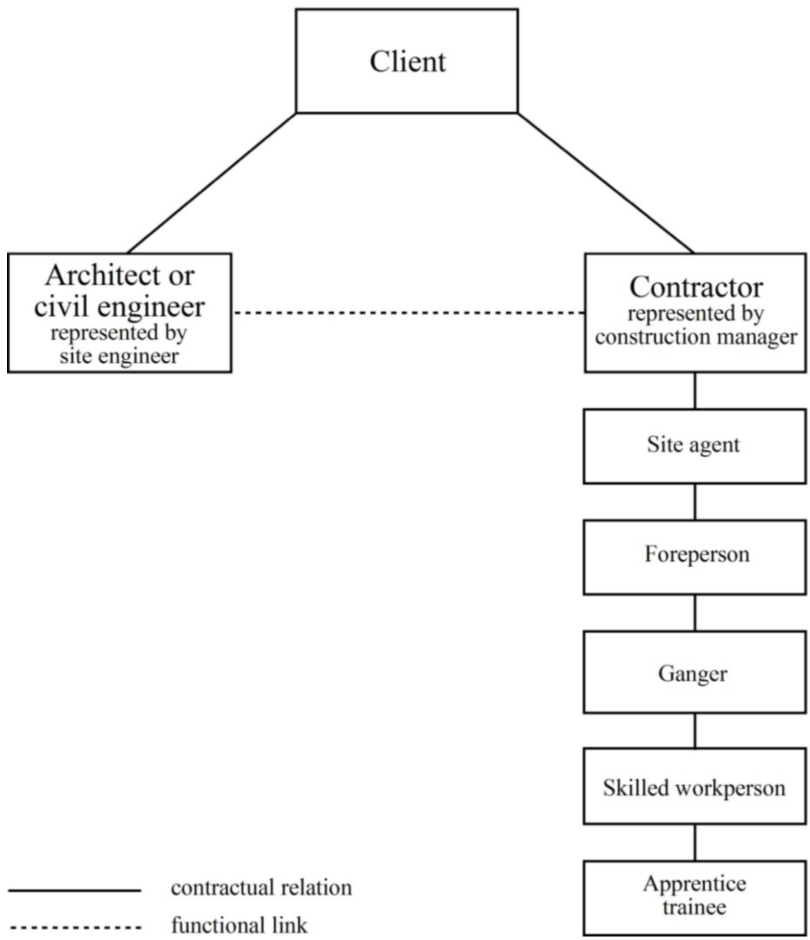
If the contract is not design and build, the architect or civil engineer usually continues to co-ordinate the job as a whole and takes on the task of inspecting the building construction as the job proceeds on site. Architects and engineers have to recognise that the site and the work on it are generally the responsibility of the contractor, from the *date of possession* until the completed building is handed over. Their duties on site are to ensure that the contractor acts in accordance with the instructions given in the drawings, bills and other contract documents and that the *quality of workmanship* and materials comply with the standards specified. The architect and engineer have to *be kept up-to-date* by the contractor and receive all relevant documents and test reports. The planning team in turn has to provide all drawings necessary for

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_14

the contractor to complete work on time. A *release schedule* states the dates by which the drawings should be provided.

The contractor has been selected by the client to realise the planning team's design. The contractor is obliged to plan, carry out and complete the work described in the contract. The contractor is also responsible for the site, which covers site access, site staff and their safety as well as all services up until completion.

In one-person and small businesses, the contractor will double as manager and constructor bearing sole responsibility for the whole operation. In larger firms, the contractor is represented by a construction manager who is responsible for all development processes and is the direct counterpart to the planner. The construction manager, with effective control of all building operations from the day the contract is signed, works in the contractor's main office and visits the site frequently to co-ordinate work and ensure that the execution is in accordance with the agreed terms. Depending on the size of the firm, the construction manager may be responsible for controlling costs and organising plant, materials, labour, meetings, sub-contractors and *programming*.



The site agent, who receives instructions from the construction manager, has direct control of all *site operations*. Trade forepeople, e.g. a bricklayer foreperson, a joiner foreperson, etc., receive their instructions from the site agent. Despite being responsible for the work as a whole, the site agent is primarily concerned with initiating each particular operation, co-ordinating it with other trades in order to ensure that it has a clear run and is supplied with the appropriate plant, labour and materials.

Each foreperson is responsible for his/her trade. On large projects a foreperson will manage several gangers, who are in charge of and work with a number of skilled and/or unskilled labourers and apprentices.

14.1.2 Grammar: Present Perfect

Within the lifetime of a construction project, the commencement of work on site is a very significant phase producing many changes. The people involved take on different roles and perform different activities. The tenses we use to describe activities which have been completed or those which continue differ.

The present perfect tense is used to describe activities which started in the past, continue up until today and will most probably continue into the future.

Example: The architect has been the client's agent.

It can also be used in the continuous form to speak about activities that are still happening or have only just finished.

Example: The building services engineer has been working on the plumbing for 10 days.

The present perfect is also used for activities which took place in the past but are mentioned without a time reference.

Example: The quantity surveyor has prepared the contract documents.

As soon as a point in time in the past is mentioned (except in combination with since), the simple past is used.

Example: The client commissioned the civil engineer in June.

Form: The present perfect is formed with have or has for the 3rd person singular plus the past participle. In regular verbs, the past participle is formed by adding -ed to the infinitive. In irregular verbs, the past participle varies considerably and the forms simply have to be learnt. Most dictionaries include a list of irregular verbs.

The inflection takes place in the helping verb "have". The negative is formed by inserting not between the helping verb and the full verb. The short forms "hasn't" and "haven't" are used in speech.

Signal words: today, this week, this month, etc. (periods that have not finished at the time of speaking)

recently, lately (either at the beginning or end of the sentence, or between the helping verb and the full verb)

ever, never (between the helping verb and full verb)

yet (usually at the end of the sentence)

since + a point in time; for + period of time

14.1.3 Exercise: Present Perfect

Choose the correct verb form or preposition in the following text.

The design team **worked/has been working** on the Brown's house **since/for** last April. They **have been/was being** very thorough. They **are discussing/have discussed** many options and **have prepared/are preparing** detailed contract documents. **Since/For** the last weeks, they **are working/have been working** on the procurement procedure. Last Thursday, the successful tendering company **have awarded/was awarded** the contract, and the project parties **were signing/signed** the documents. Work on site **has not yet commenced/is commenced not yet**. However, the pre-start meeting, which will bring the planning team and the contractor together, **was scheduled/has been scheduled** for next Friday. So far the client **is being very involved/has been very involved**. Especially last month, he **has been taking part/took part** in most meetings with consultants and **made/is making** lots of important decisions. He will now have to stand back and watch the work taking place on site.

14.2 Time management

Time management is a set of skills, tools and systems for planning and scheduling time. The aim of time management is to support an orderly accomplishment of tasks increasing the effectiveness and efficiency of not only work, but everyday life. Time is a resource, which cannot be stored and saved for later. Everyone gets exactly the same amount of time each and every day. The difference lies in the way in which it is used.

Time management strategies are fundamental to effective *scheduling*, the process by which you plan your time. Tools range from simple to-do-lists to sophisticated computer programs. No matter which format is chosen, all help to set *deadlines* and priorities, highlight urgent, *high-priority activities* as well as leave margins such as *contingency times* for *unpredicted interruptions*.

Procrastination is a major hindrance to effective time management. Everyone likes to *defer* or avoid less attractive tasks. However, all aspects of accepted work need to be completed with the same degree of *diligence* and professionalism. Being punctual, delivering on time and meeting deadlines are characteristics that every professional should *strive* for.

A useful saying for everybody is: Don't put off until tomorrow what you can do today.

14.2.1 Time terms

Timing is very important throughout the *course* of every project. A good architect or engineer will often be recognised for the quality of his or her time management. However, from time to time, even good *timekeepers* find that there are not enough hours in the day and are often given a hard time.

As can be seen from the paragraph above, there are lots of useful expressions and idioms dealing with time. Take a look at the following overview for more.

Expression	**Meaning/Idiomatic expression**	**Example**
time	▪ on time – according to schedule, punctual in time – before a time limit expires high time – the appropriate or urgent time in no time – almost instantly, immediately from time to time – once in a while ▪ to waste time; to make up for lost time; to give sb a hard time; to take time; to have time on ones hands	The contractor took so much time preparing the site, now they are going to have to make up for lost time.
date	▪ a time stated in terms of day, month, year ▪ date can also mean appointment, but a social one and often with a romantic interest ▪ to set/arrange/cancel/observe a date; to update sth	The date set for completion is 23 June 2009.
schedule	▪ a plan for performing work with a specified order and an allotted time ▪ to be ahead of/on/behind schedule	Work on site is absolutely on schedule.
duration	▪ the time required for a certain task	The clerk of works will be on site for the duration of the construction.
durability	▪ the period of *withstanding wear and tear* or *decay*	The architect has selected high-quality goods; their durability is excellent.
deadline	▪ a time limit with a target date by which sth must be completed ▪ to meet/exceed/postpone a deadline; to set/fix a deadline	The roofing company is not going to meet the deadline; we'll have to postpone the starting date for subsequent trades.
period	▪ a length of time ▪ to extend a period; the period has expired	The period assigned for tiling has expired.
stint	▪ a period spent doing a particular activity	The carpenters did a stint on another building site.
spell	▪ a short period, especially weather	Let's make use of the spell of good weather.
appointment	▪ an arrangement to do sth or meet sb at a particular time and place ▪ to make/arrange/cancel an appointment with sb ▪ the other meaning of appointment is the act of designating sb for a position/task	The structural engineer has arranged an appointment with the client on site.

14.2.2 Exercise: Time terms

Enter the following words into the text below. Make sure to use the correct tense.

postpone · period · make up for lost time · just in time · deadline · interrupt · delay · take time spell of good weather · on schedule · meet deadlines · waste time · behind schedule · date · update

George Brown's project is more or less …….…..….. The procurement ……...………. was quite tense as the tenders all only arrived …..…..……….. Then the evaluation ……...………. and a few items had to be negotiated with the lowest bidder. The pre-start meeting had to be …..………...…. by a week. Luckily the contractor ………………..…… by bringing the ……….……..…. to take possession of the site forward. The …..……...……. set for completion is realistic. The contractor does not want ……….…..…., but make use of the ……….…..…. before winter sets in. The contractor is optimistic and wants …..……..……….. Hopefully nothing unpredictable will ……….......……. building operations, which would cause ……….……... and put work ……..…....…….. The contractor is obliged to keep the client and the site engineer ……..……….. .

14.3 Construction programme

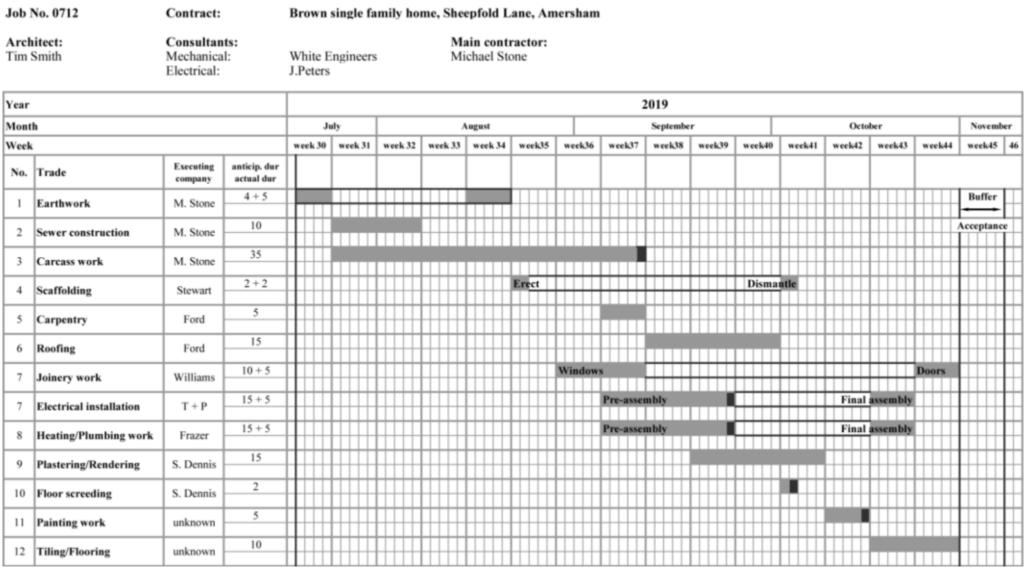
Before work commences on site, a construction programme should be drawn up. A programme is a *forecast* of activities with a precise indication of the progress planned for each trade each week. It enables all participants involved in the building project, planners as well as constructors, to plan ahead, order materials in good time and reinforce or reduce the labour force according to demand. On large contracts, it is customary to include the dates of *information release* for imminent operations. No matter how small the project, the benefits of a well thought-through programme are immense in terms of achieving the timely commencement and completion of site operations.

The schedule should be placed in a prominent position in the planner's office as well as the site office where it will signal whether or not work is proceeding at a satisfactory rate. The programme has to be *monitored* and updated whenever necessary. The only really significant date in contract terms is the *completion date*. Even if the *sequence of construction* alters slightly during the progress of the project, the person responsible should, with the help of the programme, ensure that the end date is met.

The most common programme is the *Gantt or bar chart*. Bars are used to represent each trade involved in the contract; the length of a bar indicates the *anticipated duration* of each particular element. The bars might be continuous or *suspended* to allow other operations to proceed before work is *resumed* again. A *network diagram*, which is a logical schematic picture of a project, has the advantage that it not only shows the expected duration of operations but also the relationships between the individual activities.

14.3.1 Gantt chart

The chart below shows the programme Tim Smith has drawn up for the construction work on the Brown's family home. Because it is a fairly straightforward project, the architect has chosen a Gantt chart with bars for each trade. The weeks are indicated in the time line at the top of the table. The trades are listed on the left according to their date of appearance on site. Milestones, which are shown as black boxes, highlight key dates.



14.3.2 Prepositions of time

When talking about periods, dates and deadlines, prepositions are indispensable. There are many different prepositions, which are used in different cases. What they all have in common, in the case of time factors, is that they are placed before nouns.

Preposition	Uses	Examples	Exceptions/Notes
at	+ clock time	at 4.30 p.m, at 9 o'clock	
on	+ day/date	on Monday, on 4 June	at the weekend, at Christmas
in	+ time of the day/week/ month	in the morning/afternoon, in week 23, in August, in 2007	at night, at noon
by	+ a deadline	by 4 p.m., by Friday, by May	
during	+ period of time (noun)	during the next week, during October	While and during have the same meaning but are used differently.
while (conjunction)	+ subject + verb (clause)	while they were planning while the plumbers are fitting	
from …to/	+ time/date	from 8 to 4 o'clock;	

Preposition	Uses	Examples	Exceptions/Notes
until/till		from Monday to Friday	
since	+ point in time	since 10 a.m., since Monday, since this morning	Always used with a perfect tense, e.g. the foreman has been waiting for the delivery since this morning.
for	+ period of time	for 3 hours, for 2 weeks, for ages	Often used with a perfect tense, e.g. The foreman has been waiting for 4 hours.
-	+ this, next, last	next Monday, last month, this morning	No prepositions are used!

14.3.3 Exercise: Prepositions of time

Look at the Gantt chart in 14.3.1 and complete the memo. If no preposition is required, leave the space blank.

The construction work for the Brown single family home is due to start ...….. week 30. The main contractor, Michael Stone, will be on site …..…. a total of 8 weeks. Their work has to be completed …….. 14 September in order to allow enough time for the other trades. The joiner Williams is due to start work ……. 3 September. Once he has fitted the windows, he will be off site …….. 17 September …….. 29 October. The companies Frazer and T + P will also suspend their work …….. 3 weeks while the plastering and *screeding work* is being carried out. It is absolutely essential that the *screeder* finishes …….. 9 October in order to allow the screed to dry sufficiently before the oak-strip parquet flooring is installed. The painters should be out …….. the end of week 44. However, there is a buffer of 5 days for *overruns* and *remedial work*.

14.4 Site set-up

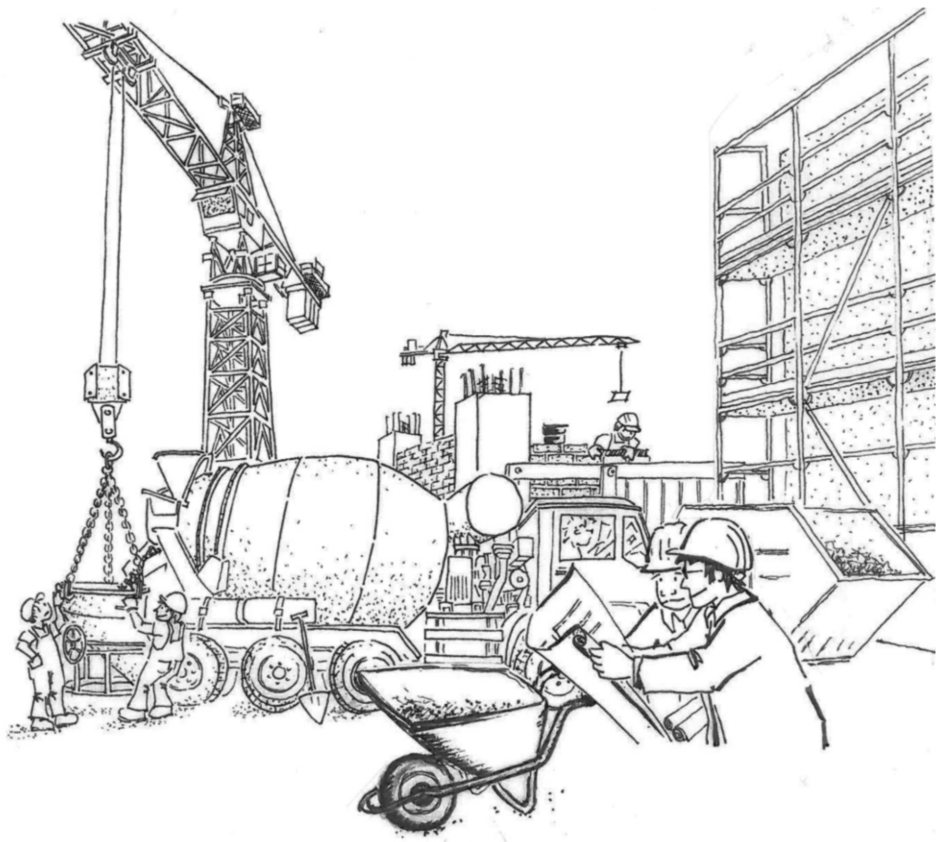
The site set-up has a major influence on the smooth running of a contract. The location of the main features, such as *access roads, material compounds*, *storage sheds*, *general plant*, offices, etc., is significant. Adequate water and electricity supplies are essential at any site from the very start to the completion of the work. Where there is no *electricity supply network*, generators will be necessary to provide *temporary power* for lighting and power. Similarly, if a *water supply mains* is not available, a *temporary water supply* will have to be arranged, possibly the installation of a storage tank with regular *top-ups* assured.

If the operation is not planned properly beforehand, time, money and *human resources* will be wasted needlessly. All of those involved in site organisation should get together to determine the best site set-up from efficiency and safety points of view.

14.4.1 Construction site

Construction sites are busy and noisy places. For *passers-by*, a construction site often resembles a beehive – it appears to be chaotic, but nevertheless everybody seems to know what they should be doing. Take a look at the drawing below and find the following items.

tower crane · lifting crab · hardhat · reinforcement · wheelbarrow · safety shoes · scaffolding shovel · ready-mixed concrete · hook · skip · plan · bucket · jib ·architect · concrete skip



14.4.2 Prepositions of place

Prepositions of place show where something is located or where something is moving to. As in most grammar, there are rules and exceptions; but, when it comes to prepositions of place, there are also lots of fixed expressions. It is best to learn these as phrases, for example stand in a queue or stand at the front/the end of a queue, sit in the front/back of a car, but write something on the front/back of a piece of paper. Corners also sometimes cause problems and there is a difference between standing in the corner (of a room) or standing at the corner (of a street).

Preposition	Use	Example	Exception/Note
at	a place in general	at the building site	at the top/bottom
in	inside an enclosed space	in the building	
on	objects with a surface	on the table; on the first floor	on site/off site; on the left/right
above	space between an object and a surface	above the ground	
under	objects with a surface	under the table	
below	space between an object and a surface	below the ground	
+ to	movement to a place	into the building; onto the table	the opposite of into is out of
Others:	from, against, along, (in) between, next to, close to, through, around, beside		

14.4.3 Exercise: Prepositions of place

Now look at the picture on page 193 again and fill the blanks with one of the prepositions from above.

1. The wheelbarrow is ………… the front of the picture.
2. The scaffolding is set up ………… the outside of the building.
3. Two builders are filling concrete ………… the concrete skip.
4. The concrete skip is standing ………… the jib.
5. The *lorry* driver is sitting ………… the cabin reading a newspaper.
6. The bucket is standing ………… the wall.
7. The shovel is leaning ………… the truck.
8. The skip has been placed ………… the building ………… the right.
9. The steel reinforcement is protruding ………… the pillar.
10. The crane can move around ………… the construction site.

14.4.4 Site layout

A *site layout plan* enables contractors to see whether the *portacabins*, plant and other machinery has been placed to meet the demands of the construction site. In most contracts, access roads also constitute an important part of the site set-up. To avoid *obstructions* and delays, sufficient space should be allowed for lorries to load and unload. Access roads must be properly maintained, especially during wet weather.

All contracts usually include a tower crane, either a static one, requiring very little space, or one running on rails. It goes without saying that the radius of the crane jib as well as the *lifting* *capacity* at the *jib nose* have to be suited to the job. Sometimes mobile cranes need to be brought in to perform operations which exceed the capacity and accessibility of static plant.

All equipment, plant and material belonging to the construction companies has to be positioned on the client's property. If additional space is required, temporarily or permanently, a permit must be obtained from the local authority before work commences. The permit for a *road closure* usually involves a fee. Furthermore, all construction companies have to adhere to legal requirements regarding aspects such as working hours, noise and vibration, *waste management*, etc. *Emission standards*, for example, prescribe the volume of noise permitted at each hour of the day.

