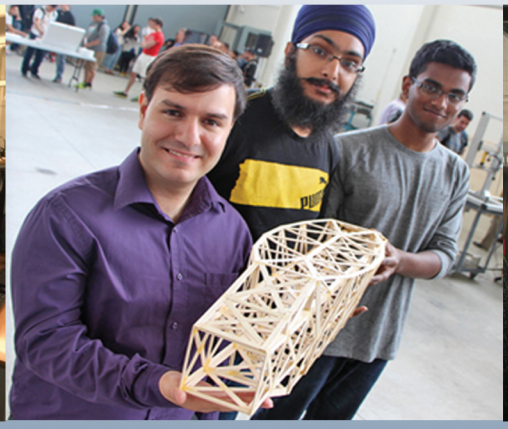
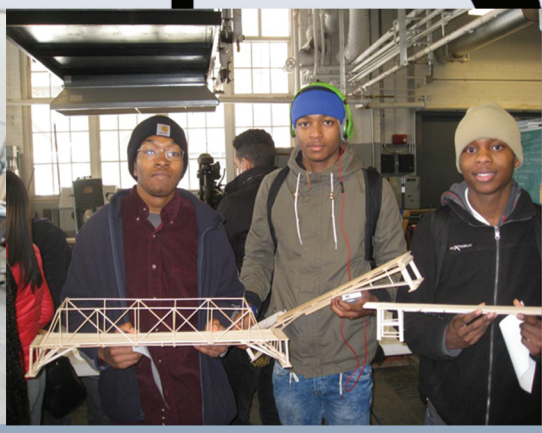
BRIDGING BORDERS

English for Students of Civil Engineering
Strokovni angleški jezik za študente gradbeništva

SABINA MULEJ

University of Maribor Press

Univerza v Mariboru

Faculty of Civil Engineering,
Transportation Engineering
and Architecture

BRIDGING BORDERS

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Bridging Borders

English for Students of Civil Engineering

SABINA MULEJ

Abstract Students of civil engineering are aware that the knowledge of English is absolutely necessary in the modern world. They want to communicate with people from all over the world and use literature in English, both at their study and work. Present materials want to lead students toward these goals and are meant for 30 lectures in one semester.

Keywords: • civil engineering • technical vocabulary • exercises • text comprehension • grammar •

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INTRODUCTION

Discuss the following questions with your neighbour

1. What secondary school did you graduate from?
2. What were your school-leaving exam subjects?
3. Which were your favourite subjects? Why?
4. What do you expect from your civil engineering studies? A degree? Some more free time before you take up a serious job? Opportunity?

1 Civil engineering studies

Watch the video (Newcastle University, 2014, June 17) **and answer the question**

1. Name some tasks of civil engineers.
2. What does the course include?
3. Talk about the role of civil engineering in society.

Listen to the video again and insert the missing words!

1. We are a very big school, so we can deliver much on geotechnical engineering, s_____ engineering, e_____ engineering, w_____ resources, t_____.
2. We try to bring everything together from a h _____ perspective.
3. We are university with a strong r_____ base.
4. The students are being exposed to e_____ in the field.
5. A lot of our staff is i_____ renowned for the work in their area.
6. We want our graduates to be able to come up with d_____ solutions which are holistic, and which are sustainable.
7. The Newcastle civil engineering d_____ programmes are built around an ambition for us to train the next generation civil engineers.
8. S_____ to us doesn't just mean green, we are also trying to factoring economic variables and s_____ factors.
9. A_____ need to realize it's a tough course.
10. M_____ and physics are commonly seen for civil engineering applications, but g _____, geology, chemistry, biology, even music, even sport science – all these s_____ can offer different perspectives, different backgrounds of understanding of problem solving, problem a_____.

The following extracts have been borrowed from City University London.First read them, then find words from the text which are described by the definitions below ("Civil Engineering (BEng)," 2019).

2 Course Content

City's BEng (Hons) Civil Engineering course provides a strong technical background in the key subjects of structural, geotechnical and hydraulic engineering. Management studies and design are also integral parts of the course. Design projects develop your ability to apply technical knowledge in a creative way to open-ended problems. Specialist subjects such as surveying, transportation, environmental and building engineering are also studied.

Course Structure

YEAR ONE

In year one, you will study fundamental engineering principles in topics such as structural mechanics, hydraulics, materials and mathematics. You will also study geology and develop basic skills in surveying, IT, computing and graphics. The course will introduce you to the civil engineering design process and civil engineering in practice.