14.5 Site safety

Construction is the most dangerous land-based work sector in Europe – only the fishing industry is more dangerous. The fatal accident rate in the European Union is almost 2.5 times greater than that in all other sectors. The major *safety hazards* on site are falls from height, motor vehicle crashes, *electrocutions*, machines and being struck by falling objects. There are European Union Directives to protect workers and to place requirements on employers to assess and secure workers' health and safety.

Safety measures cover both, *security* and *protection*. *Perimeter fences* are primarily intended to guard the site against *trespass* and theft. Usually temporary fencing is made of steel mesh fixed to concrete block fence bases. Sites directly adjoining public footpaths or roads must provide protection to the public. *Hoardings*, protected walkways and *guard rails* are installed for the duration of the site work. The contractor's insurance policy includes clauses relating to the provision of all necessary safety measures.

Safety measures for workers also include scaffolding. These temporary frames are made of metal tubes, *couplers* to hold the tubes together and boards, which provide the working surface for the users. Many Asian countries use bamboo and cord to erect scaffolding. Ladders, guard rails, netting, *harnesses* and rope also provide safety for workers on construction sites.

According to EEC directives, an *HSE coordinator* (health, safety and environment) has to be appointed if the work on site exceeds a certain volume, for example more than 500 person days. The task of the coordinator is to ensure that construction regulations are adhered to and health and safety measures conform to the rules set out. The work of an HSE coordinator also includes drawing up a safety and health plan before work commences and a safety and health file on completion.

14.5.1 Insurance and liabilities

Construction is a high risk industry. Accidents, resulting in injuries and/or damage, happen all the time, and these accidents cost the contractor money. Insurance cannot remove the risk or the likelihood that one of these events may occur but it protects against some or all of the financial impact. The intention of insurance is to help individuals recover from the financial consequences of damage or injury by pooling the resources of a large group to pay for the losses of a small one.

The *policies* in the building industry have to cover the following:

▪ Damage to work under construction occurring as a result of sudden, accidental and unforeseen causes. Specified *perils* or types of damage may be excluded.	→ Building works insurance
▪ Damage to construction plant and machinery, equipment and tools.	→ Construction equipment insurance
▪ Injuries to third parties as well as loss or damage to property belonging to third parties.	→ Public liability insurance
▪ Injuries to the contractor's personnel.	→ Industrial injury insurance

The first record of insurance specifically for building structures, *Contractors' All Risks Insurance (CAR)*, dates back to 1929 and the construction of the Lambeth Bridge over the Thames in London. It was introduced as a response to the imposition of severe restrictions regarding the provision of reserves for outstanding losses which worked to the disadvantage of the building contractors. It is a combination of the first three policies listed above providing comprehensive coverage to all parties associated with the project from the time the contractor places insured objects on site up until acceptance and/or operation of the building works.

Improper or defective work is not covered by insurance but simply has to be rectified under the terms of the work contract. The client is protected by the *performance and maintenance bond* up until the end of the *defects liability period*.

14.6 Vocabulary

14	pre-construction phase	Bauvorbereitungsphase
14.1	contractual obligation	vertragliche Verpflichtung
	inspector	Bauaufseher
	client's representative	Bauherrenvertreter
	mediator	Vermittler (in Streitfällen)
14.1.1	construction manager	Oberbauleiter (der ausführenden Firma)
	site agent	Bauleiter (der ausführenden Firma)
	foreperson, pl forepeople foreman, pl foremen forewoman, pl forewomen	Polier/in
	possession date	Übergabetermin für Baustelle
	quality of workmanship	Ausführungsqualität
	to keep sb up-to-date	jmdn. auf dem laufenden halten
	release schedule	Zeitplan für Planfreigabe
	programming	Bauzeitenplan
	site engineer	Bauleiter
	ganger	Vorarbeiter/in
	un/skilled workperson, pl workpeople un/skilled workman, pl workmen un/skilled workwoman, pl workwomen	ungelernte/r Arbeiter/in, Hilfsarbeiter/in , bzw. Facharbeiter/in
	apprentice	Auszubildende/r

	site operations	Baustellentätigkeiten
14.2	time management	Zeitplanung
	scheduling	Terminplanung
	deadline	Endtermin, Schlusstermin, Termin
	high-priority activity	Tätigkeit mit hoher Dringlichkeit
	contingency time	Zeitreserve, Zeitpuffer
	unpredicted interruption	unvorhergesehene Unterbrechung
	procrastination	Aufschieben, Saumseligkeit
	to defer	aufschieben
	diligence	Fleiß, Eifer
	to strive for sth	anstreben
14.2.1	course	Ablauf
	timekeeper	Zeitnehmer/in
	date	Datum, Termin, Verabredung
	schedule	Zeitplan, Terminplan
	duration	Zeit, Zeitdauer
	durability	Dauerhaftigkeit, Beständigkeit
	to withstand wear and tear	Verschleiß, Abnutzung widerstehen
	decay	Verfall
	stint	(kurze) Arbeitsperiode
	spell	kurze Zeitdauer, Weile
	appointment	Termin; Beauftragung
14.3	construction programme	Bauzeitenplan
	forecast	Vorhersage
	information release	Informationsfreigabe
	to monitor	überwachen, kontrollieren
	completion date	Fertigstellungszeitpunkt
	sequence of construction	Bauabfolge
	Gantt chart, bar chart	Gantt-Diagramm, Balkendiagramm
	anticipated duration	erwartete Dauer
	to suspend	unterbrechen
	to resume	wiederaufnehmen
	network diagram	Netzplan
14.3.1	to erect	aufbauen
	to dismantle	abbauen
	pre-assembly	Rohmontage
	final assembly	Endmontage
	buffer	(Zeit-)Puffer
14.3.3	screeding work	Estricharbeiten
	screeder	Estrichleger
	overrun	(Termin-)Überschreitung

	remedial work	Nachbesserungsarbeiten
14.4	site set-up	Baustelleneinrichtung
	access road	Zufahrtsstraße
	material compound	Baustofflager
	storage shed	Lagerschuppen, Magazin
	general plant	allgemeine Baustellengeräte
	electricity supply network, mains	Strom(versorgungs)netz
	temporary power	Baustrom
	water supply mains	Wasserversorgungsleitung
	temporary water supply	Bauwasser
	top-up	Auffüllung
	human resources	Arbeitskräftereserven
14.4.1	passer-by, pl passers-by	Passant
	tower crane	Turmkran
	lifting crab	Laufkatze
	hardhat	Bauhelm
	safety shoes	Sicherheitsschuhe
	shovel	Schaufel
	ready-mixed concrete	Transportbeton
	hook	Haken
	skip	Container
	concrete skip	Betontrichter
	scaffolding	Gerüst
	wheelbarrow	Schubkarre
	jib	(Kran)Ausleger
14.4.3	lorry, pl lorries BE; truck AE	Lastwagen, LKW
14.4.4	site layout plan	Baustelleneinrichtungsplan
	portacabin	Bauwagen, Mietcontainer
	obstruction	Behinderung
	lifting capacity	Krantragfähigkeit
	jib nose	Auslegerkopf
	road closure	Straßensperrung
	waste management	Abfall-/Entsorgungswirtschaft
	emission standards	Emissionsgrenzwerte
14.5	safety hazard	Gefahrenquelle
	electrocution	Tod durch Stromschlag
	safety measure	Sicherheitsmaßnahme, -vorkehrung
	security measure	Sicherheitsmaßnahme (gegen Einbruch, Diebstahl, unbefugtes Betreten)
	protective measure	Schutzmaßnahme
	perimeter fence	Sicherheitszaun, Bauzaun

	trespass	unbefugtes Betreten
	hoarding	Bretterzaun
	guard rail	Schutz-/Sicherheitsgeländer
	coupler	Verbindungsstück
	harness	(Sicherheits-)Geschirr
	HSE coordinator (health, safety and environment)	Sicherheits- und Gesundheitsschutz-koordinator (SIGE Koordinator)
14.5.1	liability	Haftung
	insurance policy	Versicherungspolice
	peril	Gefahr
	building works insurance	Bauleistungsversicherung
	construction equipment insurance	Baugeräteversicherung
	public liability insurance	Betriebshaftpflichtversicherung
	industrial injury insurance	Betriebsunfallversicherung
	Contractors' All Risks Insurance (CAR)	CAR-Versicherung
	performance and maintenance bond	Gewährleistungsbürgschaft
	defects liability period	Gewährleistungsfrist

15 Construction

15.1 Work progress

Once all the background information has been clarified and the commencement date approaches, the contractor takes possession of the site. A once desolate piece of land comes to life as numerous *tradespeople* move in and set to work. The type and the scale of work will determine the number of trades involved, the volume of noise to be expected and the duration of the project. For neighbours and surrounding properties, a very wearing period commences. A *construction site sign* informs neighbours and passers-by of the future development and all the companies involved.

The operations on site from the day of taking possession until the completion date require good organisation, time management and generally communication skills. The person responsible for the work on site and managing operations depends on the type of contract. In the case of a more traditional contract, the architect or engineer are the client's representative throughout. They are represented by a site engineer. In the case of a design and build contract, the contractor, sometimes represented by a site agent, is the responsible party. All companies, who were commissioned with work through tendering, need to be contacted in advance and commencement dates need to be arranged. The aim is to achieve a smooth run with as few interruptions and *obstructions* as possible.

15.1.1 Trades

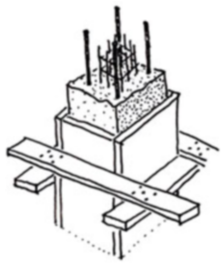
This list of trades and building processes is far from complete. The intention is to give the reader a general understanding of the work on site. For further information on building practices please refer to the list of additional reading material on page 271.

Trade/Tradesperson		Building process
Excavation work Building contractor		The site is cleared, and the ground is prepared. *Profile boards* are pegged with the help of a *level* indicating the exact location of the building. *Excavators* dig the construction *pit*, which has to either be secured by planking or sloped to prevent collapse. Excavated material is either stored in *spoil heaps* or removed.
Concrete work Concrete worker		Ready-mixed concrete is poured into *formwork*, compacted by vibrators to ensure solidity and *cured* with sprinklers. Pre-cast concrete is cast and cured in factories and transported to the site. The components, aggregate, cement, water and possibly additives, define the strength, durability, density, *impermeability* and stability of the concrete.

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_15

Formwork
Formworker

Before *in-situ concrete* can be poured, formwork, which is also known as shuttering, has to be prepared. It needs to be sufficiently tight to prevent leakage and smooth to impart a smooth finish to the concrete surface – this especially applies to *exposed concrete*. After an adequate *striking time*, the formwork is removed.
For repetitive elements, *sliding formwork* is used. Occasionally, the formwork remains in the structure; it is then called *permanent formwork*.

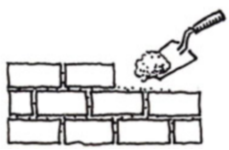


Reinforcement
Steelfixer

Steelfixers bend and fix reinforcement bars and cages and install them in formwork to strengthen concrete. *Barspacers* are used to guarantee a certain *concrete cover*. Bar intersections are securely tied with wire.

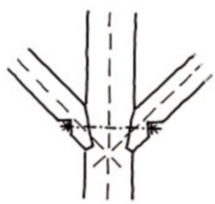
Structural steel-work
Steel erector

Steel profiles are often used to form the structure of a building. Standard profiles with I-shaped, T-shaped, etc. cross sections are welded or bolted together to form rigid frames.



Brickwork
Mason

Bricks or larger blocks are layered with *mortar* to form walls, piers, chimneys etc. All combinations of *stretcher* and *header* bonds are termed *English bond*. *Fair-faced brickwork* is built to a fair face and *pointed*. *Cavity walls* consist of several layers (non-/load-bearing) joined together by wall ties.



Timberwork
Carpenter

A carpenter's work includes the construction, erection and installation of timber structures. This may involve joining purlins and rafters to assemble a roof; it might involve posts and beams for a whole structure. A carpenter usually has a circular saw on site, other tools include milling and drilling machines, grinders and, not to be forgotten, the carpenter's hammer.

Roofing
Roofer

The roofer is responsible for covering the roof and making the structure *watertight*. Most roofs involve a combination of functions, *waterproofing*, heat insulation and *vapour barrier*. Whereas a gable roof is covered with roof tiles, a flat roof is sealed with bituminous materials.

Sheet metal work
Tin smith or sheet metal worker

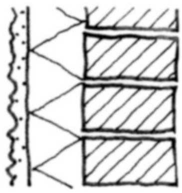
A tin smith is the person who makes and repairs things made of light metal, copper, stainless steel, aluminium, zinc, etc. Most buildings, especially in respect of roofs, require *flashings* or *copings*. Fixing *gutters*, *downpipes* and *sills* is usually also the work of a tinsmith.

Roof plumbing work
Roof plumber

It is essential for a building to be watertight. In the roof area, *roofing felt* is installed to prevent the *penetration of moisture*. A vertical *damp proof course* (DPC) is usually applied around the base of the building using a *bituminous paint coat*.

Thermal insulation work

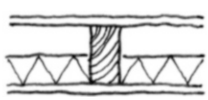
Insulation material is either fixed or installed in or on walls, ceilings and roofs to prevent heat loss. Vapour barriers are installed on the warm side to prevent moisture developing.



Dry construction work
Dry construction builder

Dry construction builders fix *plasterboards* as internal linings. Their work includes preparatory measures such as erecting frames and battens to fix boards, installing insulation and vapour barriers, as well as decorative measures.

Floor screeding
Floor screeder



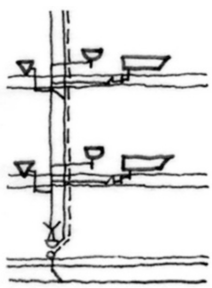
Screed is a layer of concrete or plaster which is installed on top of the structural slab. Usually the mix is pumped into a specified area and levelled creating a smooth surface for floor coverings.

Plaster work
Plasterer

Generally gypsum-based plasters are applied to internal walls in order to create smooth and uniform surfaces.

Rendering
Renderer

Render is applied to external walls. Normally cement-based materials are used to protect and smooth brickwork.



Plumbing work
Plumber

Plumbing work involves all of the *pipework* within a building. This includes water supply, *discharge* and *drainage*, heating and gas. Plumbers also fit all *sanitary appliances* and radiators. Plumbing embraces a large area of work and plumbers often specialize in one particular field.

Electrical installations
Electrician

Electrical work includes the installation of electrical and electronic equipment for industrial, commercial and domestic purposes, such as lighting, plugs, switches, etc. Electricians are responsible for laying cables in buildings and connecting a *distribution board* to the power line. Electricians have to work in stages, alternating their visits on site with plasterers, painters, etc.

Blacksmith's work
Blacksmith

A blacksmith creates objects from iron or steel by *forging* metal, i.e. by using tools to hammer, bend, cut and shape metal. Blacksmiths create products such as *wrought iron* gates, grills, railings, etc.

Joinery work
Joiner

Joinery work involves all tasks from fabricating to installing architectural woodwork. The building components can include doors, windows, stairs, wooden panelling, shop cabinets, kitchens, etc. The skills of a joiner are somewhere between a carpenter and a *cabinet maker*.

Tiling
Tiler

A tiler sets tiles made of ceramic, stone or glass in mortar or uses a *tile adhesive* to arrange tiles on floors and walls. *Grout* is used to fill and seal the joints between the tiles.

Locksmith's work
Locksmith

Locksmiths traditionally secure buildings with locking mechanisms. Today electronic lock services involve overall security systems of large complexes.

Glazing
Glazier

The trade involves selecting, cutting, installing, replacing and removing glass. Double-glazing and triple-glazing, insulated glazing units with hermetically sealed air spaces between the layers, have replaced single glazing. Glaziers work together with joiners in workshops, they also work on site installing *curtain walls*, glass floors, partitions, shelving, etc.

Painting and wall-papering work/ decorating
Painter/decorator

Usually the decorating concludes all activities on site. The work includes painting, *varnishing* and wallpapering in order to protect and decorate interior and exterior surfaces.

Flooring
Floor layer

Flooring is a general term for a permanent covering of a floor. It can refer to carpets, parquet, *raised flooring*, laminate and linoleum. The work of a floor layer also includes *levelling*, the installation of insulation and *skirting boards*.

15.1.2 Who does what?

According to the descriptions above, decide which tradesperson performs the work below.

1. They work with a *trowel* and are responsible for creating the shell of a building. ……….
2. They will be on site to fit *built-in wardrobes* in the bedrooms. …………………………..
3. When it comes to a roof conversion, they will erect dormers. ………………………..….
4. They are responsible for wall and floor finishes in kitchens and bathrooms. ……….…....
5. They use wet materials to prepare internal walls for painting. ……………………..…….
6. The owner commissions one to repair a *leak* in a flat roof. ……………………..…….
7. They will produce and install a railing on a balcony. …………………………...
8. They work with wire and *pliers* to make the building *tension resistant*. ………..……….

15.2 Site meetings

The site engineer, on small jobs this could be the architect, engineer or the contractor, is responsible for arranging and *conducting* site meetings. Usually these take place at regular intervals, either on a weekly, *fortnightly* or monthly basis. It is an opportunity to bring all participants involved to the table in order to provide and exchange information, answer queries and *check actual against expected progress*. Site meetings should be *preceded* by site inspections. Inspections, however, can also be carried out independent of site meetings.

Meetings are known *to swallow up* a lot of expensive *manhours* and many people attending may only have an interest in a small part of the proceedings. Meetings should therefore be reserved for specific purposes and planned carefully. It is useful to prepare an agenda and circulate it to the participants before the meeting. The *agenda* of a meeting will usually include the following:

- Record of all participants as well as *absentees*
- Acceptance of previous *minutes*
- Items arising from the previous *minutes*
- Progress related to programme
- Labour strength and materials required
- Drawings received or due
- *Financial review*
- Any other business
- Date of next meeting

Minutes should be taken at a meeting and copies should be sent to everyone concerned, the participants, absentees as well as the client. Minutes should be brief, recording decisions and not the, perhaps, endless discussions leading up to them. They should always include a column listing the persons responsible for dealing with any action points. Regular site meetings do not remove the need for telephone calls or correspondence, as many queries arise between meetings and need answering immediately.

One of the most important meetings during a project is the *pre-start meeting*. It should take place once the contract has been signed but before work commences. The aim of the meeting is to give everybody the opportunity to meet and hopefully form the beginning of a competent team. There will also be business matters to attend to, for example the *release of production information*, the construction programme and matters such as *insurance policies* and *bonds*.

15.2.1 Site inspection

The words inspection and *supervision* are often confused. An inspection, in this sense, is the work of an architect, engineer or consultant. It involves visiting the site and checking that work completed and in progress is in accordance with the drawings and specifications. Progress against the construction programme will also be checked. Supervision is concerned with the monitoring of the workforce and includes giving instructions regarding the execution of work. Supervision is carried out by the contractor or the appropriate representative on site.

Once work has commenced, a site inspection usually precedes every site meeting. An inspection involves visual checks, taking notes and measurements and possibly also carrying out tests. The site engineer should prepare for the site inspection, possibly by drawing up a list of items which need to be inspected. These will be apparent from the construction programme, which also needs to be reviewed in terms of progress against schedule. It is wise to vary the times of inspections and inspect *at random* to avoid poor work being covered up. Any defects identified or work not meeting the contract standards has to be pointed out and will need to be rectified or even removed. It is best to put any such matters in writing.

15.2.2 Dos and don'ts

Due to the architect or engineer's position and the importance of a good relationship between client and contractor, the behaviour of the planner as the client's representative should be *impeccable*. There are many aspects on site, which can be categorised as "dos and don'ts". Combine a beginning with an end of a sentence and decide whether the behaviour is appropriate or not.

				true	false
1.	The structural engineer doesn't have to wear	a.	the engineer should make a few random inspections.		
2.	The site engineer should look out for *infringements*	b.	should be assessed in the office before answered.		
3.	The architect should let the client	c.	with particular construction stages.		
4.	It is wise to put all comments regarding defective work	d.	a hard hat or any other protective clothing.		
5.	Before leaving the site	e.	in writing.		
6.	The architect should waste time	f.	of safety regulations.		
7.	Complicated *queries* on site	g.	instruct builders directly.		
8.	Inspections don't have to *coincide*	h.	talking about the site agent's cold.		

15.3 Variations

A variation is an *alteration* or *modification* to the design, quantity or quality of the works compared to what is shown in the contract drawings and is described in the contract documents. A variation can result from a change in the client's requirements, revisions to the design by the architect, engineer or other design consultants, or can arise from construction activity on site. Variations can be both time-saving and more reasonable as well as *disruptive* and more expensive than the item in the *priced bill*. The planning team will gladly accept cost and time-saving solutions so long as these do not reduce the quality of workmanship. Variations, which extend the construction period and/or increase the cost, need to be considered very carefully before being authorised. Any variations requested by the client outside the tendered price have to be paid for by the client. The costs deriving from variations required due to a fault in the contractor's work have to be borne by the contractor.

Variations are generally subject to the planners' instructions and confirmation. A form, letter or even memo showing the date and basic details of the instruction signed by the person responsible is important to keep track of variations and their valuation. Depending on the degree of the variation, it might be covered by the contingency sum. Where an instruction involves something quite different, an estimate should be obtained from the contractor. Modified drawings clearly indicating the alteration need to be prepared and distributed to all persons affected by the change.

The bill rates form the key to the valuation of variations. Especially regarding the quantity, *omission* or addition, the rates and prices quoted in the priced bills apply. Fair prices, in line with those in the bills, should be quoted for all alterations. Variations, which cannot be valued by measurement, are usually valued as daywork. *Daywork sheets* have to be delivered for verification at regular intervals, usually on a weekly basis.

15.3.1 Alteration

For more elaborate alterations, the normal procedure is for the architect or engineer to approach the contractor and ask for a quotation. Once the price offered is approved by the client, a *variation order* is drawn up on behalf of the client and submitted to the contractor.

Here, the client, George Smith, requests the architect to add a further window on the ground floor. The architect sends a fax with the request and a drawing to the site office where it can receive the immediate attention of the contractor. A follow-up phone call will ensure matters are sorted out promptly.

Tim Smith & Partners

Fax to Michael Stone

Hello Michael,

The client, George Brown, paid a visit to the site at the weekend and contacted me requesting an additional window in the dining room. I know that you have almost completed the exterior walls on the first floor and are getting ready to put in the roof slab, and I explained as much to our client. He is aware of the additional costs and understands that he will be giving up valuable wall space, but regards extra light as having greater value – he is very insistent regarding this change.

Could you please take a look at the attached drawing and quote a price for the alteration. It is, of course, quite urgent, as the windows are due be fitted. As soon as the client has approved the additional costs, I will release an official variation order.

I would be grateful if you could see to this immediately. Thanks for your help.

Regards

Tim

Encl: Extract from ground floor plan showing additional window in dining room.

15.3.2 Cause and effect

If you take another look at the fax, you will come across events which have a knock-on effect, for example the visit George Brown pays to the site followed by the request for an additional window, or the windows which are due to be fitted leading to the urgency expressed in the fax. The relationship between two aspects, dependent on or responsible for one another, is called cause and effect. Conjunctions used as sentence connectors are applied to express these relationships and combine the clauses.

There are many possibilities to express cause and effect. The intention of the following section is to point out the differences and the varieties, which help to make expressions and speech more appropriate and accurate.

Example: As a result of the client's visit to the site, a further window is to be added to the dining room.

The cause is the client's visit to the site; the effect is the additional window. The sentence connector chosen here is "as a result of". There are numerous conjunctions, which can be used to express a cause/effect relationship.

- Verb and verb phrases:
  The bad weather (cause) is responsible (verb link) for the delay (effect).

  Alternative verb links with a similar meaning:
  to account for, to result in, to bring about, *to give rise to*, to lead to, etc.

  Sometimes it is possible to reverse the elements:
  The delay (effect) stems from (verb link) the bad weather (cause).

  Alternative verb links with a similar meaning:
  to arise from, to result from, *to be attributable to*, etc.

- Clauses of cause:
  The contractor selected an alternative material (effect) because (conjunction) the tender item was not available (cause).

  A subordinating conjunction links the effect and cause clauses.
  Alternative subordinating conjunctions are:
  as, since, etc.

- Phrases of cause:
  Due to the delayed delivery of supplies (cause), operations on site are behind schedule (effect).

  In this case, an adverb phrase introduces the cause.
  Alternative expressions with similar meanings are:
  as a result of, because of, on account of, owing to, etc.

When an adverb clause begins the sentence, use a comma to separate the two clauses. When the adverb clause finishes the sentence, there is no need for a comma.

Example: The operations on site are behind schedule due to the delayed arrival of supplies.

15.3.3 Exercise: Cause and effect

Enter the following words into the text below. Make sure to use the correct verb form.

as a result of · to lead to · to be attributable to · to bring about · owing to · due to not to give rise to · since

In addition to the extra window in the dining room, the client also requested a second washbasin in the family bathroom. A visit to a friends house …......………. this idea. …....…..……. the already spacious layout of the bathroom, this request was fairly easy to fulfil. ……...……….. the variation, the architect had to draw a new plan showing the modification. …...………….. the sanitary appliances had not yet been ordered, the additional washbasin caused no delay. A mistake in the *door schedule* ……...………. a slight delay. The mistake …....…………. the architect, who noted a wrong number in the contract documents. …....…………. the speedy reaction of the joiner on site, the correct door was delivered quickly and the mistake …………….……. any delays.

15.4 Project diary

No matter how big or small the project, a project diary is a good way of keeping track of site activities. It is quite normal for the site engineer to receive numerous telephone calls, faxes, deliveries, etc. every day. Even though some things may seem insignificant at the time, they may turn out to be relevant later on in the project. Our human memory is *fallible* and, if not *jotted down*, trivial matters, which may turn out to be critical at a later date, are simply forgotten. A few minutes is all that it takes to write down the main events of the day, while the memory is still fresh.

The project diary should include anything that may affect the timely completion, the agreed cost or the expected workmanship. The diary should include a list of all persons present on site and their accomplished work. A note should be made of deliveries, phone calls and not to be forgotten the weather. A *notice of obstruction* filed by a contractor can easily be evaluated if a project diary is kept.

Even though the diary is personal and not part of the contract documents, it may be a valuable source of information in the case of legal disputes. It is not the style of writing, but the facts contained in the diary that are important. It merely has to be legible. Nowadays, software packages offer note pads to keep track of daily events.

15.5 Ceremonies

There are three ceremonies that are traditionally associated with new buildings and which most clients like to *perpetuate*. The first to take place is the laying of the *foundation stone*, the second is the *topping-out ceremony* and the third, marking the completion of the building, is the opening ceremony or *inauguration*.

Foundation stone: The ceremony is conducted to mark the beginning of construction work and record the building's development for *posterity*. The foundation stone often has a cavity containing a time capsule holding objects appropriate to the occasion and the building, such as a newspaper of the day, a coin, etc. The stone normally carries an *inscription* of who laid the stone when.

Nowadays, the event takes place later than the foundation stage, once there is enough evidence of building work, which can function as a stage for the ceremony. The stone is then placed in a visible position in a course of stones or bricks above the actual foundations. The foundation stone laying effectively becomes a corner stone ceremony. It is a client's event and, depending on the importance of the building, a celebrity or a political figure may be invited to place the stone and tap it into place.

Topping out: Whereas foundation stones have been found in ancient buildings, the origins of the topping out ceremony seem to be lost in history. However, it is a ceremony performed all over the world and is associated with the fixing of the topmost stone or beam to a building. Usually a fir tree or some evergreen is hoisted to the topmost structural element and a toast is drunk by everyone on site to celebrate the completion of the building structure. In practical terms, it defines the point at which the client is able to thank and pay his/her respect to those who have actually been involved in the construction of the building.

Opening ceremony: If the client has an opening ceremony, it will usually be some time after occupation and/or operation, when the building or structure is looking clean, trim and in good working order. Generally, the client has lived with the construction site since the commencement date and, despite defects, misunderstandings and *teething troubles*, most probably feels part of the achievement. The opening ceremony declares and confirms the client as the owner. Depending on the size of the event, it may include a description of the design, the planning and construction process as well as the credits, a list recognising the contribution of everybody involved in the project.

15.6 Vocabulary

15.1	work progress	Baufortschritt
	tradesperson, pl tradespeople; also tradesman, pl tradesmen and tradeswoman, pl tradeswomen	Handwerker/in
	construction site sign	Bau(stellen)tafel
	obstruction	Behinderung
15.1.1	trade	Gewerk
	excavation work	Aushubarbeiten
	profile boards	Schnurgerüst
	level	Nivelliergerät
	excavator	Bagger
	pit	Baugrube
	spoil heap	Aushublagerhaufen
	concrete work	Betonarbeiten
	to cure	aushärten
	impermeability	Undurchlässigkeit, Dichtheit

in-situ concrete	Ortbeton
formwork	Schalung
exposed, fair-faced or visual concrete	Sichtbeton
sliding formwork	Gleitschalung
permanent formwork	verlorene Schalung
striking time	Ausschalzeit
reinforcement	Bewehrung
steelfixer	Betonstahlverleger, Eisenflechter
barspacer	Abstandshalter für Betondeckung
concrete cover	Betonüberdeckung
structural steelwork	Stahlbauarbeiten
steel erector	Stahlbauer
brickwork	Mauerwerk
mason	Maurer
mortar	Mörtel
stretcher	Läufer
header	Binder
English bond	Blockverband
fair-faced brickwork	Verblendmauerwerk
to point	auskratzen und ausfugen (Mörtelfuge)
cavity wall	zweischaliges Mauerwerk
timberwork	Zimmerarbeit
carpenter	Zimmerer, Zimmermann
roofing	Dach(ein)deckung
roofer	Dachdecker
watertight	wasserdicht, -undurchlässig
waterproofing	Abdichtung
vapour barrier	Dampfbremse, Dampfsperre
sheet metal work	Metalldacharbeiten
tinsmith, sheet metal worker	(Bau-)Spengler
flashing	Spritzblech
coping	Mauerabdeckung
gutter	Rinne
downpipe	Fallrohr
sill	Fensterblech
roof plumbing work	Dachklempnerarbeit
roof plumber	Dachklempner
roofing felt	Dachpappe
penetration of moisture	Eindringung von Feuchtigkeit
damp proof course (DPC)	Feuchtigkeitssperre
bituminous paint coat	Bitumenanstrich

thermal insulation work	Dämmarbeiten
dry construction work	Trockenbauarbeiten
dry construction builder	Trockenbaumonteur
plasterboard	Gipskartonplatte
floor screeding	Estricharbeiten
floor screeder	Estrichleger
plaster work	Putzarbeiten
plasterer	Putzer
rendering	Außenputzarbeit
render	Außenputz
plumbing work	Sanitärinstallation
plumber	Sanitärinstallateur, Klempner
pipework	Leitungs- u. Rohrverlegearbeit
discharge	Schmutzwasser
drainage	Kanalisation
sanitary appliance	Sanitärobjekt
electrical installation	Elektroinstallation
electrician	Elektriker
distribution board	Verteiler
blacksmith's work	Schmiedearbeit
blacksmith	Schmied
to forge	schmieden
wrought iron	Schmiedeeisen
joinery work	Bauschreinerarbeit
joiner	Bauschreiner
cabinet maker	Möbelschreiner
tiling	Fliesenlegearbeit
tiler	Fliesenleger
tile adhesive	Fliesenkleber
grout	Vergussmörtel
locksmith	Bauschlosser
glazier	Glaser
curtain wall	Vorhangfassade
painting and wallpapering work, decorating	Maler- u. Tapezierarbeiten
decorator	Maler
to varnish	lackieren
flooring	Bodenbelagsarbeit
floor layer	Bodenleger
raised flooring	aufgeständerter (Fuß-)Boden
to level	ausgleichen, glätten
skirting board	Sockelleiste

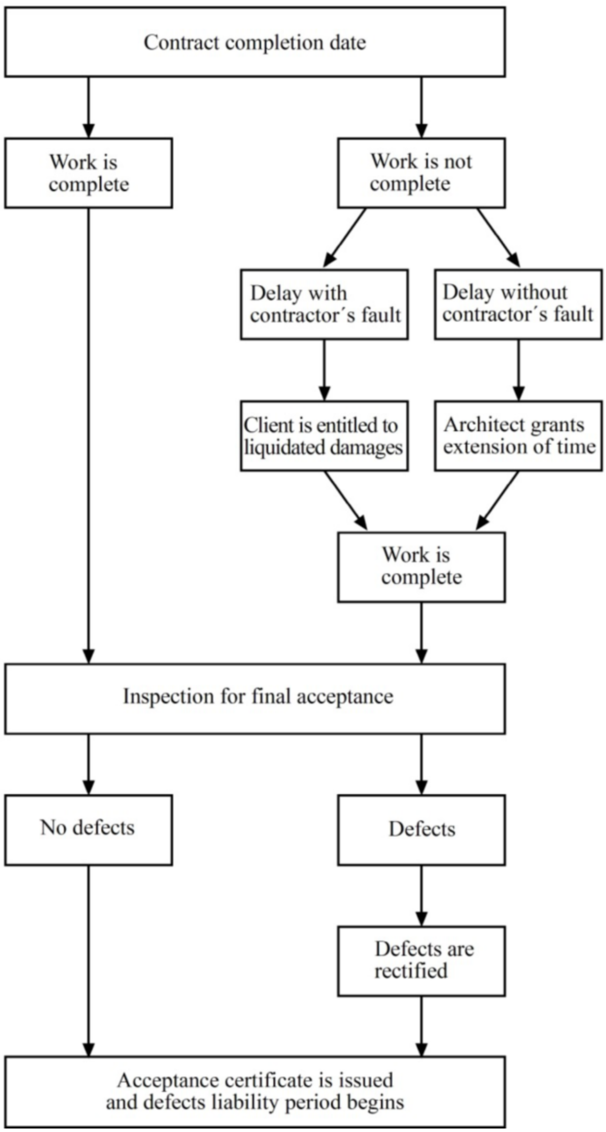
15.1.2	trowel	(Maurer-)Kelle
	built-in wardrobe	Einbauschrank für Kleidung
	leak	undichte Stelle, Leck
	pliers	Beißzange
	tension resistant	zugfest
15.2	site meeting	Baustellenbesprechung
	to conduct a meeting	eine Besprechung führen
	fortnightly	vierzehntägig, zweiwöchentlich
	to check actual against expected progress	Ist- u. Sollfortschritt gegenüberstellen
	to precede	vorangehen
	to swallow up	schlucken
	manhour	Arbeitsstunde
	agenda	Tagesordnung
	absentee	Abwesende/r
	minutes	Protokoll
	financial review	finanzielle Prüfung
	pre-start meeting	Vorbesprechung
	release of production information	Freigabe der Ausführungspläne
	insurance policy	Versicherungsschein
	bond	Bürgschaft
15.2.1	site inspection	Baustellenbesichtigung, -begehung
	supervision	Bauüberwachung
	at random	stichprobenartig
15.2.2	impeccable	makellos, tadellos
	infringement	Verletzung (der Vertragspflicht)
	query, pl queries	Anfrage
	to coincide	zeitlich zusammenfallen
15.3	variation	Bauvertragsänderung
	alteration, modification	Änderung, Abwandlung
	disruptive adj	störend
	priced bill	ausgefülltes Leistungsverzeichnis
	omission	Auslassung, Wegfall
	daywork sheet	Stundenlohnzettel
15.3.1	variation order	Bauänderungsanweisung, Änderungsauftrag
15.3.2	cause and effect	Ursache und Folge
	to give rise to	führen zu, Anlass geben zu
	to be attributable to	jmdm. zuzuschreiben sein
15.3.3	door schedule	Türliste
15.4	project diary	Bautagebuch
	fallible adj	fehlbar

	to jot down sth	rasche Notizen machen
	notice of obstruction	Behinderungsanzeige
15.5	to perpetuate	aufrechterhalten
	foundation stone	Grundstein
	topping-out ceremony	Richtfest
	inauguration	Einweihungsfeier
	posterity	Nachwelt
	inscription	Inschrift
	teething troubles fig	Anlaufschwierigkeiten

16 Completion

16.1 Completion stage

The completion stage is a significant phase in the course of a project. After months, sometimes even years, of construction work, the scheme, which was originally developed on paper, finally appears in its true dimensions. The diagram below shows the various phases of completion. The process is similar throughout the world. The number of certificates, however, varies as does the length and the character of the *defects liability period*.



S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_16

For most commercial transactions completion is easily measured and achieved at some clearly defined moment. For instance, the purchase of a commodity that also requires a complete tender before payment is due. Upon delivery, the performance is complete. In construction practice, the point at which a project becomes complete is rarely so easy to define.

The basic facts at completion are that the client, who relied on the planner's competence to transform the contents of the brief, is able to experience the full scope of the project. The contractor, who once took possession of the site to perform the work, hands it back to the client. Despite the festive character of this phase, it is also one governed by *inspections*, *certificates* and payments. Furthermore, it is not always one which is completed in agreement and it may end up in disagreement and *legal disputes*. For this reason, it is vital for all parties to *adhere* to their contractual obligations and to do their best to avoid expensive and time-consuming *lawsuits*.

16.2 Delays

There are few businesses for which the saying "time is money" is more appropriate than the construction industry. It is also extremely time sensitive. Construction contracts specify the sum of money due for the work and the period in which the work must be undertaken. The agreements show a commencement and completion date or an *anticipated construction period*. In both cases, a contract completion date is established. Failure to meet dates specified is a *breach of contract*. Whereas the client loses opportunities and profit in waiting for completion of delayed projects, the contractor carries the *financial burden* of running the site beyond the date anticipated at tendering stage.

In many cases and for numerous reasons, jobs *overrun* and finish at a later date than originally agreed. This later date is then the *actual contract completion date*. Most contracts provide a buffer and give the architect or engineer the power to extend the original contract completion date. If the cause for the delay is not the contractor's fault, an extension of time is usually granted. A new contract completion date is fixed, and the threat to the contractor of liquidated damages being implemented is lifted for the extended period.

Events which would usually allow an extension of time:

- Variations
- *Deferment of possession*
- Inaccurate forecast of quantities
- *Suspension* of contractor's obligations
- *Impediment*, *prevention* or *default* on behalf of the client
- Delays resulting from other trades not completing on schedule
- Exceptional weather conditions
- Loss or damage caused by *perils*, such as fire
- Civil commotion
- Strikes
- *Force majeure*

If the contractor is responsible for the delay and an extension of time is not awarded, the contractor is in *culpable delay* and *liable for damages*. In this case, the client is entitled to deduct *liquidated and ascertained damages* (LADs) from moneys otherwise payable to the contractor for every day the contractor fails to meet the completion date. The rate, which is stated in the contract, is the amount the contractor agreed to pay the client to cover *losses*, *expenses* and *damages* up until completion. The clause normally takes the following form:

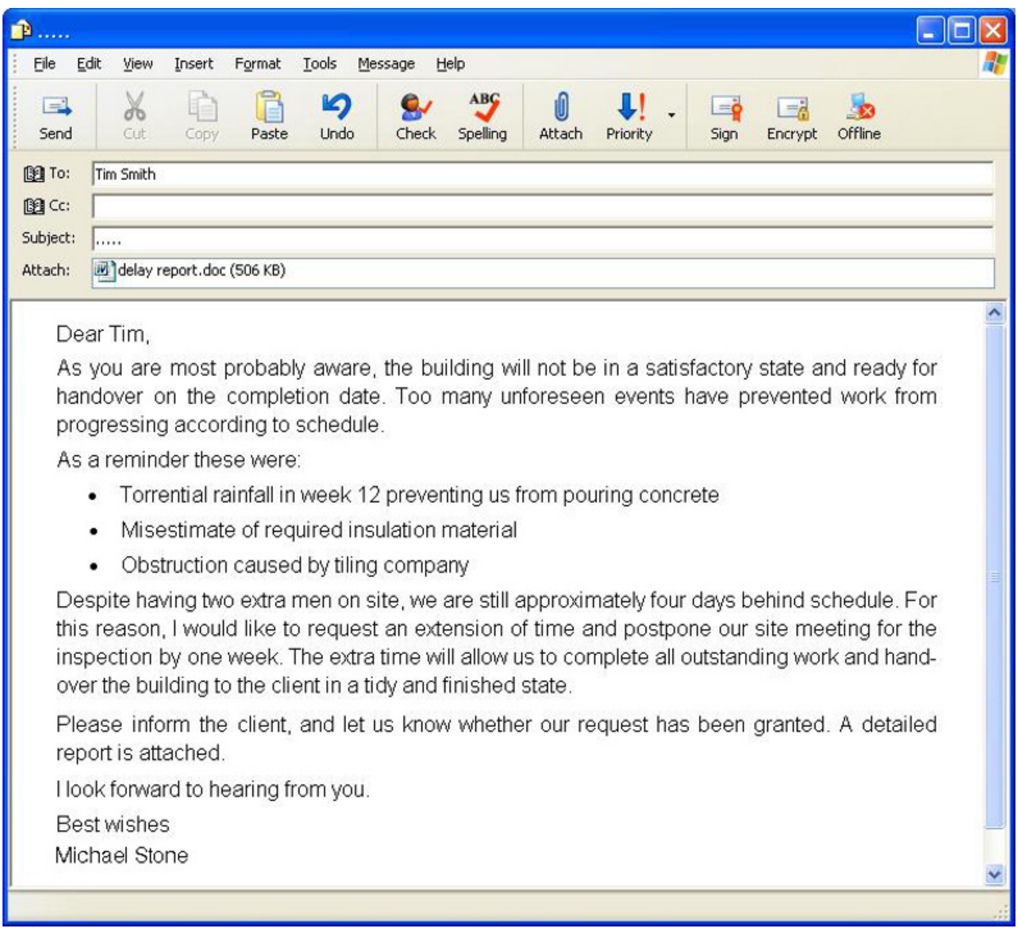
"If the contractor fails to complete the work within the contract time or fails to achieve any of the contract milestones, the contractor agrees to pay the owner £ X per day as liquidated damages to cover losses, expenses and damages of the owner for each and every day which the contractor fails to achieve completion of the milestone work or the entire project."

The key to liquidated damages is then the value assigned to the per diem cost "X". Despite many beliefs, the provision should not punish a contractor; its purpose is compensatory only.

16.2.1 Extension of time

During the construction of George Brown's single-family home, several events outside the contractor's control gave rise to delay. Read the email from the contractor to the architect. Which of the following suggestions is the most appropriate subject line?

- Nearly finished
- Request for extension of time
- Too many changes have caused delays



To: Tim Smith
Cc:
Subject: .....
Attach: delay report.doc (506 KB)

Dear Tim,

As you are most probably aware, the building will not be in a satisfactory state and ready for handover on the completion date. Too many unforeseen events have prevented work from progressing according to schedule.

As a reminder these were:

- Torrential rainfall in week 12 preventing us from pouring concrete
- Misestimate of required insulation material
- Obstruction caused by tiling company

Despite having two extra men on site, we are still approximately four days behind schedule. For this reason, I would like to request an extension of time and postpone our site meeting for the inspection by one week. The extra time will allow us to complete all outstanding work and hand-over the building to the client in a tidy and finished state.

Please inform the client, and let us know whether our request has been granted. A detailed report is attached.

I look forward to hearing from you.