YEAR TWO

Fundamental principles learned in Year one are then applied to the analysis and design of steel and concrete structures, the prediction of the mechanical behaviour of soil and the mechanics of fluids. You will learn more about managing construction projects and surveying and undertake design projects that include the outline design of real-life industry projects.

YEAR THREE

The BEng (Hons) Civil Engineering course becomes more applied in the third year, with the analysis and design of typical geotechnical and hydraulic structures, numerical analysis techniques used in structural design and construction law, contracts and economics.

You will undertake a challenging individual project and work on an intensive design module featuring real-life projects. You will also take two elective modules.

A series of lessons = _____

The activity of learning about the subject at university = _____

Gained information about a topic = _____

An area of knowledge that is studied = _____

A general or scientific law that explains how something happens or works = _____

Ability to do something = _____

Action as opposed to theory = _____

The process of examination and interpretation = _____

A task set as an educational exercise, requiring students to do their own research and present the results = _____

Put to practical use = _____

A part of a university course (e.g. Civil engineering structures) = _____

Chosen subject = _____

Useful vocabulary

The Bologna Process was launched in 1999 by the Ministers of Education and university leaders of 29 countries and aims to create a European Higher Education Area. It improves transparency between higher education system and recognition of degrees and academic qualifications, mobility, and exchanges between institutions.

Three cycle degree system comprises undergraduate (**Bachelor**) and graduate degrees (**Master** and **PhD**).

A credit system is a systematic way of describing an educational programme by attaching credits to its components.

ECTS (European credit transfer and accumulation system) is based on the principle that 60 credits measure the workload of a full-time study programme during one academic year.

The academic year is divided into **autumn term** and **summer term (semesters).**

Visit our English faculty pages to learn

- The name of our faculty
- Its historical background
- Programmes and courses

Homework

Prepare a short oral presentation with the title **Our Faculty**

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UNIT 1: ENGINEERING

Modern life has become easier as a result of work of engineers; almost everything has been made by engineers: vehicles, buildings, household gadgets, central heating … **Engineering** is about the design and production of useful products and services.

An engineer is someone who is trained or professionally engaged in a branch of engineering. Engineers use scientific knowledge, technology, and creativity to solve practical problems. People who work as engineers normally have an academic degree or equivalent work experience in one of the engineering disciplines.

While **scientists** explore nature in order to discover general principles, engineers apply established principles drawn from science and develop economical solutions to technical problems. The work of engineers is the link between perceived social needs and commercial applications. Engineers consider many factors when developing a new product. In comparison with scientists, engineers are not free to select a problem; problems must be solved as they arrive and their solution must be optimal regarding money, time and safety. Engineering is optimizing, so an engineer's job is to secure a maximum output with a minimum input. A good engineering product is a result of efficient methods, devices, personnel organization and social responsibility.

So, where does the word engineer come from? The word is derived from Latin *ingeniare* which means contrive, devise (iznajti, izumiti) and *ingenium* = cleverness and it literally means to 'make things happen'.

Engineering is the practical application of scientific knowledge, putting scientific knowledge to practical use. Early branches of engineering were based on observation and experience rather than science. Since no formal education was provided, engineers learned their skills through on-the-job training or trial and error.

Civil engineering is the design, construction and maintenance of buildings and public works such as roads, bridges, water, sewer and energy systems as well as public facilities like ports, railways and airports. Civil engineering is the second-oldest branch of engineering after military engineering, and was defined to distinguish non-military engineering from military engineering.

Civil engineers are responsible for the safety and quality of the infrastructure of modern society. They must not only consider the latest principles of science and related technical fields, but recognize aesthetic and social aspects, and have good command in the arts of communication and finance in order to handle resources of the world. Furthermore, they are responsible for the management and protection of natural sources and the optimization of these sources for the benefits of people.

Civil engineering careers comprise the planning, analysis, design and construction of facilities for public and private sectors.

Sub-disciplines of civil engineering include geotechnical engineering, surveying, foundation engineering, structural engineering, transportation engineering, municipal or urban engineering, sanitary or infrastructural engineering, water resources engineering, environmental engineering, hydraulic engineering, materials engineering, and construction engineering.

Geotechnical engineers deal with all aspects of earth and its effect on construction works. This involves the fields of soil mechanics, rock mechanics, foundation engineering, and earthwork engineering. For example, they analyse, design and construct earth dams, tunnels, foundations and canals. They also control and eliminate groundwater contamination and hazardous waste.