Best wishes

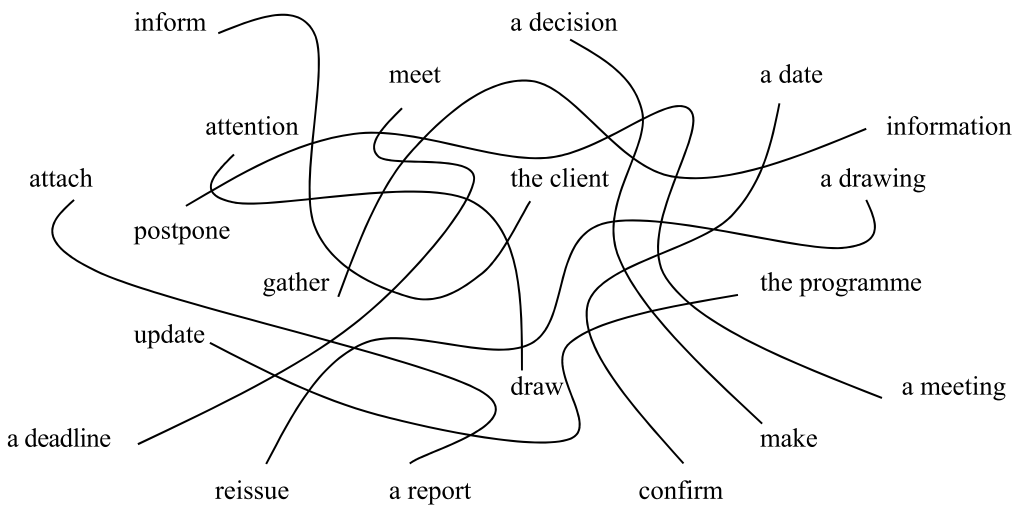
Michael Stone

16.2.2 Collocations

As already mentioned in the very first unit, it is important to understand the significance of collocations to improve general language skills. Recognising that some words combine better than others, leads to better speaking and writing skills since chunks of speech rather than individual words are used. It is also important to recognise that some collocations are the same as in the mother tongue, whereas others are completely different. The different ones are often a source of error in the foreign language, for example heavy rain instead of strong rain, to take a picture instead of to make a picture or reinforced concrete instead of steel concrete

Before continuing with this section, take another look at the email in 16.2.1 and underline the collocations. Which language patterns (verb + noun, adverb + verb, etc.) do they follow?

There are in fact many, and this experiment highlights the importance of learning chunks or phrases rather than single words. Identify the following verb + noun collocations which commonly appear in everyday business situations. Then correct the collocation errors in the sentences below. There may be more than one error in each sentence.



1. Please don't forget to enclose the photos with your reply to this email.
2. We'll have to meet a decision on the cost matters this Friday.
3. The contractor cannot catch the deadline because the tiler confused the workflow.
4. May I pull your attention to the following issue?
5. We need to gather some more informations on facility managers.
6. Please confirm the delivery by writing.
7. The client is upmoving the meeting with the landscape architect due to the strong rain.
8. They'll have to republish the plans if they want to hinder confusion.

16.3 Acceptance

The task of inspecting and approving work performed on site is called acceptance. It is a process which takes place at various stages during the course of a project. As soon as an operation has been completed, the tradesperson who undertook the work requests formal acceptance in order to leave the site and receive payment. It would not be appropriate to have a company wait until the final completion date. Furthermore, some work needs to be accepted before it is covered up by other work. One example would be the acceptance of the reinforcing steel before the concrete is poured.

The inspection for *final acceptance* is, in a sense, the most important because it not only marks the completion of construction work, but also the *handover* to the client. For the final acceptance, the building or structure should be in a state ready for *occupation* and operation by the client without *inconvenience*. There are conflicting views regarding the meaning of completion. It certainly does not have to be certified simply because the client has occupied the building or the contractor is trying to meet the completion date stipulated in the contract without the liquidated damages clause being *invoked*.

Since perfection is not a practical measurement in the building industry, construction law has adopted the concept of *substantial completion*. Substantial completion is achieved when the client has beneficial use of the project, i.e. when the owner can take advantage of the project for the purpose intended. For example, a building may be substantially complete when it is occupied, a treatment plant when it is started up or a bridge when it is open for traffic. In each of these examples, the work may not be 100 per cent complete but the project's purpose has been achieved. It goes without saying that substantial completion does not relieve the contractor of the obligation to complete the project in its entirety.

A date for the final inspection is arranged once completion is imminent. It focuses on the correct operation of all equipment, completion and state of all *finishes* and the recording of defective or *omitted* items. The purpose is not one of catching up on points noted or missed at regular site inspections, although some of these may be open issues recorded at the final inspection. All items, either incomplete or requiring *remedial work*, are then put on the so-called *snagging list*.

Depending on the extent and/or significance of remedial work, the client may have to decide whether he/she is prepared to receive the building in an incomplete state, or whether to fix a new date for a second acceptance. In both cases, the contractor is responsible for performing the remedial work, however, in the second case, the client may be entitled to liquidated and ascertained damages.

If the client wishes to take possession and move in before completion has been achieved (substantial completion), he/she may, in agreement with the contractor, be granted *partial possession*, which must be clearly documented. Some contracts incorporate provisions for *sectional completion*. In this case, it was planned from the very beginning that the client would not take over the entire building at one time, but in several phases. The same clauses regarding liquidated damages, liability periods, *retention* sums etc. apply to each section in the same way as they do for the full completion.

16.3.1 Acceptance certificate

The acceptance certificate, also referred to as taking-over certificate, is formal evidence of the architect or engineer's opinion regarding his/her satisfaction that the works are in accord with the contract with no obvious defects and no major outstanding work.

The acceptance certificate marks the end of the construction phase and the beginning of the defects liability period. It is the transfer from the contractor to the client and the date from which the client must undertake insurances.

The acceptance certificate marks an important stage and the contractor will be anxious to receive it for the following reasons:

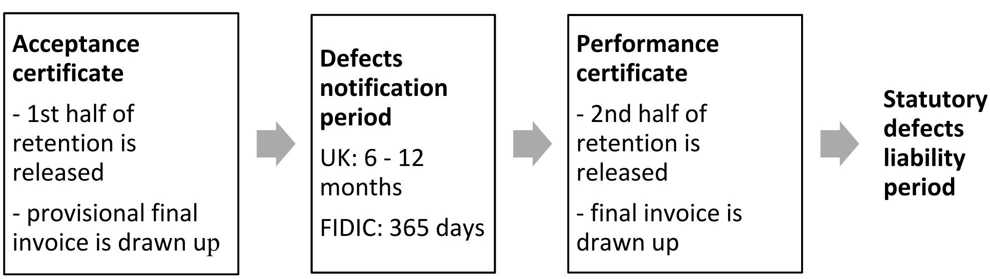
- The contractor's liability for damage to the works ends.
- The contractor's *liability insurance* expires.
- The danger of liquidated damages being invoked no longer exists.
- Part of the retention is released.
- A *final invoice* can be drawn up.

It is general practice either during or after the inspection at completion to hand over the keys and all *maintenance manuals* to the client. The client should also receive a full set of the *as-built drawings* together with information regarding construction materials, *user instructions* for technical equipment, possible contact numbers, etc.

16.3.2 Defects notification period

British building legislation, which has been adopted in the FIDIC wording, provides for the acceptance of construction work being performed in two stages. The first stage marks the completion of construction work when an acceptance certificate is issued and the *care for the works is transferred* to the client. The certificate determines the beginning of the *defects notification period.* It is now that the first half of the retention monies is released and the contractor prepares a *provisional final invoice*.

After a period of 6 months or 365 days and once all the defects have been remedied, a second certificate, the *performance certificate,* is issued. The second half of the retention monies is released, and the contractor prepares the final invoice. The performance certificate marks the *completion of the contract*, which, however, does not mean the *elimination of contractual obligations*. Any matters arising after issuing the performance certificate are covered by *statutory defects liability* clauses. In many countries, the date of the performance certificate is the commencement date for *decennial liability* under civil law. During what is usually a 10-year period, the contractor is liable for any hidden defects. This excludes damage resulting from *extraneous events* or *wear and tear*.



In Germany, the defects notification period is 4 years for contracts based on the VOB and 5 years for contracts based on the *Civil Code (BGB)*. Some contracts adopt the VOB for all aspects except for the clause regarding the defects notification period and the BGB is applied to allow for a 5-year period for all defects arising after completion. These periods apply to all *concealed* and hidden defects. A period of up to 30 years can apply to all defects caused by *malicious deceit*.

16.3.3 Remedial work

Remedial work includes all operations taking place on site after final acceptance and after the building has been handed over to the client. The contractor is obliged to perform all outstanding work, remedy the defects noted on the snagging list as well as see to all defects which appear after having left the site and cannot be categorised as maintenance caused by ordinary wear and tear.

It is the contractor's contractual obligation to perform the remedial work at his/her own cost within the determined period. If the contractor fails to perform the work within the specified timescale, the client is entitled to engage another contractor to make good the defects. All costs incurred are deducted from the *outstanding retention*.

16.3.4 Exercise: Remedial work

Having settled into the building, the client contacts the architect to talk about a number of items, which need to be taken care of. Decide which of these items are maintenance and which ones are defects requiring remedial work.

1. The *skirting board* has come away from the wall.
2. There is a broken tile in the bathroom.
3. There are no logs for the open fireplace.
4. The kitchen door scrapes the floor.
5. There is a *leak* in the flat roof above the garage.
6. There is a red wine *stain* on the parquet flooring.
7. There are dirty fingerprints on the walls.
8. The tilt-turn window in the dining room only turns and doesn't tilt.
9. The *flush plate* is still missing in the utility room.

16.4 Payment procedures

All *payment conditions* are laid down in the contract. The terms and conditions determine whether payments are to be made at a set date or according to progress. In case of a *lump sum contract*, the dates for *instalments* are agreed in the contract. *Progress payments*, also called *interim payments*, refer to a completed activity, a particular stage or percentage of work. Progress payments are subject to adjustment depending on whether the contractor is ahead or behind schedule. A *payment schedule* clearly indicates when payments are due.

Independent of the payment conditions, all *invoices* prepared by contractors include a *measurement sheet*, assigning quantities to the completed work. *Unfixed materials* can be included. Unfixed materials are either items already delivered to site, but not yet fixed, or materials off-site, ready to be included in the works, e.g. pre-cast concrete elements, windows, etc. The contractor sends the invoice and all other necessary documents to the client's representative, who checks the invoice and defines the amount due in a *payment certificate*. The payment certificate is then forwarded to the client, who transfers the money to the contractor's account.

It is the architect, engineer or, in the UK, the quantity surveyor's task to certify the amounts due and keep track of the overall construction costs. The payment certificates include the value of work properly executed and the unfixed materials, less a percentage to be held back, which is known as the retention sum. If unsure about the valuation, the contractor may be requested to provide further information or the person responsible for checking the payment certificates may have to pay a visit to the site specifically to check items listed on the invoice. It is helpful if the client representative and the contractor agree on the final figure. If this is not the case, the client has to be informed accordingly. All items paid for become part of the client's possession.

If the client fails to pay the requested amount within the period specified in the certificate, the contractor is entitled to *interest* on the amount in default.

16.4.1 Final statement

The final statement is an itemised list of construction work, which should take into account all variations agreed during the period of the contract. It sets the original provisional sums or prime cost assessments against the actual sums and includes all information provided by the contractor, which the architect, engineer, or, if commissioned, the quantity surveyor, carefully checks beforehand. It should present a complete picture of the financial situation for the project as a whole.

The final statement should not be a surprise to the client. It is the architect or engineer's responsibility to keep the client up-to-date throughout the contract. The client should be aware that most changes result in extra cost. As mentioned earlier, variations involving extra cost may not be instructed without prior agreement of the client.

16.4.2 Retention

Usually every contract for building work includes a provision for retention. It is a percentage of monies owed to the contractor for work already performed. It serves as security for later work stages through until the expiration of the defects notification period. The retention monies are held until all defects are remedied and work is completed to the satisfaction of the client, the owner, if this differs from the client, and the planning team. In the event of the client's default or *bankruptcy*, the monies become available to pay off the contractor.

Every invoice shows the amount to be held back or retained. The sum, usually ranging from 5% to a maximum of 10% of the building costs, is released in two stages. The first half of the retention is released as soon as the acceptance certificate has been issued. In Germany, the second half is released after the defects liability period has elapsed. Contracts incorporating the VOB guidelines allow for a period of 4 years; the Civil Code (BGB) grants a period of 5 years. In the UK, the second half of the retention monies is released once the performance certificate has been issued, i.e. 6 or 12 months after the acceptance certificate was signed.

The retention monies have to be set-aside in a separate account in the joint names of the client and the contractor. The contractor can achieve the release of retention monies by providing a *surety bond*.

If the contractor fails to fulfil his/her contractual obligations and make good the defects identified during the defects liability period within a reasonable time, the client may engage others to do the work and charge the full cost to the original contractor. In this case, the costs for the remedial work would then be deducted from the retention fund.

16.4.3 Fee calculation

The fees are the costs for professional services provided during the course of a project. Since fees are usually a percentage of the *actual construction costs* (see section 5.3), the architect, engineer and other consultants cannot perform their fee calculations until the costs have been determined in the final statement. The fee statement should describe all stages through which the contract has passed, list all *interim accounts* and include all *outstanding expenses*. The final account for fees represents the completion of the services to the client.

Any information of interest to the client, such as maintenance information, as-built drawings or photographs, should be handed over to the client at this point. It may also be necessary to inform the client about copyright in connection with the building's *artistic merit* and any drawings. Copyright remains with the originator for his or her lifetime and for 50 years thereafter.

16.4.4 Lexis: Payments

Match the terms on the left with the correct definition on the right.

1. unfixed materials	a. a certificate usually issued by a bank as a guarantee for the client in case the contractor fails to fulfil the contractual obligations
2. measurement sheet	b. an amount of money due to the architect and other consultants for their professional services
3. retention	c. items manufactured and/or supplied, but not yet installed
4. instalment	d. a document listing the prices charged for providing a service
5. surety bond	e. to subtract or take away an amount
6. invoice	f. a payment for a stage or percentage of work completed
7. final statement	g. money spent in connection with the supply of services, e.g. travel
8. to deduct	h. a document or diagram showing the quantities of completed works
9. fee	i. a list of the actual building costs drawn up after the acceptance certificate is issued
10. expenses	j. a percentage of a payment withheld as a security

16.5 Close-out

The close-out at the end of a project development is the process of finalising all the activities that took place to plan and erect the building. It includes handing over all the facilities and documents to the client according to the terms and conditions of the contract. In addition to all financial matters, it also involves *commissioning* the technical equipment, instructing persons responsible on how to use individual components as well as issuing documents showing the final results. The aim of an orderly close-out is to present a finished project which conforms to what was originally intended.

The planning and construction period is only a brief moment in the life cycle of a building. The involvement of the persons responsible for the development is also limited to this short period, but the future existence of the property depends on their work. The planners lay the ground for the ease of use and maintenance of materials, components and the property as a whole, therefore ensuring that the building can reach its anticipated target life. It follows that this will only be achieved if the building is commissioned in an orderly fashion and all the relevant documents are handed over to the client and/or owner to enable the building to be managed and operated as intended.

16.5.1 Commissioning

Commissioning is the process of putting an item into operation and ensuring that it is in good working order. It involves intensive quality assurance tests and is designed to make sure that all equipment operates as originally intended. This generally requires that performance levels are set during the design phase of the building, such as power consumption or carbon emissions. A *comparison of the predicted and actual values* will highlight which corrections and adjustments have to be made to meet or at least not exceed target values.

A fundamental aspect of commissioning is the training of future building *occupants* and ensuring that they understand how the building has been designed to work. The air in a Passive House building, for example, is exchanged and supplied by a mechanical ventilation system in winter in order to minimize heat loss through opening windows. Sleeping with the windows open at night would therefore be *self-defeating*, and residents must learn to adapt accordingly.

Commissioning is a process. It must be planned well in advance of the completion date and a *commissioning manager* must be appointed to take care of the testing and handover. The process continues after the building has been occupied by recording and comparing data at regular pre-set intervals.

16.5.2 As built drawings

Some of the most important documentation products of a construction project are the as built drawings. These are the original design drawings that are updated continuously to reflect any changes made during the construction of the project. They should be submitted to the client and/or owner as part of the completion process.

The as built documents will make any maintenance or refurbishment work in the building more efficient and less disruptive. Simply knowing where ducts and cables are located when changing the position of a wall can be extremely helpful. If as built or record drawings are not available, a building survey must be performed to recreate the building as it was built. This is often a necessary, but also a very lengthy and expensive process in the case of old and historic buildings.

It goes without saying that today's as built drawings are not a set of plans. All the drawings will be contained in a set of data, possibly a building information model, and handed over as a digital file.

16.5.3 Project documentation

In addition to the as built drawings, the project documentation should also include:

- A *building owner's manual* with information for the operation, maintenance, *decommissioning* and *demolition* of the building. It contains information about the construction and the building materials, but also mechanical and electrical services.
- A *building user's guide* is a non-technical guide with information on, for example, how to operate the heating, lighting and cooling systems, how to save water or manage waste. It

should be easily accessible, possibly online, so that the occupants can learn how best to use, live and work in the building.

- A *technical guide* can be provided as a separate document, if the information is not already contained in the building owner's manual, to help occupants understand how the building services systems are supposed to work. It should be written in simple language and explain the expected performance of the building as well as strategies for *energy metering*.
- A *health and safety file* is designed to reduce the risk of harm to those who use and maintain the structure. It may contain information about key structural principles and safe working loads for floors and roofs or the nature and location of fire-fighting services.

The compilation of these documents for the efficient and correct use of the completed property is an integral part of planning services. According to research, operating costs can be reduced by 20 per cent by looking after, monitoring and servicing equipment regularly.

16.6 Vocabulary

16	completion	Fertigstellung
16.1	defects liability period	Gewährleistungsfrist, Mängelhaftungszeitraum
	delay	Verzögerung, Verzug
	with/without fault	mit/ohne Verschulden
	to be entitled to liquidated damages	Anspruch haben auf vertraglich festgesetzte Schadenssumme
	extension of time	Bauzeitverlängerung
	inspection for final acceptance	Besichtigung zur Endabnahme
	defect	Mangel
	acceptance certificate	Abnahmebescheinigung
	inspection	Kontrolle, Überwachung
	certificate	Bescheinigung
	legal dispute	Rechtsstreitigkeit
	to adhere to sth	befolgen
	lawsuit	Prozess, Klage
16.2	anticipated construction period	vorgesehene Bauzeit
	breach of contract	Vertragsverletzung, -bruch
	financial burden	finanzielle Last
	to overrun	überschreiten
	actual contract completion date	tatsächlicher Fertigstellungszeitpunkt
	deferment of possession	Verzögerung der Übergabe durch den Auftragnehmer
	suspension	Aufschub
	impediment	Behinderung
	prevention	Verhinderung
	default	Versäumnis

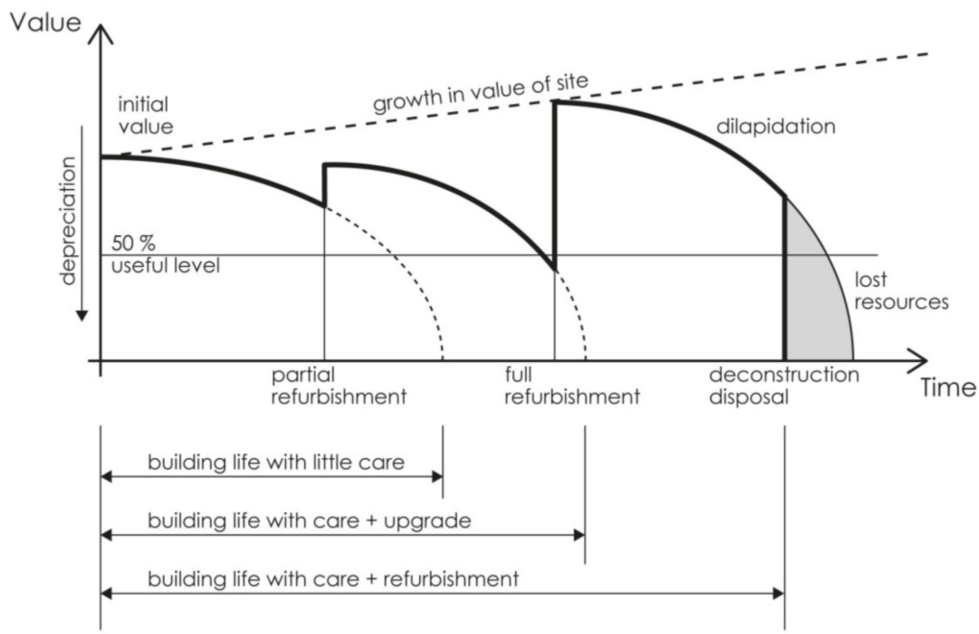
	peril	Gefahr
	force majeure	Höhere Gewalt
	culpable delay	schuldhafter Verzug
	to be liable for damages	schadensersatzpflichtig
	liquidated and ascertained damages	Verzögerungsschadensersatz
	losses	Verlust
	expenses	Kostenaufwand, Auslagen
	damages	Entschädigung
16.2.1	misestimate	Fehlkalkulation
	obstruction	Behinderung
16.3	acceptance	Abnahme
	final acceptance	Endabnahme
	handover	Übergabe
	occupation	Besitznahme
	inconvenience	Unannehmlichkeit
	to invoke	anrufen
	substantial completion	wesentliche Fertigstellung
	finishes	Oberflächengestaltung, -ausführung
	to omit	auslassen, weglassen
	remedial work	Nachbesserungsarbeiten
	snagging list	Mängelliste
	partial possession	teilweise Inbesitznahme
	sectional completion	Fertigstellung in Bauabschnitten
	retention	einbehaltener Betrag, Einbehalt
16.3.1	liability insurance	Haftpflichtversicherung
	final invoice	Schlussrechnung
	maintenance manual	Wartungshandbuch
	as-built drawings	Bestandspläne
	user instructions	Gebrauchsanleitung
16.3.2	to transfer the care for the works	Gefahrenübergang
	defects notification period	Mängelanzeigefrist
	provisional final invoice	vorläufige Schlussrechnung
	performance certificate	Erfüllungsbescheinigung
	completion of the contract	Vertragserfüllung
	elimination of contractual obligations	Erlöschung der Vertragspflicht
	statutory defects liability	gesetzliche Gewährleistung
	decennial liability	zehnjährige Haftung
	extraneous events	Fremdeinwirkung
	wear and tear	Verschleiß, Abnutzung
	Civil Code	BGB, Bürgerliches Gesetzbuch
	concealed defect	verdeckter Mangel

	malicious deceit	arglistige Täuschung
16.3.3	outstanding retention	ausstehender Einbehalt
16.3.4	skirting board	Sockelleiste
	leak	undichte Stelle, Leck
	stain	Fleck, Verfärbung
	flush plate	(Schalter-)Abdeckplatte
16.4	payment conditions	Zahlungsbedingungen
	lump sum contract	Pauschalvertrag
	instalment	Rate, Zwischenzahlung
	progress payment, interim payment	Abschlagszahlung, Zahlung nach Leistungsabschnitten
	payment schedule	Zahlungsplan
	invoice	Rechnung
	measurement sheet	Aufmassblatt
	unfixed material	noch nicht eingebaute Materialien
	payment certificate	Zahlungsbescheinigung
	interest	Zinsen
16.4.1	final statement	Schlussrechnung
16.4.2	bankruptcy	Konkurs
	surety bond	Bürgschaft
16.4.3	fee calculation	Honorarberechnung
	actual building construction costs	tatsächlichen Baukosten
	interim accounts	Zwischenabrechnung
	outstanding expenses	ausstehende Ausgaben
	artistic merit	künstlerischer Verdienst
16.5	close-out	Abschluss
	commissioning	Inbetriebnahme
16.5.1	comparison of predicted and actual values	Ist- und Sollwertvergleich
	occupant	Nutzer
	self-defeating	kontraproduktiv
	commissioning manager	Leiter der Gesamtinbetriebsetzung
16.5.2	as built drawings	Bestandszeichnungen
16.5.3	building owner's manual	Benutzerhandbuch
	decommissioning	Stilllegung, Außerbetriebnahme
	demolition, to demolish	Abriss, abreißen
	building user's guide	Wartung- und Pflegeanleitung
	technical guide	technischer Leitfaden
	energy metering	Zählerablesung
	health and safety file	Arbeitschutzrichtlinien

17 In Use and End of Life

17.1 After completion

The construction costs of a conventional new build represent only approximately 20 per cent of the total life cycle costs. The remaining 80 per cent is taken up by operation and maintenance expenses. The average life cycle of a building is 30 years, but it depends on the type of project and can vary considerably. When designing a building, the aim should therefore be to choose durable, low-maintenance materials and to ensure that these, along with the building services systems, are well looked after through regular *servicing*, repair and renewal of components. As the diagram below shows, the *anticipated life span* of a building can only be reached, or possibly exceeded, if the building components are well maintained.



The vertical lines in the diagram indicate that a large proportion of construction work is performed during the lifetime of a building, i.e. in the *existing building stock*. According to statistics, the proportion of work in the existing stock is increasing and will make up 70 % of all construction work by 2025.

The aim of the work in existing buildings is to increase the *service life* of technical facilities, components and the building as a whole. The value of invested resources should be sustained for as long as possible and a wasteful use of resources avoided.

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_17

17.1.1 Building operation

Ideally, all building components should reach their target service life. For this to succeed, the visible finishes of an interior space need to be cared for by, for example, replacing in-built furniture, repainting surfaces and exchanging panelling and cladding. Attention must also be paid to the technical facilities with regular maintenance, repair and, when necessary, replacement. A well maintained building has happy occupants, who are more willing to invest time in taking care of their surroundings, no matter whether this is the work place or home. This aspect is fundamental for the *value preservation* of each and every property.

The operation of the technical building services should consume as little energy as possible. Technology has brought about enormous benefits, but it has also given rise to critical environmental problems. In order to slow down and possibly even reverse the man-made damage, the aim should be to develop and maintain sustainable and, ideally, net zero energy-built environments. This can be achieved by using simulation and monitoring tools.

Building performance simulation software allows planners to create a virtual model of the building during the planning processes and *predict* how various aspects of the building will perform in differing situations, for example, the heat demand or the *solar heat gain*. Simulated results of the scheme's final version are then used as benchmarks against which the actual performance of the building can be assessed. In theory, the target and actual values should match. If there are significant differences, the reasons need to be investigated.

17.1.2 Value depreciation and appreciation

The value of a property changes over time. An increase in value from a fixed date, such as the date of construction or purchase, is called the amount of appreciation, while a decrease is the amount of depreciation.

A property value has two main elements. These are the value of the structure and the value of the land on which it is built. They appreciate or depreciate in different ways and need to be considered separately.

Taking the value of the land, this can go up or down, but the tendency is for it to increase. The reason why it is usually an appreciating asset is simple. There is a limited supply of land and no more will be produced. The growing population leads to a greater demand for land and prices increase as a result.

Like most everyday items, built structures have a limited life span. This means that the value of the object tends to decrease as time passes. The date of construction is therefore a key factor when calculating the depreciated value of a property.

The market value of a property at any point in time is the sum of the value of the land, which will have changed due to market forces, and the depreciated value of the building. The location of a property also plays an important role and will influence the selling price.

When buyers invest in an apartment property, they are also buying a proportion of the land where the block is built. The reason why resale flats are often sold at higher prices than the original buying cost is that the appreciation in land value outweighs the depreciation in structure value.

A very simplified example of a depreciation calculation is as follows. It has been assumed that the depreciation is linear over the lifespan of the building, which means that the value decreases at a constant rate. The amount of *annual depreciation* is calculated by dividing the cost of the building by the expected life span.

Example:
If a building that cost €1,500,000 with the land valued at €500,000 was expected to last 50 years, how much would it still be worth after 10 years?

1. Original property price - original land price = original value of building
   €1,500,000 - €500,000 = €1,000,000
2. Original value of building / anticipated life span of building = annual depreciation
   €1,000,000 / 50 years = €20,000
3. Original property price - 10x annual depreciation = value of property after 10 years
   €1,500,000 – 10 x €20,000 = €1,300,000

In this example, the market value of the property after 10 years is €1,300,000. The market value of the land has not been taken into consideration.

The depreciation in the value of the structure may be neutralised if the location is much in demand and there is a *scarcity of land*. Another factor which might impact the value of a property is *obsolescence*. This is a factor which applies to elements that may still be in good working order but have become outdated, like interior fittings and finishes, technical facilities or even the architectural design.

17.1.3 Facility management

Properties, particularly those for commercial use, are becoming increasingly complex and make use of sophisticated technology. As a result, facility managers are frequently commissioned to maintain and manage the facilities. They are expected to understand their client's needs and contribute towards the *bottom line*, i.e. the total profit of a business, not only by reducing *operating costs*, but also by improving *productivity*, the *revenue generating capacity* and the image of the entire business.

A facility manager is usually responsible for the following aspects of a property:

- Cleaning services: daily, periodic, special cleaning
- Support services: *procurement and contract management*, e.g. for repair work
- Property services: space management; building and grounds maintenance; heating, air conditioning, automation, sensors, blinds, movement sensors for lighting; utilities and communications infrastructure
- Security services: health and safety, e.g. fire and smoke detection facilities and alarm systems; security, e.g. locking and unlocking of entrances and exits; clocking systems, burglary systems, *surveillance cameras,* or better known as *CCTV (closed-circuit television)*
- Catering services: *vending machines*

Facilities management professionals, and the membership organisations supporting them nationally and internationally, are good stewards of the earth's limited resources. Whenever possible, they use best practices in sustainability to ensure operations are energy efficient, environmentally sound and promote the wellbeing of occupants. They also help preserve natural resources and limit organisational footprints.

It follows that, in addition to the responsibilities mentioned above, facility managers must keep track of the energy inputs and outputs by monitoring levels and making any necessary adjustments.

17.1.4 International language differences

FM is generally interpreted as facility management in the US, Australia and some other countries. In the UK and across much of Europe the term facilities management, i.e. the plural form, is more common. Both are used across the Global FM website, as content is contributed from many nations. The difference is largely historical and not especially significant. Nevertheless, facility management tends to mean the management of a property (a facility), for example a hospital or office complex, whereas facilities management refers to the various components of a property (e.g. technical facilities) and a broader range of activities.

There are numerous differences in English around the world. Most tend to only be familiar with the American and British English differences. This applies to spelling, in particular, where the Americans tend to be less fussy than the British, opting to drop the u in -our endings, e.g. favor or color instead of favour and colour, or change the complicated ught spelling for a simple ft like in the word draught. There are also vocabulary differences, such as faucet in American English for tap in British English.

When working with partners in other countries, all project participants should also be aware of differences not solely due to the use of language. One example is the use of lakh for 1,00,000 (one hundred thousand) or crore for 1,00,00,000 (ten million) in Indian English to express large numbers. Not only do they use different words, but the separators do not follow the international system. Instead of grouping digits by threes, the rightmost three digits are grouped together and thereafter groups of two digits.

Indian system	Indian system in words	Western system	Western system in words
25,25,25,250	Twenty-five crore, twenty-five lakh, twenty-five thousand, two hundred and fifty	252,525,250	Two hundred and fifty-two million, five hundred and twenty-five thousand, two hundred and fifty

Practise saying and writing the following number:

Indian system	Indian system in words	Western system	Western system in words
		1,234,567,890	

17.1.5 Intercultural competence

Awareness of cultural differences, or in other words intercultural competence, is an essential skill to interact effectively and appropriately in a global market. It is the ability of using knowledge, skills, awareness and attitude to communicate and behave suitably with persons from different countries and backgrounds. Naturally, the differences go beyond pronunciation and vocabulary and cover traditions, social and political relationships, religion and more.

Simply knowing how to address somebody is useful information before the actual meeting takes place. Luckily, there are no problems with the German Du and Sie forms in English. Nevertheless, it can be confusing when a higher-ranked respected person uses first names instead of Mr and Ms in the introductions, which is quite common in English-speaking countries. The use of first names, however, does not mean that the conversation should continue without the same level of respect you would possibly attach to a person you would address with “Sie” in German.

The following diagram expresses the four dimensions of intercultural competence for the successful operation of an international project.

Knowledge Information gathered through experience and education, such as learning a language or understanding the reason and meaning of different traditions.	**Motivation/attitude** The desire to communicate and interact appropriately and effectively with persons from different countries and cultures.
Intercultural competence	
Awareness The quality of being able to reflect on one's own practices and beliefs in contrast and comparison to those of communication partners.	**Skills** The ability to apply knowledge verbally and non-verbally successfully in intercultural situations.

17.2 Upkeep

No matter whether the property is used as an office, a commercial kitchen, an apartment complex or for any other client-based business, there are numerous reasons why the building and all facilities have to be kept clean and well maintained.

One of these reasons is the impression the place makes on others. It takes only seven seconds for an individual to form an initial impression of a new environment, but much longer to change that first opinion, in particular if it was a negative one. Therefore, the first impression is *crucial* if the aim is to finalise a deal or set up a long-term business relationship.

A healthy environment can help to limit the number of *sick days*, as well as counteract *absenteeism*. Stress factors may derive from other human beings or situations, but they could also be caused by the workplace environment. The Sick Building Syndrome is a term coined by the World Health Organization to describe symptoms that are experienced as soon as individuals enter the office building and subside as soon as they leave. The symptoms include health issues, such as headaches, *fatigue*, shortness of breath, etc., which are caused, among other things, by a lack of ventilation, high humidity or mould. It goes without saying that the productivity of workers is also influenced by the quality of the work environment.

17.2.1 Maintenance

Maintenance is the action taken to keep a property in good condition. It is the landlord’s responsibility to ensure that the building is safe and in a reasonable state of cleanliness during the course of the occupation. A lot of maintenance issues are simple and *innocuous*. They develop gradually over time and are very often not noticed until it is almost too late. Cracks in the building's structure or rust on its pipework might not be identified until they develop into bigger issues.

The aim should be to spot the early signs before a problem really arises. This is best performed by creating a checklist to inspect the space inside and out, including all the technical equipment.

The overall aim should be to conserve the original condition for as long as possible and, at regular intervals, undertake renovations to deal with any normal *wear and tear*. Some general advice is:

- repaint the interior walls every 5 years
- repaint the exterior walls every 10 years
- replace the heating system every 15 years
- modernise the kitchen and bathroom approximately every 20 years
- replace the windows and doors approximately every 30 years
- reinsulate the roof and replace the roof tiles after approximately 30 to 50 years

17.2.2 Servicing

Since the operating costs can be reduced by up to 20 per cent through monitoring and servicing equipment regularly, it is always good to enter into a *servicing contract* with a suitable company. The servicing contract is an agreement between the owner and a specialist company to maintain specific items of equipment or systems. It includes checking the piece of equipment at regular intervals and possibly making adjustments or performing minor repair work.

Servicing contracts are quite normal for all technical equipment in a modern building, for example the lifts, the fire protection system, security cameras, heating and cooling systems. As an example, the servicing contract for a heating system includes checking internal components and pipework, cleaning parts, exchanging filters, testing and measuring components and heating performance. Important aims are to reduce the risk of unexpected breakdowns and avoidance of large repair bills due to lack of regular maintenance. *Prevention is better than cure.*

17.2.3 Repairing

Even if technical facilities are serviced regularly, it is unavoidable that repair work will be necessary from time to time. The German proverb "Where wood is chopped, splinters must fall" says exactly that. Buildings subject to heavy use or high *footfall*, like schools, hospitals or railway stations, are particularly exposed to damage and breakages.

In some cases it is necessary to understand who is responsible for fixing and paying for the problem. If damage in rented accommodation is intentional or caused by carelessness, the *tenant* is liable for the cost of repairs. If the damage is caused by natural events, such as storms, floods or earthquakes, or fair wear and tear, the *landlord* is responsible for repairing the damage. It is usual for most of these risks to be covered by a suitable insurance policy and specialist advice should be taken as to the amount and type of cover required. In any case, it is important that the landlord and tenant communicate regularly, in particular if something needs inspecting or repairing.

17.3 End of service life

When a building no longer meets its functional needs, the owner has to make a decision on the property's future. The future in this case tends to be either keep and refurbish or demolish and start again.

In both cases, a *property condition survey* must be made to determine the most appropriate option for the property. The assessment is necessary to *gauge* the extent of work necessary so that the procedures for refurbishment or demolition can be planned in the correct manner and sequence.

A property condition survey should also take the objectives of the project into consideration by comparing the targets established using simulation techniques during the planning stages and the results of the actual performance at the end of the life span. The analysis can be applied to different aspects of the construction or the building as a whole, for example the energy demand or the ageing of surface materials. The *actual vs. target analysis* will point out the deficiencies and help with the decision on the future of the project at hand and other developments.

17.3.1 Demolish or refurbish?

In some cases demolition is the only option. If the building is unstable and needs to be structurally altered to be safe, then demolition and new build is usually the better option. A refurbishment of such a building could be very time consuming and expensive. Sometimes the decision is also based on the energy impact of the building. For some buildings, it is the expense of ongoing maintenance that makes demolition the most logical solution.

If the building is *listed for preservation*, there is no choice but to retain and refurbish the property, irrespective of cost.

Some believe that decisions regarding refurbish or demolish are too heavily influenced by political or financial considerations rather than environmental benefits and sustainability effects. The existing building stock should not be destroyed solely for financial reasons and factors such as appeal. The incentives to encourage *green retrofits* are perhaps in need of review.

17.3.2 Comparing and contrasting

A common way for speakers to organise thoughts is by comparing objects or ideas. The organisation patterns help to create a picture for the listener. The word compare is generally associated with adjectives where we use the three forms of an adjective, for example tall (positive form), taller (comparative form) and the tallest (superlative form), to compare the properties of an object (see Unit 6). However, there are additional phrases which are very useful such as **similar to** or **compared to** for making comparisons and phrases such as **although**, **unlike** or **however** for highlighting contrasts. Noticing and understanding the meaning and function of these words for describing similarities and differences will help you to better understand and organise text.

Read the following text and mark all the words and phrases that describe similarities or differences.

> The Browns' neighbours have commissioned an architect to weigh the options concerning their existing home, which has become too small for their growing family and is in a rather poor condition.

If we demolish your current house, we could build something much bigger and more suited to your needs. It could be fundamentally different to your current home and living there would make a world of difference to your daily routines. There would also be a marked contrast in the energy consumptions, since we would plan for something that makes better use of the natural environment, such as *solar irradiation*. Unlike your current house, this could produce all the power required and be a net zero home.

On the other hand, if we remove the house, we'd lose all of the resources that went into the original building and a *replacement home* would have to be found for the period of construction. If we retain the building as it is, upgrade and extend it, the shape of the refurbished house would clearly *resemble* that of the current building. However, with an extension, there would be a significant increase in floor area. From a cost point of view, the upgrade and extension would be cheaper than *starting again from scratch*.

In addition to the phrases marked in the text, the expressions in the following table are useful for comparing and contrasting. You can practise using these phrases in the exercise 17.4.2.

Similarities	Differences
• alike • identical • similar, similarity • resemble, (little) resemblance between • sth compares favourably with sth	• *as opposed to* • conflicting • *contradict, contradictory, contradiction* • *conversely* • dissimilar • on the contrary • in contrast to • unlike • while, whereas

17.3.3 Refurbishment work

When buildings are new, they tend to be cared for and well maintained. Time flies and, before long, a level of disrepair is reached and a decision has to made as to how much time and money should be invested in the building's future. The choices of how much work can or should be done range from nothing, to as little as possible, just enough to maintain a certain standard to everything necessary for the building to reach a good standard. The decision very often depends on the expected period of future use. A longer period justifies a larger investment. Ideally the *payback period* of the investment should be shorter than the anticipated service life of the refurbished building.

Light touch	**Medium intervention**	**Extensive intervention**	**Comprehensive refurbishment**
only absolutely necessary work is performed; damage is removed	enough time and money to increase the service life to the desired period	sufficient time and money to give the building a new lease of life	no limit to time and money; the building is made as good as new

The degree of intervention and the associated costs, give the planning practice an indication of the time required for planning and completing the work. However, since an existing building is much more likely to present unforeseen problems – you never know what you might find in a ceiling until you actually open it up – the fees tend to be higher than those for a new build. Some practices specialise in retrofitting.

Refurbishment work generally goes through the same phases as those for a new build. Each project begins with a feasibility study, a preliminary and developed design, technical drawings, procurement procedures followed by the actual development and then completion. Whether or not planning permission is required will depend on the nature of the work to be performed.

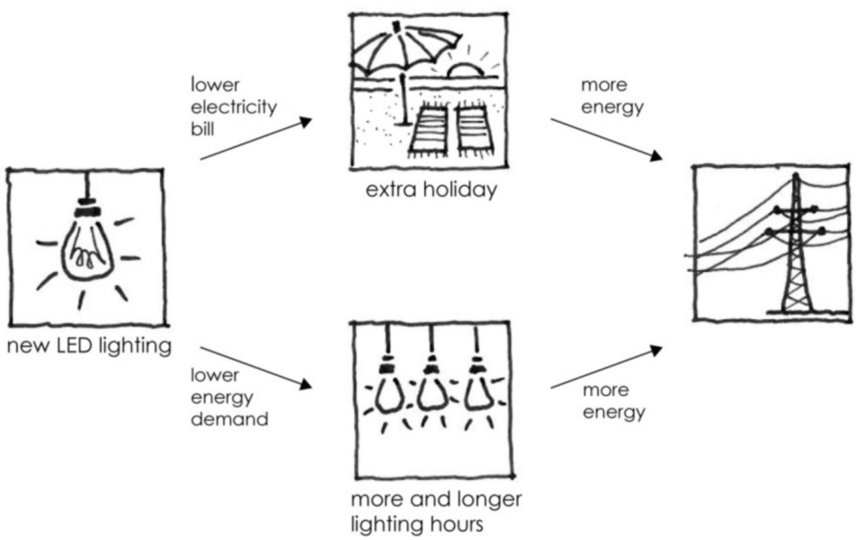
In contrast to a new build, the plans of a refurbishment show the existing and new structures in one plan in different colours. Grey or black is used for existing structures that are to be retained, red is used for new elements and yellow for all the parts that are to be removed.

17.3.4 Rebound effect

Refurbishment work, in particular to the building envelope, should in theory lead to a reduction in the energy demand and associated costs. However, because consumers often use this as a trigger to increase the room temperature or spend the money saved on other goods or services, the overall cost and energy savings can be less than those predicted. This phenomenon is called *rebound effect*.

A very simple scenario is that of a new car. Let us assume that a new car uses less petrol and the driver saves money. Instead of being satisfied with the positive effect for the environment and possibly also the savings account, the car owner drives more often and further and loses the cash and energy benefit of the savings. This is the direct rebound effect. The indirect rebound effect is if the car owner uses the savings to acquire other goods, for example a new computer or services, for example an extra holiday, which require energy and produce emissions. When planning a building or refurbishment, the overall aim should be to minimise the rebound effect as much as possible.

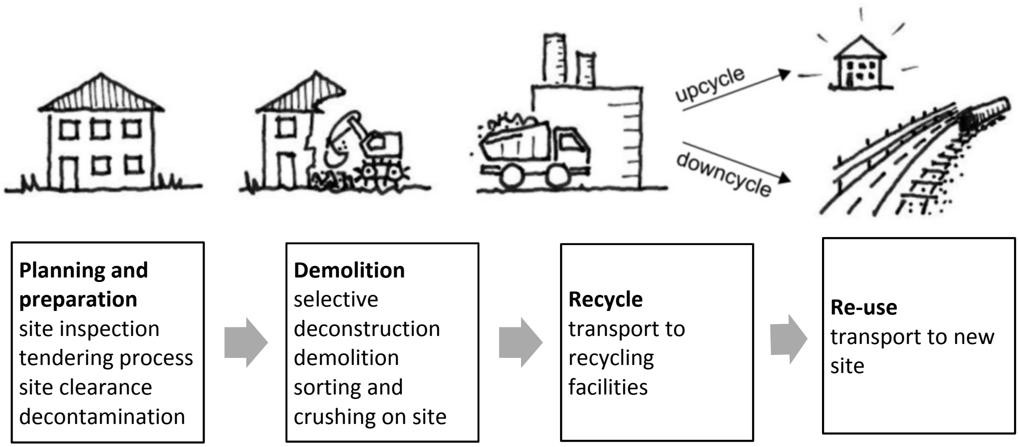
The following illustration shows the phenomenon of saving energy and money by replacing conventional light bulbs with LEDs and a possible rebound effect.



17.4 Demolition

Buildings, roads, bridges and other structures are demolished when they have reached the end of their useful life and are no longer suitable or safe to use. The process involves breaking down, *dismantling* and removing building materials that were put in place to serve a particular purpose over a period of time. The site that becomes available through demolition makes room for new, perhaps larger structures, or is returned to its natural state, possibly with the intention of restoring ecosystems.

Construction and demolition waste (CDW) accounts for roughly 25 to 30% of all waste generated in Europe. Construction waste is *left-over* or *scrap material* produced during the construction of a building. It can amount to as much as 10 to 15% of all the materials going into the new build. Demolition waste is *debris* and *rubble* generated through the destruction of buildings, bridges, roads and other structures. These two types of waste include a variety of materials, such as concrete, bricks, gypsum plasterboard, glass, steel, but also hazardous materials, such as asbestos. Many of the materials can be re-used or recycled and the technology to do so is readily available. The following diagram shows the removal process of a building.