Surveyors measure the Earth's surface to obtain information for locating and designing engineering projects. They also use satellite surveying and computer processing of photographic images.

Structural engineers determine the structural design and perform structural analysis of buildings, bridges, towers, tunnels, off shore structures such as oil and gas fields in the sea, dams, power plants, and other structures. Their work involves identifying the loads that act upon a structure and the forces and deformation resulting from loads, such as its own weight, wind load and earthquake effects, the appropriate material and the possible structure type.

Transport engineers are concerned with moving people and goods efficiently and safely. This includes specifying, designing, constructing, and maintaining transportation infrastructure (road and rail networks, canals, airports, and ports), traffic management and logistics. They need to understand the economic, political, and social factors connected with their projects.

Sanitary and environmental engineers work to provide a safe supply of drinking water and to prevent and control pollution of air, soil and water. They focus on water resource management, comprising the design of water treatment and wastewater treatment plants. They also deal with the management of toxic and hazardous wastes.

Hydraulic engineers deal with all aspects of water control: collection, storage, transport, regulation, measurement and usage. They work to prevent floods, develop irrigation projects, manage and train rivers, predict water runoff and help to design hydroelectric power systems.

Construction engineers use both technical and management skills to build public works and commercial projects. They implement construction methods, equipment, and principles of planning, organizing, financing, managing, and operating construction enterprises in their work (Kasíková, Horká, Nivenová in Sedláková, 2007).

Answer the questions

1. What is the role of engineers in the society?
2. What is the difference between an engineer and a scientist?
3. How did engineers learn before the formal education was available?
4. Is civil engineering an old branch of engineering? Give the explanation of its name and support your answer.
5. Name some outcomes of civil engineers' work.
6. How is civil engineering sub-divided?
7. Which fields does geotechnical engineering include?
8. Discuss the importance of surveying.
9. What is structural engineering about?
10. What does transportation engineering involve?
11. Discuss the importance of sanitary and environmental engineering.
12. Compare hydraulic engineering to construction engineering.

1 Civil engineering jobs

Watch the video and insert the missing words (Go Jobs, 2008, June 19)**.**

Civil engineers design roads, _____, tunnels, dams and airports. They combine knowledge of material science, engineering, economics, physics, geology and hydraulics to create a physical infrastructure, essential to modern _____. Naturally, there are numerous subspecialties: surveying and mapping engineers identify the best sites for construction, hydraulic and irrigation engineers _____ on dams, flood control, wells and reservoirs. Environmental engineers deal with waste _____ products, garbage disposal and recycling plants. And traffic engineers specialize in designing people moving system: be they underground subways, commuter railroads or new or improved _____ and highways. A Bachelor's degree is the minimum _____ requirement. At some universities this is a five-year programme, but co-op, junior college and night school _____ are also available. Becoming a civil engineer is a lot of

_____. But if you like the idea of being a part of big, complex projects that improve people's lives, it could be just a _____ for you.

2 Branches of engineering

First watch the video (Study Bucket, 2013, March 1)**. Then match the type of engineering with its description** (Županek, 2014):

Mechanical engineering	1 _____	a. and metallurgical engineering is concerned with extracting metal ores from the earth.
Civil engineering	2 _____	b. deals with the production, storage and transport of petroleum.
Electrical engineering	3 _____	c. determines the most economical ways of using people, machines and materials in an industrial organization.
Chemical engineering	4 _____	d. deals with the prevention of air, water, soil, and noise pollution.
Nuclear engineering	5 _____	e. deals with permanent structures for civilian use.
Aerospace engineering	6 _____	f. involves the design, production and maintenance of aircraft.
Petroleum engineering	7 _____	g. deals with development, production, and testing electrical and electronic devices and equipment.
Mining engineering	8 _____	h. is concerned with the design, operation and testing all kinds of machines.
Environmental engineering	9 _____	i. deals with processing of chemicals for industrial and consumer uses.
Industrial engineering	10 _____	j. is concerned with production and application of nuclear energy.

3 Working as an engineer

Read the text and form the correct words

An engineer is someone who is trained or professionally engaged in a branch of _____ (engineer). Engineers use creativity, technology and scientific _____ (know) to solve practical problems. People who work as engineers normally have an _____ (academy) degree or equivalent work experience in one of the engineering disciplines.