Demolition may seem like the quickest and easiest way to dispose of an unwanted structural object. The clearance of a site creates a new build option, which might deliver a significant increase in *lettable area*, something that a refurbished building could simply not meet. However, demolition should not be used as a method to replace low-cost housing with homes for the better off, which would be a form of *social cleansing*. The aim should be to keep a blend of old and new.

The objective of the EU project BAMB (Buildings as Material Banks), initiated in 2015, is to increase the value of building materials by eliminating construction and demolition waste. Buildings are material banks and the principles of waste hierarchy are: prevent, re-use, recycle. As is the case for other resources, for example glass, the BAMB project is designed to help the building industry move from a *linear* (take, make, dispose) to a *circular economy*.

17.4.1 Demolition methods

There will always be situations where there is no other choice but to remove an existing structure, and there are various ways to achieve this. Generally, they can be divided into methods using explosives and those without. The *implosion technique*, where explosives are fixed to the main supports, causes the building to *collapse* very quickly. Depending on the amount of space available on the site, the explosives are either fixed to make the structure fall like a tree or fall into its own *footprint*.

In the case of non-explosive demolition, different tools and machines are used to remove the building, ranging from handheld hammers, bulldozers, high-reach excavators with hydraulic hammers for taller buildings and cranes with wrecking balls.

17.4.2 Exercise: Demolition

The following text uses a mixture of conjunctions (e.g. however, although), comparative adjectives (e.g. quicker, closer) and phrases (e.g. similar to) to express the difference between removing a building using explosives and machine tools.

Choose the correct expressions to complete the text correctly.

Conjunctions:	unlike, while, even though, however
Comparative adjectives:	much longer, closer, much quicker
Phrases:	strikingly similar, entirely different, polar opposites, a clear disadvantage, wide variation, little resemblance to, find a balance

(1) …………… the Browns' neighbours, who decided to retain their home and build an extension, the old warehouse up the road is being removed to create space for a new residential estate. There have been lengthy discussions concerning the demolition method. (2) …………… the result of implosion and mechanical methods is (3) …………… , the costs and required time are (4) …………… . After removing all the windows, doors, floor coverings and technical installations, the use of explosives would remove the structural framework (5) …………… . (6) …………… , the danger of using explosives in a residential neighbourhood is (7) …………… . The amount of time required when using machine tools is (8) …………… and the residents would have to bear the noise and dust for a (9) …………… time. Due to the (10) …………… of advantages and disadvantages, the owner is trying to (11) …………… : (12) …………… the structures to the rear will be removed using explosives, the elements (13) …………… to the residential neighbourhood will be demolished using machine tools. Once the warehouse has been removed, there will be (14) …………… what the area looked like before.

17.4.3 Confusing words

When learning a foreign language, it is often difficult to differentiate between words, especially if they sound or look similar. Some of these similarities occur between the mother tongue and the foreign language, such as the English word actual and the German word aktuell, or the English word *fabric* and the German word Fabrik. These similar words are called *false friends*. Experience has also shown that German students frequently mix up two English words that sound and look similar, such as then and than, while and whereas, remember and remind or live and life. The following sections look into some of these differences.

then or than
First they solved the equation, (a) …….. they did an experiment.
This experiment is more difficult (b) …….. the one we did yesterday.

then – adverb of time
than – conjunction or preposition used to make a comparison

while or whereas
(a) ……. she was preparing the presentation, her colleagues were updating the homepage.
(b) ……. Toyota has switched to electric cars, VW is still mainly producing fuel-powered cars.
(c) …….. I prefer working at a desktop computer with a full keyboard, my colleague is quite happy working with her laptop.

whereas – a conjunction to link two ideas that can contrast and contradict each other
while – mainly used as a conjunction to introduce a time clause; also used like whereas to link two ideas that contrast, however do not contradict each other

live or life
If you haven't got (a) …….. insurance, you should wear a (b) …….. jacket.
The former CEO, who is no longer (c) …….. , loved watching (d) …….. shows.
If our (e) …….. were longer, we'd (f) …….. more sensibly.

live – a verb (pronounced like sieve) and an adjective often combined with music, an act or show (pronounced like hive)
alive – an adjective
life – a noun (pronounced like wife); in its plural form, lives, it looks like the 3rd person singular present tense form, but is pronounced like wives and not like sieves.

17.5 Re-use and recycling

As mentioned above buildings are like banks, with materials rather than money. The materials should either be left in place or, if removed, invested in a meaningful way. The overall aim is to prevent construction and demolition waste, reduce the consumption of *virgin resources* and move towards a circular economy.

This can be achieved by drawing up *material passports* for the buildings and developing *reversible building designs*. A material passport is a document that describes all of the products and components integrated in a building. When the building is eventually dismantled, which is an easy process due to the reversible design, an overview of all the materials that will become available is already in place. Rather than following the conventional principle *cradle-to-grave*, material passports would allow a *cradle-to-cradle* (C2C) approach. This method ensures that the life span of building materials is extended, materials become part of a *continuous loop* and waste is prevented.

17.5.1 Selective deconstruction

The process of deconstruction is like “unbuilding” the development. It involves taking a building apart piece by piece, essentially reversing the order of its construction. A difference is made between selective deconstruction, which is also referred to as a *soft strip*, and whole-house deconstruction. Selective deconstruction involves going into the property before its demolition and removing high value materials, such as doors, windows, hardwood flooring. The second method goes a step further by taking apart the entire structure for *salvage* purposes. Almost 90 per cent of the materials in homes and buildings can be *reclaimed* for future use, including materials like concrete, reinforcing steel and wiring.

By choosing deconstruction over demolition, *landfills* are not clogged up with construction and demolition waste and the amount of carbon dioxide released when new materials are produced is reduced significantly.

17.5.2 Waste house

There are numerous houses around the world that have been built making use of waste products or, in other words, trash. Some of these are extreme and immediately visible as a recycled home, for example houses made out of thousands of recycled glass or PET bottles cemented or tied together, or homes made of reclaimed shipping containers. There are, however, also conventional homes which cannot be recognised as 100% recycled.

The following text describes a house that has been built in the Brown’s neighbourhood by architect students. The words missing are all related to the re-use of *discarded* materials.

damaged and returned · *offcuts* · sourced on · end up in a landfill · salvaged · recycled re-used · discarded from · leftover · collected · brand new · thrown out by · closing down *harvest* · as good as new

On the outside, rubbery black *shingles* cover the walls of the two-storey building. It turns out these are (1) …………… carpet tiles, 2,000 of them, (2) …………… from a nearby office building and hung with their waterproof underside facing outwards.

Stepping inside, you find a series of rooms. There are white-painted plasterboard walls – (3) …………… paint on (4) …………… sheets of plasterboard that look (5) …………… – and a plain timber staircase.

The structural frame of the house was made by crafting columns and beams from sheets of plywood (6) …………… sites for *hoarding* and concrete shuttering. Cross-braced with more (7) …………… , they are oversized at almost half a metre thick. The frame supports a roof of lightweight clay tiles that were (8) …………… a website for reusable building materials.

The building is pierced by little peephole windows that show what is going on inside the walls. They reveal piles of toothbrushes and stacks of video cases. Since all the video rental shops seemed to be (9) …………… at the time of construction, the DVD cases and VHS tapes were (10) …………… to use as insulation. The 20,000 toothbrushes came from a company that cleans planes after long-haul flights. This vast quantity represents the (11) …………… of just four days, which would otherwise (12) …………… , or the sea, joining the islands of plastic that are *swirling* around our oceans. Upstairs, the peepholes reveal stacks of denim, (13) …………… a local firm that imports jeans from India and slices off the legs to make cut-off shorts.

How these (14) …………… forms of insulation perform will be monitored over the next few years by sensors fitted throughout the house to measure temperature and humidity. The aim is to achieve something close to Passive House standard – aided by triple-glazed windows, the only (15) …………… element in the building, along with the wiring and plumbing.

Source: www.theguardian.com (altered)

17.6 Vocabulary

17.1	completion	Fertigstellung
	to service	warten
	anticipated life span	erwartete Lebensdauer
	partial/full refurbishment	Teil-/Generalsanierung
	depreciation	Wertverlust
	dilapidation	Verfall
	existing building stock	Baubestand
	service life	Lebensdauer
17.1.1	value preservation	Werterhalt
	building performance simulation software	Gebäudeanlagensimulationssoftware
	to predict, prediction	vorhersagen, die Vorhersage
	solar heat gain	solarer Wärmegewinn
17.1.2	value depreciation/appreciation	Wertminderung/-steigerung
	annual depreciation	jährliche Wertverlust
	scarcity of land	Landknappheit
	obsolescence	Veralterung
17.1.3	bottom line	Nettoprofit
	operating costs	Betriebskosten
	productivity	Leistungsfähigkeit
	revenue generating capacity	Umsatzgenerierungspotential
	procurement and contract management	Beschaffungs- und Vertragsmanagement
	surveillance camera	Überwachungskamera
	CCTV, closed circuit television	Fernsehüberwachungsanlage
	vending machine	Verkaufsautomat
17.2	upkeep	Unterhalt
	crucial	entscheidend

	sick day	Krankheitstag
	absenteeism	Ausfallzeit
	fatigue	Ermüdung
17.2.1	innocuous	harmlos
	wear and tear	Verschleiß
17.2.2	servicing contract	Wartungsvertrag
	Prevention is better than cure.	Vorsicht ist besser als Nachsicht.
17.2.3	footfall	Kundenfrequenz
	tenant	Mieter
	landlord	Vermieter
17.3	property condition survey	Objektgutachten
	to gauge	beurteilen
	actual vs. target analysis	Ist-/Sollwert Analyse
17.3.1	listed for preservation	unter Denkmalschutz stehen
	green retrofit	energetische Sanierung
17.3.2	solar irradiation	Sonneneinstrahlung
	replacement home	Übergangswohnung
	to resemble, resemblance	ähneln, Ähnlichkeit
	to start from scratch	von vorne anfangen
	as opposed to	anstatt; im Gegensatz zu
	to contradict, contradiction, contradictory	widersprechen, Widerspruch, widersprüchlich
	conversely	im Gegenzug
17.3.3	payback period	Amortisationsdauer
	intervention	Eingriff
	a new lease of life	wieder in Schuss bringen, Neustart
17.3.4	rebound effect	Abprall-/Rückschlageffekt
17.4	to dismantle	demontieren, auseinandernehmen
	construction and demolition waste (CDW)	Bau- und Abbruchabfälle
	left-over/scrap material	Baurestmasse
	debris, rubble	Bauschutt
	lettable area	vermietbare Fläche
	social cleansing	soziale Säuberung
	linear economy	Wegwerfwirtschaft (Linearwirtschaft)
	circular economy	Kreislaufwirtschaft
17.4.1	implosion technique	Sprengung
	to collapse	in sich zusammenfallen
	footprint	Grundfläche
17.4.3	fabric	Gewebe, Stoff
	false friend	Übersetzungsfalle, falscher Freund
17.5	virgin resources	(neue, jungfräuliche) Rohstoffe

	material passport	Materialpass
	reversible building design	reversible Gebäudeplanung
	cradle-to-cradle (C2C)	von der Wiege zur Wiege (C2C)
	cradle-to-grave	von der Wiege zur Bahre
	continuous loop	Dauerschleife
17.5.1	selective deconstruction	selektiver Rückbau
	(soft) strip, to strip	Entkernung, entkernen
	to salvage, salvation	bergen, retten, Rettung
	to reclaim	wiedergewinnen
	landfill	Mülldeponie
17.5.2	to discard	wegwerfen
	offcut	Reststück
	to harvest, harvest	sammeln, ernten, Ertrag
	shingle	Schindel
	hoarding	Bauzaun
	to swirl	herumschwimmen

18 Education, Registration and More

18.1 Education

All planning professionals, architects, civil and structural engineers, building services engineers, etc. are not only responsible for planning and designing but also for managing the realisation of all planned projects. The word architect is derived from the Greek word "arch" meaning chief and the word "teckton" meaning carpenter or builder. As the name implies, architecture involves more than designing a building. The roots suggest that the architect is a master builder or one might refer to him/her as being the leader of a construction team. It follows that architects, and this also applies to the other planning professionals, require theoretical as well as practical knowledge. This is acquired through a combination of academic education and professional training.

Qualification as a planning professional requires *enrolment* in an academic programme and *practice-based training*. Universities and Universities of Applied Sciences offer a variety of programmes with differing emphases, durations and requirements. In order *to enrol* in courses, the applicant has to have completed *secondary education* to the requisite standard.

The Bologna Agreement, signed in June 1999, introduced the European Higher Education Area (EHEA) aimed at *increasing competitiveness* between European universities and adopting a system with comparable *degrees*. The system comprises three cycles at bachelor's, master's and doctoral levels. Depending on the emphasis of the course, either a Master of Arts (MA or M.A.), Master of Science (MSc or M.Sc.) or a Master of Engineering (MEng or M.Eng.) is awarded on completion. The same titles and abbreviations apply to Bachelor degrees.

A system of academic credits was introduced to make achievements at European universities comparable and facilitate the transfer between universities, including those abroad. The European Credit Transfer System (ECTS) awards *credit points* to students who successfully complete modules, seminars, workshops, examinations, etc. A full-time student can receive a maximum of 60 credits per year. The credits reflect the quantity of work required to achieve the objective. Most university homepages and brochures list modules with the number of credits they are worth. The performance of students is documented by *grades*. Grades range from A (very good) to F, which is a fail.

The website of the European Commission www.ec.europa.eu offers information regarding education and programmes in Europe.

18.1.1 Studying in Germany

In Germany applicants need either Abitur or Fachabitur to enrol at a university. They must apply directly to the university and sometimes their admission, especially in architecture, is subject to passing an *aptitude test*, which is aimed at evaluating their talent and enthusiasm for the profession. Courses in Germany are numerous and differ greatly with regard to the number of semesters and course contents. There is, however, a clear leaning towards the internationally recognised Bachelor/Master courses. The *degree courses* leading to the German title of Diplomingenieur (certified engineer) are gradually being replaced by the internationally recognised bachelor's and master's programmes.

The possibilities currently offered in Germany are:

S. Heidenreich, *Englisch für Architekten und Bauingenieure - English for Architects and Civil Engineers*,
https://doi.org/10.1007/978-3-658-26052-1_18

- Degree courses at universities and universities of applied sciences incorporating 8 to 10 semesters, usually with an integrated practical semester, leading to the German title of Diplomingenieur (certified engineer). The courses at universities of applied sciences tend to be, as the name implies, more practical than those at universities. Degree courses generally consist of a basic and an advanced course. Work experience in a construction-related profession is usually required before and/or during the course. A *thesis* has to be completed in the last semester.
- Bachelor courses incorporate at least 6 semesters. The degree, either Bachelor of Arts (BA) or Bachelor of Science (BSc), enables graduates to start work in the construction industry at a younger age, albeit less qualified than those with a master's degree and not necessarily entitled to the same salary. However, there is always the opportunity to continue with a master's degree course. Sometimes this requires a further *aptitude test* and a minimum period of practical training.
  There are several reasons to opt for a Bachelor course at a university of applied sciences. One of them simply being the type of school-leaving exam, which does not qualify to enter a university, or the grades obtained in the final exams. Some also prefer the smaller classes, the shorter period of study and the more practical approach at universities of applied sciences.
- Master's degree courses require a good bachelor degree and usually one year of practical experience. They tend to run four semesters at the end of which the students compile a thesis. Some master's degree courses are offered as part-time programmes, which enable students to continue their professional career.
  There are many different courses to choose from. Some are oriented towards management, while others lean towards on-site construction business. The compulsory period of work experience – one year or more – is usually sufficient to give postgraduates a clear idea of their strengths and interests and provide guidance as to the most suitable course to follow.
- Doctorate or PhD programmes (Doctor of Philosophy) are interesting for all those who want to stay on at university after completing the master's degree course. These postgraduate programmes give individuals the opportunity to perform independent, self-directed research with the support of supervisors. The knowledge acquired is written up in a thesis.

18.1.2 Studying in the UK

Whereas it is a fairly new approach in Germany to offer students the opportunity to share their time between work and study (Duales Studium), this has always been a fairly common feature of education in the UK. The two routes to become an architect or engineer have for a long time been:

- full-time education and training programme
- practice-based education and training

Full-time education is comparable with the bachelor's and master's degree courses offered in Germany. Universities offer sandwich courses, which include a three-year bachelor's degree course followed by a year of practical training. For those pursuing the master's degree course, studies continue with a two-year postgraduate course, which is then followed by a further year of practical training. The master's degree course concludes with a final examination.

Practice-based education is a combination of practical training in an office and short academic programmes. This method suits those who cannot engage in full-time education and those looking for a more practical approach. The time factor attached to this route can be a disadvantage. On the other hand, the income from the employment compensates for the extended training period. Students selecting this route still have to go through the three phases applicable to full-time students.

Job advertisements often indicate whether a company is looking for a graduate, registered or senior architect or engineer. Job advertisements often refer to Part 1, Part 2 or Part 3 architects or engineers, which means that the stage reached in one's studies is extremely relevant for those seeking new positions.

18.1.3 Exchange programmes

There is more to studying today than just visiting *lectures* and participating in workshops at a local university. International mobility is recognised as an important attribute for a successful career and anything that helps to build international experience can be of enormous value. The facility to interrupt a course for a semester or more can provide an excellent opportunity to travel abroad to gain work experience or to participate in a language course. Both can pay dividends in the later career.

The changes across Europe brought about by the Bologna Agreement, which is aimed at making European higher education programmes more comparable, enable students to interrupt a course and enrol at another University without losing time. The European credit point system (ECTS) allows students to accumulate credits independent of their location.

Exchange programmes encourage the mobility of students worldwide. Programmes such as Erasmus, which stands for European Action Scheme for the Mobility of University Students, was introduced in 1987 to enable students to continue their studies while spending time abroad. For more information see www.erasmus.ac.uk or www.daad.de.

18.2 Finding work

A country's economic situation very often decides how easy and quickly a job may be found. At times, there may be a large range of jobs to choose from; a few months later, the situation may have changed and finding a job can become a very frustrating and time consuming affair. Nevertheless, in both cases, a good demonstration of talent, experience and personality is advantageous, since the art of finding employment is very much about the art of *self-presentation*. Job-seekers need to market themselves effectively. A first step is to carry out a *self-assessment*, which should include an evaluation of qualifications and experience.

It is not easy to plan a career, and few people do, but it pays to think carefully about the type of work and the role one aspires to. The *remuneration package* is also very important, and there may be a balance to strike between short term and longer term interests, e.g. a position offering great career development opportunities but maybe not the best starting salary.

18.2.1 Opportunities

If you do not receive unexpected phone calls offering just the job you are looking for, there are many other ways of going about locating job vacancies. Construction journals, professional press, national and regional newspapers advertise *job vacancies*. These should be answered according to the request either by sending for an *application form*, sending a *CV* or phoning for further detail. The aim here is to get through to the interview stage, which provides applicants with the opportunity to meet the employer and demonstrate suitability for the job in person.

There is also of course the possibility to make a speculative approach to particular architects or firms. The choice may be influenced by a number of factors such as reputation, knowledge of the type of work undertaken and matches with one's own area of expertise. *Word of mouth* recommendations through contacts in the industry are always useful and one should not ignore *recruitment consultants* or approaches from *head-hunters*, who may introduce opportunities which otherwise would not have been considered.

The Internet is also a fruitful source of jobs. There are thousands of sites for job-seekers, and the difficulty lies in finding the right one. The following websites are examples of online career and recruitment services committed to connecting organisations with individuals.

Sites with an architectural background:
www.ribaappointments.com
www.architecturejobs.co.uk
www.careersinconstruction.com

Sites with an engineering background:
www.justengineers.net
www.ice.org.uk
www.nce.co.uk

General job-matching websites:
www.monster.co.uk
www.jobs.theguardian.com
www.fish4jobs.co.uk
www.londonjobs.co.uk

18.2.2 Job advertisement

Take a look at the two following job advertisements and answer the following questions:

1. Which job has been advertised on the Internet?
2. Which companies are seeking to *recruit* an experienced professional?
3. Which advertisement is looking for a graduate in architecture?
4. Which job requires a very dynamic, energetic applicant?
5. Which job requires a good knowledge of steel construction?
6. Which job has to be applied for in writing?

A

Job Title:	Architect (pt3)
Contract:	Permanent
Salary:	£39k
Location:	London
Closing Date:	06 September 2019
Date Posted:	22 April 2019

IDSA
Construction

We are currently seeking a part 3 qualified architect to enhance our team.

The individuals must have qualifications recognised by the RIBA. Knowledge of UK building regulations is preferred as is the ability to "*hit the ground running*".

In return we offer excellent salary for the right candidate.

If you feel you have the skills and experience *to be an asset to* our progressive company and help push the business forward, look no further.

Send CV and selection of A4 illustrations to:

IDSA Construction, 28 Edward Street, London SW5 8GK

B

Structural Engineer (Ref: PKP NT 140015863)	
Recruiter	Technical Services Ltd
Salary:	Negotiable *DOE*
Location:	Northamptonshire
Posted on:	25/03/2019
Description: Technical Support Engineer - Ideal candidate will be either a Chartered Structural Engineer or working towards Chartered status. Must be self-motivated and enthusiastic with proven professional experience in design and /or fabrication of structural steelwork and a good working knowledge of the construction industry. Must have a good understanding of tubular steel sections.	
Interested? Please click the 'apply online' button below.	

C

We require talented and enthusiastic Part I, II and III Architects in our busy office to work on a variety of commercial, educational and residential schemes.

Please apply in writing with your CV and A4 examples of your work to:

David Owen
Duncan Architects
25 Burton Way
Leeds LS8 9YJ

Duncan Architects

18.3 Job application

A job application is a set of documents indicating interest in a particular place of employment or position within a company. An application usually consists of a cover letter, a curriculum vitae and *references* from former placements, which are designed to draw attention to favourable aspects and provide credibility.

Employers may receive hundreds of applications for a single job, so it is vital to make sure that the documents you send create the right impression. The application documents can generally be regarded as the applicant's opportunity to say why he/she is interested in the job and is most suitable for the post advertised. It is a way to impress a prospective employer and stand out as a prospective employee.

18.3.1 Cover letter

When applying for a job, a cover letter should be sent together with the other documents requested, such as the CV and reference letters. It should be written specifically for the position and relate the personal skills and experience of the applicant. It is generally regarded as the first, and possibly best, opportunity to make a good impression.

There are of course many ways to write a cover letter, either in true written form or as an email, and there is a lot of advice on the Internet. The most important aspects are as follows:

Salutation: There are a lot of forms to choose from for the salutation. However, if you know the name and title use "Dear Mr. X". If you do not know the name, use the standard salutation "Dear Sir or Madam". Only use "To whom it may concern" as a last resort.

Body: You should mention the job you are applying to and where you read the advertisement at the beginning of the body. The following paragraphs should then explain why you are a qualified candidate for the position, the experience you have to meet the requirements of the vacancy and why it is specifically this company that you would like to work for.

The final paragraph should mention how you intend to proceed with the application, provide contact information, mention the other documents included in the application and possibly thank the person for their time. The close should match the salutation.

Make sure that the letter is clear and well-structured. Ideally it should be no longer than a single A4 page. Re-read the letter before you send it, and make sure that there are no spelling mistakes. For further advice on letter writing, please also see 12.5.2.

18.3.2 Curriculum Vitae

CV stands for curriculum vitae, which is Latin and means the story of life. Most companies are not actually interested in your life story, but your career history. When companies request a CV, they are usually only interested in facts relevant to the application. Although a CV is, in many ways, a formal document it nevertheless conveys the first impression of the applicant to the potential employer. This first impression can be critical. The CV should therefore be written with care and tailored to suit the needs of the post for which one is applying.

There is a great range of books and websites giving advice on how to write the perfect CV and many offers to perform the task for a small fee. A useful website with a clear layout and good examples is www.tcd.ie/careers. Offering all the advice here would go beyond the scope of this book, however, some aspects need to be mentioned.

There is a significant difference between the style of the more traditional *chronological CV* and a *skills-based CV*. A chronological CV lists education and practical experience according to their occurrence, usually starting with the most recent first and working backwards; the reverse order is also acceptable. A chronological CV underlines the continuity of a career and is suitable if the history is consistent without interruptions. A skills-based CV eliminates the listing of repetitive work details and emphasises skills and abilities, such as accomplishments, organisational skills and strengths. It is a style, which is becoming more common in the UK. Despite being more difficult to write, it is a targeted CV and can be written specifically to answer the demands of an advertisement. It goes without saying that a combination of the two styles is also possible.

Features of a CV

- A CV should be clear and concise, ideally no longer than two A4 pages, especially for job applications in the UK.
- It should be easy to read with an attractive layout. Imagine an employer reading several hundred CVs and separating them into two piles – possible candidate and bin.
- Always send the CV with a cover letter addressed in the formal manner.
- Use the cover letter to include some comments not appropriate for the CV, such as what motivated you to apply, but keep it short and to the point.
- Use the spell-check facility on your computer – there should be no spelling mistakes.
- Use a format and style which best reflects your experience and your skills.
- If you are emailing your CV make sure your email address is business-like. Use a suitable name to save the CV.

18.3.3 Interview

As mentioned above, the offer of an interview is the first hurdle every job-seeker strives to overcome. The interview is then concerned with matching the applicant's skills and experience with the employer's demands.

It may not seem so for graduates, but interviews are two-way affairs and not only the interviewer must decide whether the applicant is suitable, but the interviewee must decide whether he/she wants the post. Both parties should be well-prepared and, even if it is not specifically requested, the job-seeking professional or student should take along some excerpts from recent projects, e.g. plans or photos, to demonstrate acquired skills and experience.

Interview questions
Every interview contains awkward questions. The ability to deal with them depends on experience and competence. Decide which of the answers are more appropriate for these typical questions:

1. Why are you leaving your present post?
   a. I would like to move on and see this post as an opportunity to meet new challenges.
   b. I *was made redundant*.
2. Who is your favourite architect?
   a. I haven't really thought about that question before.
   b. I'm a great admirer of Frank Lloyd Wright, who created functional architecture conform to the setting.
3. What has been your greatest disappointment?
   a. I failed to solve the escape route situation in Building X.
   b. The award-winning design was not realised due to financial difficulties.
4. Where do you see yourself in 10-years' time?
   a. I'd like to take early retirement. So I might be on a beach somewhere.
   b. If the opportunities allow it, I'd like to concentrate on creating master plans and supervise a small group of planners.
5. Do you think you are too young for this post?
   a. I may be young, but I'm motivated and willing to learn.
   b. Has age got anything to do with experience?
6. How would you motivate others?
   a. I'd bribe them and take them out for drinks.
   b. I'd look for special talents and skills and praise them for these capabilities.
7. What salary are you looking for?
   a. I'm looking for something between £22,000 and £25,000.
   b. I'll take what is going.
8. Are you prepared to put in extra hours?
   a. I like to be at home in time to watch the 6 o'clock news.
   b. If deadlines have to be met I will do my utmost to ensure that work is finished on time.

18.3.4 Outcome

Depending on how many candidates are being interviewed, the outcome of the interview may be announced the same day, but seldom later than a week after the meeting. The result of an interview is hopefully a job offer or at least confidence and experience earned for sometimes yet another interview. If the outcome is a job, a written *contract of employment*, setting out the terms and conditions of employment, should be drawn up and signed by both employer and employee. Every employee will be eager to find the following points in writing:

- the job title
- remuneration (salary, bonuses and fringe benefits, such as company car or pensions)
- hours of work and regulations concerning overtime
- holiday entitlement
- the *period of notice* required to terminate the contract.
  The statutory minimum of 4 weeks before month end applies in Germany; the period increases according to the length of employment. In the UK the notice period is also dependent on the length of employment. For an employment lasting between 2 and 5 years, the minimum notice period is two weeks, but a senior architect or engineer would expect longer, probably at least one month.

18.4 Practising as an architect or civil engineer

Years ago, opportunities for employment were more limited than they are today. Architects and civil engineers tended to be employed either in private practices or by the local government. A relatively small number of graduates worked in other areas. For a variety of reasons this is now changing. In part, this is supported by a much broader education, in terms of the range of subjects offered, which opens up new career possibilities. In some occupations, there is opportunity to make use of all skills, in others only one facet of services will be applied.

Apart from the obvious employment positions in local governments, which still employ approximately 10 per cent of all architects and civil engineers, departments in large companies, contractors and manufacturers of building components also employ architects and civil engineers. If the job-seeker has an interest in teaching, there are positions available in the architecture and civil engineering departments at universities. There are also good opportunities in IT, especially regarding the development and application of planning and design software, in *property transaction*, surveying work and many other fields.

Nevertheless, working in a private practice is still the preferred career route for the majority. The opportunities to be creative, to work in a particular field of construction and take on responsibility are greater here than in the public sector. Small to medium-sized practices offer work to more than 50 per cent of all architects and civil engineers, and undoubtedly, working locally in a small unit, usually in friendly and familiar surroundings, is a major attraction.

18.4.1 Types of practice

Planning practices range from small one-person businesses to large practices with several partners and many employees. Approximately 50 per cent of all practices are run by a *sole principal*, who either works entirely alone or employs staff. For some this is an ambition, for others factors such as the economic situation may have influenced scale and structure. Whatever the reason, it can be difficult and demanding bearing the sole responsibility each and every day.

However, many will see substantial benefits in terms of job satisfaction and having greater control over one's own destiny.

In a partnership, the ups and downs of everyday business life are shared in the same way as the *profits and losses*. Partners are *jointly liable* for the actions of the partnership. Indeed, the partners are responsible to the full extent of their *personal wealth* unless the business is run as a *limited liability company*. Partnerships make up approximately 40 per cent of all practices. It is often argued that a larger team brings benefits in terms of flexibility and creativity, and is therefore able to attract more work than those who work alone. Even though partners usually share similar views regarding the general philosophy of the partnership, a written agreement can be helpful in the case of disputes.

A group practice shares features of both, a one-person business and a partnership. The concept is that independent architects and civil engineers associate themselves to *mutual benefit*. They do not share the profits, but access the same staff and office resources. Each group member bears the responsibility for his or her own clients. Nevertheless, the engineers can support one another by helping to even out the *peaks and troughs* of too many and too few *assignments*.

18.4.2 Registration

Successful completion of studies does not automatically grant the right to practise as an architect and use the title. Architect is a *registered profession* and the title is protected. Although in theory, the role of an architect can be carried out by anyone, use of the title is restricted to those registered according to the applicable regulations. Any person who publicly uses the title and is not qualified to do so can be sanctioned or *prosecuted* by the responsible body.

In Germany, applications for registration are made to the Federal Chamber of Architects in the land where the applicant is resident. Applicants must have passed the final examination at a school of architecture and provide proof of two years' experience working as an architect.

In the United Kingdom persons wishing to use the title architect have to apply to the Architects Registration Board (ARB). The website of the Architects Registration Board (ARB) www.arb.org.uk offers information concerning registration. There is also the possibility to contact them directly with any questions.

In the case of civil engineering, different rules apply. In the UK, graduates from universities may practise civil engineering, and the title is not protected. One can become a Chartered Engineer by registering with the ICE (Institution of Civil Engineers).

In Germany, the title is protected and civil engineers must register with an authority or professsional association to practise as a civil engineer.

18.4.3 Practising in the UK

Most German graduates have a very good command of English, which is of course helpful when looking for work in an English-speaking country. So long as there is a demand for architects and civil engineers, which seems to be the case at the time of writing, planning practices are very willing to employ students and graduates from abroad.

In order to actually set up a company and obtain planning permission for construction work, registration is required. As long as the person wishing to work in the UK satisfies the requirements of the European Commission Architects' Directive 85/384/EEC, architects may register with the ARB and practise without any further restrictions.

The website www.deutsche-in-london.net has some success stories of Germans living and working in London. There are also websites offering general advice and support for those wishing to seek work abroad: www.workwide.de or www.careertrotter.de

18.4.4 Self-appraisal

Even if an architect or civil engineer is in long-term employment, he/she should perform a self-appraisal from time to time. Job satisfaction and reward are extremely important and, all too often, an excess of work prevents employees, as well as employers, from reflecting on the current work situation. It is sensible, every now and then, to take time out and ask oneself a few questions. The answers may help to get one's career and performance into perspective and perhaps highlight a need for change.

A self-appraisal could include the following questions:

- Have my responsibilities changed since the last appraisal?
- Are there any changes I would like to make to increase my effectiveness?
- How well do I assess relationships with my colleagues, boss, clients and contractors?
- Are my skills being used to the full, or do I need to acquire new skills, possibly by participating in a further training programme?
- Were my recent assignments interesting and did they provide me with a sense of achievement?
- How well do I meet targets?
- Am I entitled to a pay rise or a bonus?

Changes from every day office life refresh the mind and generate ideas. Employees should therefore be encouraged to take part in professional activities and *continuing professional development (CPD)*. In some chambers and institutes, members are obliged to participate in CPD; in many cases, employers make it a contract condition. The obligations exist to help ensure that qualified professionals maintain their competence to practise and stay up to date.

18.5 Vocabulary

18.1	enrolment	Immatrikulation, Einschreibung
	practice-based training	praxisbezogene Ausbildung
	to enrol in sth	sich immatrikulieren, einschreiben
	secondary education	weiterführende Schule (z.B. Gymnasium)
	to increase competitiveness	Wettbewerbsfähigkeit erhöhen
	degree	akademischer Grad
	credit point	Leistungspunkt
	grade	Note
18.1.1	aptitude test	Eignungstest
	degree course	Studium, Studiengang
	thesis	Abschlussarbeit, Dissertation
18.1.2	postgraduate course	weiterführendes/postgraduales Studium, Aufbaustudium
18.1.3	exchange programme	Austauschprogramm

	lecture	Vorlesung
18.2	self-presentation	Selbstdarstellung
	self-assessment	Selbsteinschätzung
	remuneration package	Gehalt
18.2.1	job vacancy	unbesetzte Stelle
	application form	Anmeldeformular
	CV, Curriculum Vitae	Lebenslauf
	by word of mouth	durch mündliche Mitteilung
	recruitment consultancy	Personalagentur
	head-hunter	Personalbeschaffer, -vermittler
18.2.2	to recruit	(neu) einstellen
	£38k = £38,000.00	38.000,00 engl. Pfund im Jahr
	to hit the ground running	sofort voll einsatzfähig sein, unermüdlich
	to be an asset to sth	eine wichtige Stütze sein
	DOE, depends on experience	erfahrungsabhängig
18.3	reference	Empfehlungsschreiben
18.3.1	cover letter	Anschreiben zum Lebenslauf
18.3.2	chronological CV	chronologischer Lebenslauf
	skills-based CV	stärkenbetonter Lebenslauf
18.3.3	to be made redundant	entlassen werden
18.3.4	contract of employment	Arbeitsvertrag
	notice period	Kündigungsfrist
18.4	property transaction	Immobiliengeschäfte
18.4.1	sole principal	alleiniger Geschäftsführer
	profit and loss	Gewinn und Verlust
	to be jointly liable for sth	gemeinsam haftbar sein
	personal wealth	Privatvermögen
	limited liability company	Gesellschaft mit beschränkter Haftung
	mutual benefit	beiderseitiger Vorteil
	to even out the peaks and troughs	die Höhen und Tiefen ausgleichen
	assignment	Aufgabe, Arbeit
18.4.2	registration	Eintragung (hier in die Architektenliste)
	registered profession	eingetragener Beruf
	to prosecute sb	jmdn. strafrechtlich verfolgen
18.4.4	self-appraisal	Selbsteinschätzung
	continuing professional development (CPD)	berufliche Weiterbildung

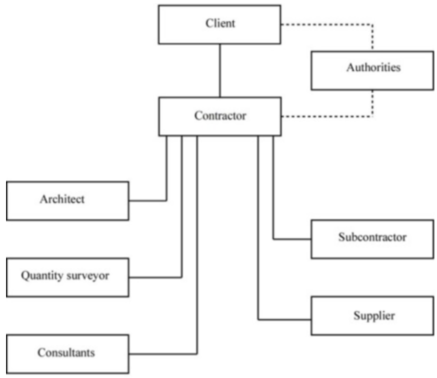
Answer Key

Unit 1

1.2.4 Who is who?

1 structural engineer
2 client
3 quantity surveyor
4 civil engineer
5 clerk of works
6 subcontractor
7 client
8 architect
9 building services engineer

1.3.2 Design and build contract

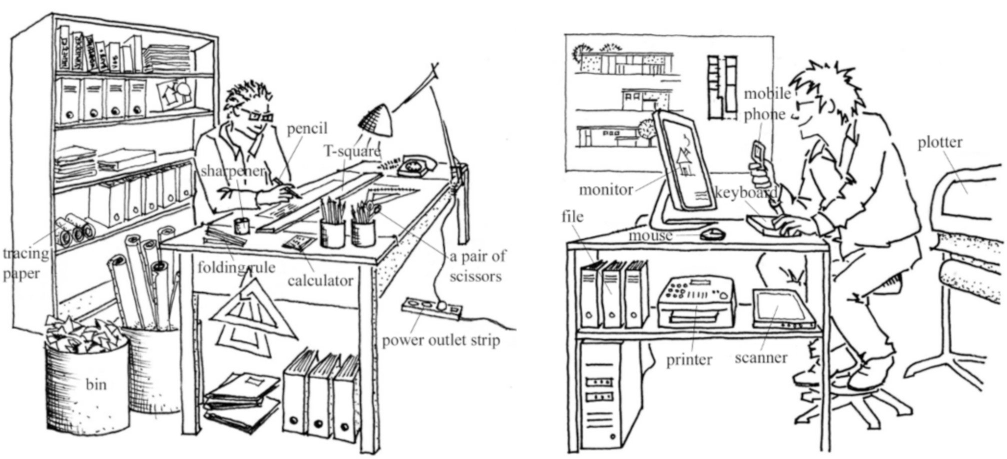


1.4.2 Collocations

Part 1:
1 turnkey development
2 sign a contract
3 professional conduct
4 commission a contractor
5 quantity surveyor
6 thermal insulation
7 disciplinary proceedings
8 estimate the costs

Part 2:
1 thermal insulation
2 quantity surveyor
3 costs of the scheme should be estimated
4 commission a contractor
5 turnkey development
6 contract that is signed
7 professional conduct
8 disciplinary proceedings

1.5.1 Office equipment



1.5.3 Exercise: Simple present versus simple past

designed, managed, spent, invented, appeared, did not become, sit, give, still use

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https://doi.org/10.1007/978-3-658-26052-1

Unit 2

2.1.3 Statistics

1. growth
2. projections
3. rise
4. peak
5. proportions
6. majority
7. fraction
8. marginally
9. rate
10. equivalent
11. per cent
12. share
13. decreasing
14. percentage
15. minority

2.2.1 Fixed factors

1. mountain
2. spring
3. waterfall
4. pool/pond
5. stream
6. bridge
7. lake
8. dam with hydroelectric power plant
9. river
10. riverbed
11. riverbank
12. waterfront
13. upstream
14. downstream
15. estuary
16. seafront
17. sea/ocean

2.4.2 Exercise: Word Order

1. The Buckinghamshire town High Wycombe was hit by industrial decline during the 1980s.
2. The town was left struggling to find a new identity and economy.
3. High Wycombe is fortunate in that its excellent location has allowed it to develop new industries based on logistics and manufacturing.
4. An agency developed a 25-year vision for the renaissance of the town in 2002.
5. The ideas were then examined in community workshops.
6. The vision was refined into a masterplan, and a model was constructed for a public exhibition in the town centre.
7. A development brief has been commissioned based on the masterplan for the public space along the waterfront.
8. The aim of the masterplan is for High Wycombe to become a more attractive place for business, workers, visitors and investment.

Unit 3

3.1.3 Exercise: Questions and answers

1b 2g 3f 4a 5c 6e 7h 8d

3.2.1 Comprehension

1. true
2. false
3. false
4. true
5. true
6. false
7. false
8. true

3.2.4 Writing numbers

1.	31.09.1808	the thirty-first of September eighteen oh eight
2.	12.02.2014	the twelfth of February twenty fourteen
3.	⅞	seven eighths
4.	6,789,101,022	six billion seven hundred and eighty-nine million one hundred and one thousand twenty-two
5.	3.5 m x 6.3 m	three point five by six point three metres
6.	1,023.45 m³	one thousand twenty-three point four five cubic metres
7.	56.3 %	fifty-six point three per cent
8.	0044-812-983210	oh oh double four eight one two nine eight three two one oh
9.	7.5 h (time)	seven and a half hours

10.	7.23 kWh	seven point two three kilo watt hours
11.	47 kN/m^2	forty-seven kilo newton per square metre
12.	$10^3 \times (9 - 6) = 3000$	ten to the power of three multiplied by nine minus six in brackets equals three thousand

3.3.3 Situations

on a slope
spacious, rural
small buildings
narrow roads
in the countryside
friendly, quiet
distant neighbours, peaceful

in town
constricted
commercial, busy
wide roads
narrow plots
close neighbours
urban, dense, noisy
large buildings

3.5.1 Email

site location plan, boundaries, properties, planning permission, restrictions, constraints, water level, soils report, ground consultant, services, site, measurements, photographs

3.5.2 Register

to inform	= to let you know	to contact	= to give him a ring
to receive	= was able to get	to return	= have been back to
to present	= it clearly shows	to arise	= questions have cropped up
to arrange	= to set up		

Unit 4

4.2.1 Saving energy

1e 2i 3h 4f 5b 6a 7j 8d 9g 10c

4.5.2 Exercise: Future tenses

will end, is planning, will have to be insulated, will have to install, is going to change, will be, will be generated, are encouraging, will probably become, are planned, are signing, will only be

Unit 5

5.1.2 Needs and worries

Client's needs	**Architect's worries**
We'd like an office integrated in the main living area.	Does the office need a separate entrance?
We'd like a cellar for technical equipment and storage facilities.	A cellar makes the building very expensive. Is the site big enough to offer the necessary space on the ground floor?
We'll need four bedrooms on the first floor.	Should all bedrooms have an *en-suite bathroom*?
There has to be a terrace for dining in the summer.	Does the kitchen have to be linked to the terrace?
We'll be needing a guest bedroom.	Would it be possible to locate the guest bedroom on the ground floor?
I'd like l*oft* space for storage.	A loft assumes a *gable roof*. Could storage space be located somewhere else? Could the roof also have a different shape?

5.2.3 Exercise: Telephoning

George Brown: George Brown.
Tim Smith: Hello, George. It's Tim.
George Brown: Hello, Tim. Nice to hear from you. What can I do for you?
Tim Smith: I'm just phoning to let you know that I've spoken to Jo White and he'd be interested to do the structural planning for your house.
George Brown: Oh, that's good news. Should I arrange a meeting with him?
Tim Smith: Yes, definitely, but there's no rush at the moment. I'd like you to take a look at some sketches first and confirm the brief. And once I have got some preliminary drawings prepared, we could all sit down together.
George Brown: That sounds good. So how about our meeting then? How does Thursday late afternoon suit you?
Tim Smith: Thursday would be fine. Shall we say 5 o'clock? Would you like to come round to the office?
George Brown: Yes that suits me fine. I'll be round at 5.
Tim Smith: Excellent, I look forward to seeing you. Goodbye George.
George Brown: Goodbye.