Engineers and scientists _____ (be) often confused in the minds of the general public. While scientists explore nature in order to discover general principles, engineers apply established principles drawn from science in order to develop economical _____ (solve) to technical problems. The work of engineers is the link between perceived social needs and commercial _____ (apply). Engineers consider many factors when developing a new _____ (produce). For example, in developing an industrial robot, engineers precisely specify the functional _____ (require); design and test the robot's components; integrate the components to produce the final design; and _____ (evaluation) the design's overall effectiveness, cost, reliability, and safety. This process applies to the _____ (develop) of many different products, such as chemicals, computers, engines, aircraft, and toys.

Many engineers work in testing, production, or _____ (maintain). These engineers supervise production in factories, determine the causes of component _____ (fail), and test manufactured products to maintain quality. They also estimate the time and cost to complete projects. Some move into engineering _____ (manage) or into sales. In sales, an engineering background enables them to discuss technical aspects and assist in product planning, installation, and use. Supervisory engineers are _____ (responsibility) for major components or entire projects.

Engineers use computers _____ (extensive) to produce and analyse designs; to simulate and test how a machine, structure, or system operates; and to generate specifications for parts. Many engineers also use computers to monitor product quality and control process _____ (efficient).

Useful vocabulary

In relation to **engineering**, the following words have to be referred to (Brkan, 2009):

Technology is scientific knowledge applied for practical purposes in different areas, e.g. solving problems, inventing useful tools. It can also refer to the collection of such tools, including machinery, modifications, arrangements and procedures, for example space technology.

Technique is a skill of doing some engineering or scientific work and also the method, procedure or way something is done (a teaching/management/skating technique).

Technician is a person whose job or training involves a specific technical process or someone skilled or trained in a specific art or craft.

Professional is a person who performs a job that requires special training, education or skill in a specified professional activity.

Expert is someone who has advanced knowledge or skill in a particular area, someone who is very skillful or has advanced training and knowledge in a particular area or field.

Match the terms on the left with their definitions. Terms may be used more than once

Engineering	someone who knows a lot about a particular subject
Technology	someone who works with and mends scientific equipment
	skills in scientific, artistic or sporting activity
Technique	work involved in construction of engines and machinery
	methods, systems, tools used for practical purposes
Technician	someone who is a member of a profession
	use of scientific knowledge for practical purposes
Expert	activity of designing the way the roads are built
Professional	someone who is very good in painting

Fill in the gaps using the words *technique, technology, engineering, technician, expert* and *technical*

1. The train is delayed due to a _____ fault.
2. He went to the Music Academy to improve his _____.
3. He is involved in the design and _____ of space vehicles.
4. _____ is changing fast.
5. She works as a laboratory _____.
6. In this office you will get _____ advice on how to reduce material losses.
7. Only graduates with degrees in _____ are admitted to this course.

8. They should be allowed to wait for cheaper _____ to be developed.
9. Whether he was a great artist or not, Dali was a superb _____.
10. He is an _____ in electronic engineering.
11. He is a footballer with brilliant _____.
12. The factory uses the very latest _____.
13. He handed in a _____ report on the maintenance of equipment.
14. Our team of _____ will be on hand to offer help and advice.
15. Tests were performed using a new _____.

Pair work

Discuss the necessary knowledge and skills of a civil engineer.

Homework

Prepare a short oral presentation with the title **Competent Civil Engineer**.

4 Present tenses

Present Simple (I study)

Time indicators: every day/month/year, sometimes, never, always, generally… **(used for repeated actions, general truths)**

Present Continuous (I am studying)

Time indicators: now, at the moment, this week, this month… ***(used for continuous actions [trajajoča dejanja] and for actions happening during a limited period of time))***

Present Perfect Simple (I have studied)

Time indicators: ever, never, yet, not yet, up to now, already, so far, since, for, recently… ***(used for past actions with some importance or consequence now)***

Complete the sentences using present tenses.

Civil engineering _____ (be) arguably the oldest engineering discipline. It _____ (deal) with the built environment which _____ (encompass) much of what _____ (define) modern civilization. Civil engineers often _____ (specialize) in one of a number of technical areas.

Three former civil engineers _____ (serve) as presidents of United States: George Washington, surveyor, Herbert Hoover, structural engineer and geologist, and James Carter, civil engineer.

Since the explosion, the building _____ (not get) heat, hot water, or cooking gas for three weeks.

I can see three labourers on the building site. The first one _____ (dig) trenches, while the other two _____ (prepare) the excavation pit.

Mechanical engineering _____ (derive) its breadth from the need to design and manufacture everything from small individual parts and devices to large systems. The scope of this discipline _____ (allow) students a variety of career options.