5.3.4 Lexis: Building costs

1b 2f 3h 4c 5g 6d 7a 8e

Unit 6

6.1 Presentation form

1c 2i 3g 4a 5h 6b 7e 8d 9f

6.2.2 Word families

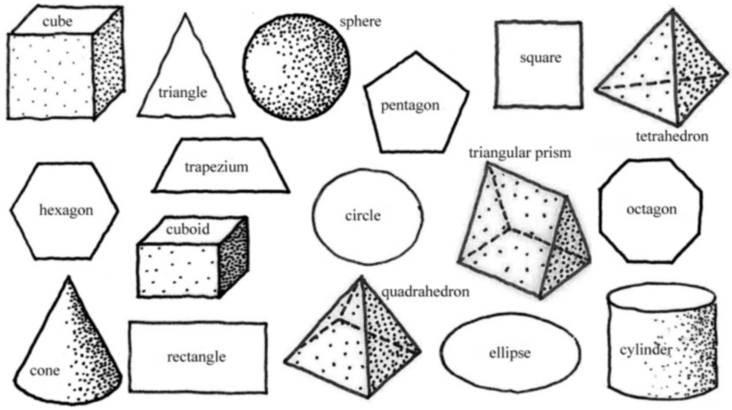
adjective	verb	noun	others
high	heighten	height	
long	lengthen	length	
short	shorten	shortness	shortage
wide	widen	width	
large	enlarge	enlargement	largeness
broad	broaden	breadth	broadness
deep	deepen	depth	deepness
weak	weaken	weakness	
strong	strenghten	strength	
thick	thicken	thickness	

Gap exercise: 1. length; 2. weaken; 3. enlarged; 4. width, depth, height; 5. shortage; 6. widened; 7. shorten; 8. strength

6.3.1 Exercise: Comparisons

the tallest, the most distinct, the largest, the highest, the tallest, taller, the highest, the lowest, the most ancient, as tall as, more famous

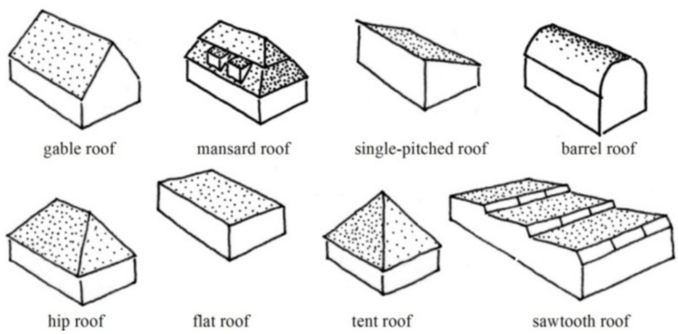
6.4.1 Standard shapes



6.4.2 Descriptive terms

1. obtuse, acute, right; 2. radius, diameter, circumference; 3. perimeter; 4. flat, curved; 5. solid, hollow

6.5.1 Roof shapes

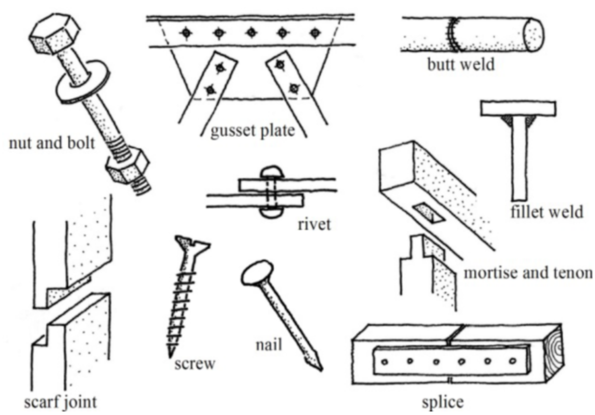


6.7.1 Stair layout

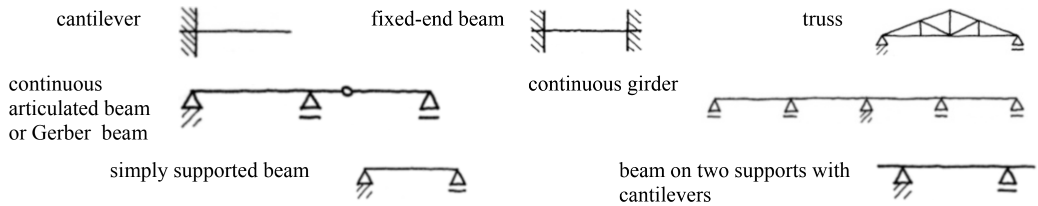
1g 2h 3i 4b 5f 6d 7e 8c 9a

Unit 7

7.1.3 Exercise: Connectors



7.3.1 Beams



7.4.1 Lexis: Statics

A	B	C
in	equilibrium	The active external forces are balanced with the internal forces.
live	load	Load imparted by the external environment and intended occupancy or use.
dead	load	Load generated by the weight of the structural member being considered.
stresses	and strains	Related terms defining the intensity of internal reactive forces caused by external forces.
bending	moment	The result of internal forces caused by external loads.
shearing	force	A force acting parallel to a plane.
uniformly	distributed load	A load imposed evenly on a load-bearing member.
bearing	capacity	The load-bearing properties of the ground.
column	buckling	Bending of a vertical member due to a compressive load.
reinforced	concrete	Concrete with steel mesh or bars embedded in order to increase the tensile strength.

Unit 8

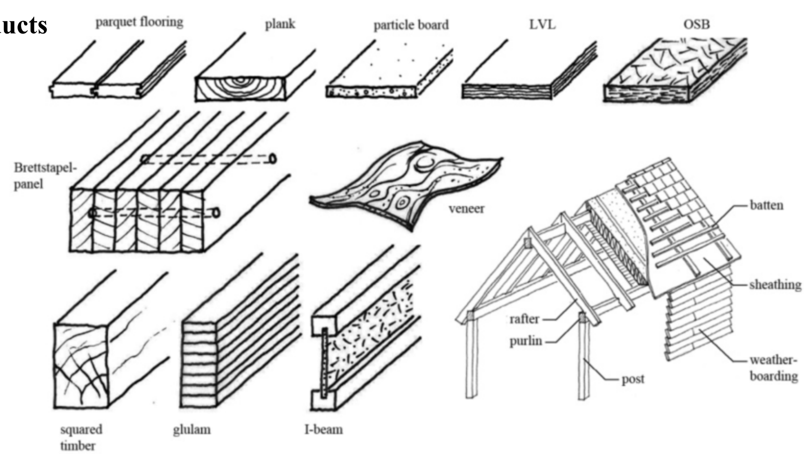
8.1.1 Material properties

1. airtight, luftdicht; 2. load-bearing, tragend; 3. brittle, brüchig; 4. malleable, formbar; 5. opaque, opak, lichtundurchlässig; 6. monolithic, monolithisch; 7. rigid, biegesteif, starr; 8. sustainable, nachhaltig; 9. combustible, brennbar; 10 durable, langlebig

8.3.1 Steel members

1j 2a 3k 4b 5g 6i 7f 8h 9d 10c 11c

8.4.2 Timber products



8.6.1 Exercise: Wall configurations

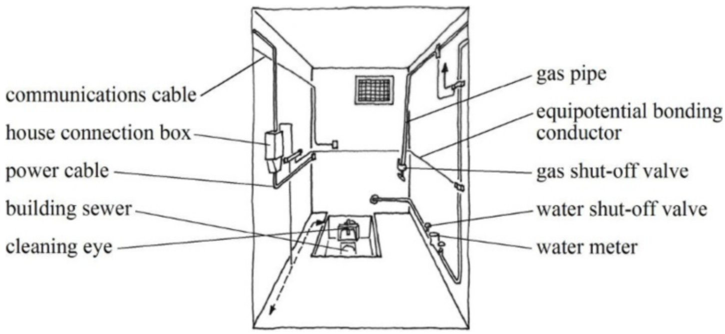
From left to right (from outside to inside)

Reinforced concrete wall with thermal insulation composite system: 12 mm silicate render, 200 mm EPS insulation, 200 mm reinforced concrete, 10 mm plaster finish, triple glazing in aluminium frame

Closed timber wall system with exterior cladding: 24 mm weatherboarding, insect mesh, 30 x 60 mm batten/cavity, 16 mm wood fibreboard, 241 mm I-beam, cellulose insulation, 18 mm OSB panel, insulated services void, 12.5 mm gypsum fibreboard

Unit 9

9.1.1 Service-entrance room



9.2.1 Drinking water supply

1g 2d 3h 4j 5a 6b 7i 8c 9e 10f

9.3.4 Solar energy

1h 2b 3e 4g 5d 6a 7i 8f 9c

9.4 Ventilation

1 fresh air 2 supply air 3 outlet air 4 exhaust air 5 recirculated air

9.4.2 HVAC systems

1. by-pass
2. supply air blower
3. chiller unit
4. mixing chamber
5. mist eliminator
6. air filter
7. air preheater
8. hygrostat

9.5.2 Electrical layout

1i 2j 3c 4a 5f 6d 7e 8b 9g 10h

9.6.2 Comprehension

1. false
2. true
3. false
4. true
5. false
6. true
7 . true
8 . true
9. false

9.6.3 Business skill: Phrasal verbs

1. hang on
2. make do
3. taken on
4. draw up
5. work out
6. put together
7. keep to
8. add up
9. bring down
10. set up
11. look forward
12. come up with

Unit 10

10.1.1 Informing the design team

An appropriate subject line could be: Brown, alteration

1. to inform you
2. to postpone
3. as soon as possible
4. to confirm
5. to enclose
6. to be on a tight schedule
7. the alterations
8. to be taken with an idea

10.1.3 Meetings

on, on, out, into, on, on, up, down, down, off, out, up, up, without

rely	= to count on sb	tolerate	= to put up with sth/sb
finish	= to run out of sth	relax	= to calm down
solve	= to sort out sth	not require	= to do without sth
investigate	= to look into sth	arrange	= to fix up sth
wait	= to hold on	continue	= to move on
employ	= to take on sb	cancel	= to call off sth
raise	= to put up sth	reduce	= to cut down on sth

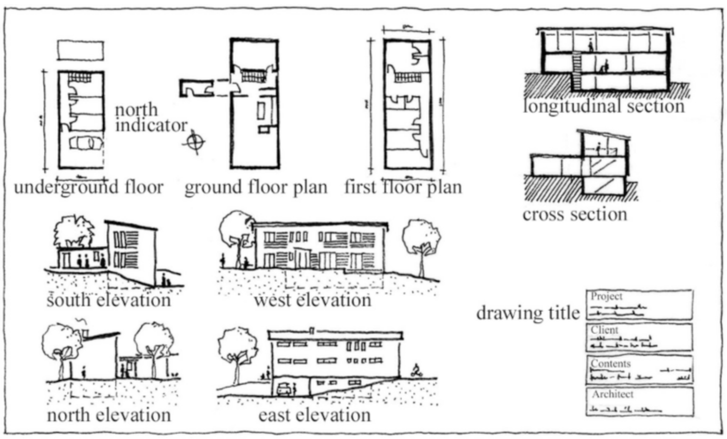
10.2.1 Visuals

5	organigram	38	sketch	56	diagram	60	pie chart
141	table	147	flow chart	160	drawing	191	bar chart

10.2.2 Explaining visuals

1c, 2a, 3d, 4g, 5e, 6b, 7h, 8f

10.2.3 Plans



10.3 Presentation language

1. a simple and clear structure
2. a smart and professional appearance
3. a good sense of humour
4. good eye contact
5. an enthusiastic attitude
6. a strong voice
7. expressive body language
8. careful preparation

10.3.2 Presentation

1. Good morning everybody,
2. It's nice to be here with you again today...
3. Let's begin at the main entrance....
4. If you take a look at the cross section ....
5. We'll now move onto the elevations.....
6. So, I've completed the little tour of the house ....
7. Well, I hope the proposal meets ....
8. So, what about our utility room ....
9. Ah, yes. I thought you might ask. The ...

10.4 Exercise: Conditional sentences

1f 2g 3h 4c 5a 6b 7e 8d

Unit 11

11.2.1 Exercise: Permitted development?

1. UK: The porch exceeds the permissible total area of 3 m² and is closer than the requested 2 m distance to the road.
   Germany: Habitable extensions may not be built without planning permission.
2. UK: No problem, as long as it is at least 1 m away from the boundary.
   Germany: No problem.
3. UK: No problem as the added volume will be less than 10 per cent of the total floor area.
   Germany: Planning application is necessary.
4. Different regulations apply to all extensions in conservation areas.
5. Walls up to 2 m do not require planning permission.
6. UK: If garages are positioned more than 5 m away from the main building, they are considered to be a shed. Sheds must be positioned at least 1 m away from the site boundary.
   Germany: Garages may be built anywhere so long as they do not exceed an average height of 3 m and a total length on the boundary of 9 m.
7. No problem
8. UK: Extensions may not be any higher than 4 m. This extension will also exceed the 15 per cent rule regarding the volume of the extension in relation to the original building.
   Germany: Habitable extensions may not be built without planning permission.

11.2.3 Idioms

a.	to have the same opinion	(4) to be on the same wavelength
b.	to fall flat; to be a total failure	(8) to go down like a lead balloon
c.	to take a different approach, possibly not shared by others	(7) to go out on a limb
d.	to hope that plans will be successful	(15) to keep fingers crossed
e.	to be certain it will happen	(16) to be in the bag
f.	to start building work	(17) to cut the first sod
g.	to make a compromise (2x)	(5) give and take, (11) to meet halfway
h.	to do everything right to achieve the result	(14) to be on the right track
i.	to be familiar with the process	(13) to know the ropes
j.	to make a great effort to achieve sth.	(3) to pull out all the stops
k.	to avoid becoming overwhelmed by (work-related) problems	(2) to keep one’s head above the water
l.	movement backwards and forwards	(10) to-ing and fro-ing
m.	something of the past	(12) water under the bridge
n.	to be in agreement	(6) to see eye to eye
o.	to be very busy	(1) be up to your eyes in work
p.	to want sth very much	(9) to set one’s heart on sth

11.3.4 Lexis: Fire safety

1b 2g 3h 4i 5c 6a 7j 8e 9f 10d

Unit 12

12.2.3 Exercise: Dimensions

2.51 m 2.88^5 m 7.24 m² 1.01 m 1.26 m 4.26 m 3.25 m 14.95 m² 88^5 63^5 240 80

12.3.3 Lexis: Tendering

1f 2j 3h 4g 5b 6i 7c 8e 9a 10d

12.4.2 Exercise: Active versus passive

are made up, is made, is plastered, is not rendered, is placed, enclose, consists, are required, are embedded, are left open

12.5.3 Exercise: Business letter

Tim Smith & Partners
6 Willow Road
Chorleywood
Herts WD4 3RS

Pepper Road
Great Missenden
Bucks HP6 2BP

5th April 2016

~~Hi~~Dear Tim~~!~~,

~~I received your letter with~~Thank you for your very informative letter and the list of contractors. Your selection looks fine to me/I generally approve of your selection. Some of the names ring a bell/are familiar, but most companies are unknown to me.

A friend of mine has used Company X on your list and had great difficulties with the quality of workmanship and meeting deadlines; therefore I would like to take them off/remove them from the list. I have added two further companies: Company Y, for whom my brother-in-law works and Company Z, who built our current neighbour's house.

If you have no objections to these changes, I suggest you ~~go ahead and we get this tendering business sorted out~~proceed and complete the tendering phase as soon as possible. Please don't ~~ask any more questions~~hesitate to contact me if you have any questions.

~~Cheers,~~ Best regards

George

Encl.: Altered ~~L~~list of contractors

Unit 13

13.3.2 Exercise: Comparison of tendered prices

the most favourable, the lowest, the highest, higher, lower, as high as, more labour-intensive, more expensive, the most reasonable

13.4.2 Exercise: More diplomatic?

1. Unfortunately, your tender price is not quite in line with our estimate.
2. I'm afraid the unit price for a square metre of raised flooring is higher than we had expected.
3. Might it be possible to downgrade the quality of plumbing fixtures?
4. To be honest, it looks like we might have to remove the solar panels.
5. Could you please send us an updated schedule as soon as possible?
6. At the moment, we are unable to guarantee we'll meet the deadline.
7. Unfortunately, this is our last offer.

13.4.4 Comprehension

1. false	3. true	5. false	7. true
2. false	4. false	6. true	8. true

13.5.4 Lexis: Contracts

A	B	C
contract	award	decision on which company will be performing the work
risk	distribution	responsibility for dangers is shared between contract partners
terms and	conditions	all agreements making up the contents of a contract

A	B	C
breach	of contract	contract termination due to failure of performing contractual obligations
tender	report	a document put together by the architect enabling the client to award a company with a contract
contract	parties	companies or individuals signing an agreement
payment	method	agreement concerning the details of remuneration
turnkey	project	a service including everything, from the design to the pictures on the wall
comparative	analysis	overview of prices offered by tenderers as a basis for comparison

Unit 14

14.1.3 Exercise: Present Perfect

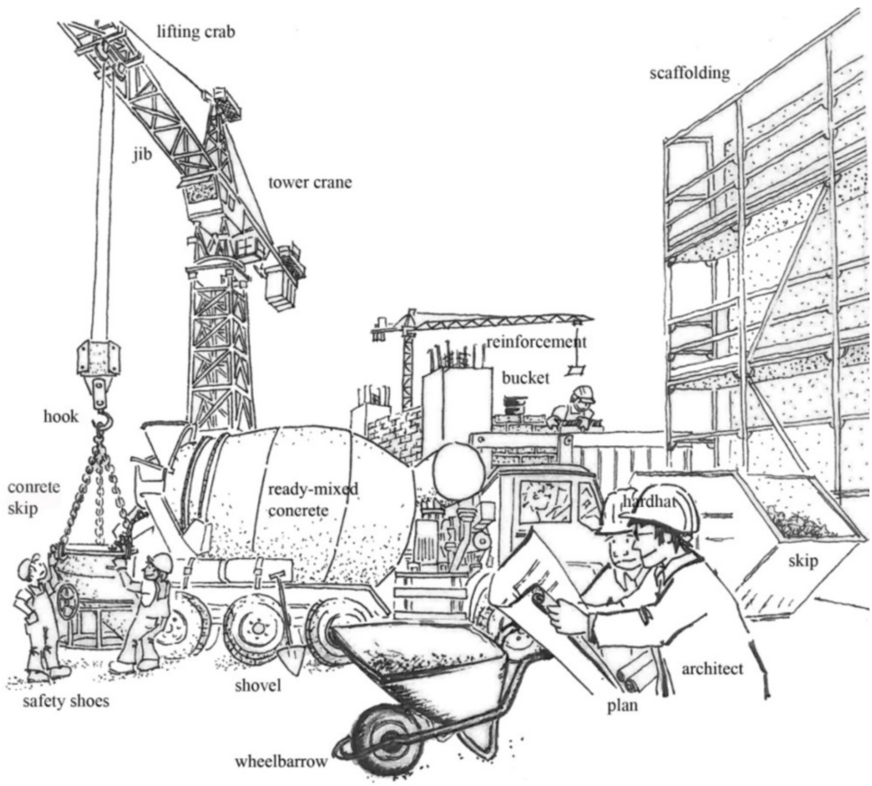
has been working, since, have been, have discussed, (have) prepared, For, have been working, was awarded, signed, has not yet commenced, has been scheduled, has been very involved, took part, made

14.2.2 Exercise: Time terms

on schedule, period, just in time, took time, postponed, made up for lost time, date, deadline, to waste time, spell of good weather, to meet deadlines, interrupt, delay, behind schedule, updated

14.3.3 Exercise: Prepositions of time: in, for, by, on, from, to, for, by/on, by

14.4.1 Construction site



14.4.3 Exercise: Prepositions of place

1. at, 2. around, 3. into, 4. below, 5. in, 6. on, 7. against, 8. next to, on, 9. from, 10. above

Unit 15

15.1.2 Who does what?

1. mason	3. carpenter	5. plasterer	7. blacksmith
2. joiner	4. tiler	6. roof plumber	8. steelfixer

15.2.2 Dos and don’ts

True: 2f 4e 5a 7b False: 1d 3g 6h 8c

15.3.3 Exercise: Cause and effect

brought about, Due to, As a result of, Since, led to, is attributable to, Owing to, did not give rise to

Unit 16

16.2.1 Extension of time

Most appropriate subject line: Request for extension of time

16.2.2 Collocations

1. Please don’t forget to **attach** the photos **to** your reply to this email.
2. We’ll have to **make** a decision on the cost matters this Friday.
3. The contractor cannot **meet** the deadline because the tiler **disrupted** the workflow.
4. May I **draw** your attention to the following issue?
5. We need to gather some more **information** on facility managers.
6. Please confirm the delivery **in** writing.
7. The client is **postponing** the meeting with the landscape architect due to the **heavy** rain.
8. They’ll have to **reissue** the plans if they want to **avoid/prevent** confusion.

16.3.4 Exercise: Remedial work

Maintenance: 3, 6, 7
Remedial work: 1, 4, 5, 8
Remedial work or maintenance, depending on the cause: 2
Outstanding work: 9

16.4.4 Lexis: Payments

1c 2h 3j 4f 5a 6d 7i 8e 9b 10g

Unit 17

17.1.4 International language differences

Indian system	Indian system in words	Western system	Western system in words
1,23,45,67,890	One hundred twenty-three crore, forty-five lakh, sixty-seven thousand, eight hundred ninety	1,234,567,890	One billion, two hundred and thirty-four million, five hundred and sixty-seven thousand, eight hundred and ninety

17.3.2 Comparing and contrasting

Similarities	Differences	
• to clearly resemble	• to weigh the options	• unlike
	• much bigger and more suitable	• on the other hand
	• to be fundamentally different	• however
	• to make a world of difference	• to be a clear distinction
	• to be a marked contrast in	• to be cheaper
	• to make better use of	

17.4.2 Exercise: Demolition

1. Unlike
2. Even though
3. strikingly similar
4. polar opposites
5. much quicker
6. However
7. a clear disadvantage
8. entirely different
9. much longer
10. wide variation
11. find a balance
12. while
13. closer
14. little resemblance to

17.4.3 Confusing words

Then or than: (a) then, (b) than; while or whereas: (a) while, (b) whereas, (c) while; live or life: (a) life, (b) life, (c) alive, (d) live, (e) lives, (f) live

17.5.2 Waste house

1. reused
2. salvaged
3. leftover
4. damaged and returned
5. as good as new
6. discarded from
7. offcuts
8. sourced on
9. closing down
10. collected
11. harvest
12. end up in a landfill
13. thrown out by
14. recycled
15. brand new

Unit 18

18.2.2 Job advertisement

1. B 2. B 3. A/C 4. A 5. B 6. C

18.3.3 Interview questions

1a 2b 3b 4b 5a 6b 7a 8b

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Vocabulary English–German

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https://doi.org/10.1007/978-3-658-26052-1

deferment of possession Verzögerung der Übergabe durch den Auftragnehmer **216**
deflection Durchbiegung **88**
deforestation Abholzung **105**
deformation Verformung **86, 89**
degree akademischer Grad **245**
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https://doi.org/10.1007/978-3-658-26052-1

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