John _____ just _____ (come) from the lectures. He _____ (study) for the maths exam at the moment.

Waiter! What is this?

It's bean soup.

I don't care what it _____ (be) I want to know what it is now.

5 Expressing future

Time indicators: tomorrow, next week/month/year, when I am 30…

'Will' future (I will study)

used for spontaneous decisions, weather forecast, age…

I can't solve this equation. – I'll help you. / It will be cloudy and cold tomorrow.

He'll be 25 in July.

Present Continuous (I'm studying)

used to express future time when we have already decided to do something and arranged it

When are you sitting for the maths exam? / Are you coming to the party on Monday? - No, I can't. I'm doing my presentation on Monday.

'Going to' (I'm going to study)

used to express intended future; we have already decided to do something

I'm going to study more for the next exam.

Put the verb in the correct form to express future time.

1. The results from the tests _____ (not be) available before next year.
2. We _____ (digitize) the pictures so that we can upload them to our website.
3. Scientists_____ (discover) new planets in the future.
4. On these pages, you _____ (find) examples on diversity of engineering.
5. In 2020, challenges _____ (abound), but opportunities also _____ (exist) if engineering _____ (take) the initiative to prepare for the future.
6. Engineering _____ only _____ (contribute) to success if it _____ (be) able to continue to adapt to new trends.

If you _____ (venture) just seven miles off the British coast to a place called Red Sands, you _____ (encounter) an unusual sight – giant towers rising from the ocean on rusted legs (a relic of Britain's military past: the Maunsell Forts).

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UNIT 2: MATHEMATICS

Jurij Vega (1754 – 1802)

Foto: Jurij Vega
("Jurij Vega," n.d.)

Baron **Jurij Bartolomej Vega** ("Jurij Vega," n.d.) was a Slovene mathematician famous for publishing books of logarithm tables. His major work was *Thesaurus Logarithmorim Completus* (*Treasury of all Logarithms*) that was first published 1794 in Leipzig. In 1798 he set a world record as he calculated π (*pi)* to 140 decimal places. The importance of Vega's logarithmic tables was in the times without computers and even without (scientific) calculators enormous even for simple computations. The essential formulae were $\boldsymbol{log(x \cdot y) = log(x) + log(y)}$ and $\boldsymbol{log(x^r) = r \cdot log(x)}$. His tables with 10 decimal places were among others used by the German mathematician Carl Friedrich Gauss.

Although Vega also worked in other subjects (ballistics, physics, astronomy), his major contributions are those to the mathematics of the second half of the 18th century.

What is the importance of Vega's work?

What is practical application of logarithms?

1 Numbers

CARDINAL NUMBERS - USED FOR COUNTING

1 one
12 twelve
21 twenty-one
100 one hundred
101 one hundred and one ...
1000 one thousand
1,000,000 one million
1,000,000,000 one milliard (UK) one billion (US)

Also there are a number of ways you can say 0 in English.

	When we use it	For example
0 = oh	after a decimal point	9.02 = "Nine point oh two."
	in bus or room numbers	Room 101 = "Room one oh one." Bus 602 = "Bus six oh two."
	in phone numbers	9130472 = "Nine one three oh four seven two."
	in years	1906 = "Nineteen oh six."
0 = nought	before a decimal point	0.06 = "Nought point oh six."
0 = zero	in temperature	-10°C = "10 degrees below zero."
	US English for the number	0 = "Zero"
0 = nil	in football	Chelsea 2 Manchester United 0 = "Chelsea two Manchester United nil."
0 = love	in tennis	30 - 0 = "Thirty love."

Table 1: Names for the number 0

ORDINAL NUMBERS - USED FOR RANKING

1st the first
2nd the second
3rd the third
4th the fourth
27th the twenty-seventh
100th the hundredth
101st the hundred and first
1000th the thousandth

FRACTIONS

Vulgar fractions	Decimal fractions
$\frac{1}{2}$ one half	0.5 nought (zero) point five (point five)
$\frac{1}{3}$ one third	2.04 two point oh four
$\frac{2}{5}$ two fifths	62.3 sixty-two point three
$\frac{1}{4}$ one quarter	10.356 ten point three five six

2 Basic processes of arithmetic

25 + 14 = 39 addition (+) ____ plus/and _____ equals/is _____

36 – 4 = 32 subtraction (−) __ minus/subtracted by/take away ___ equals/is _____

25 · 3 = 75 multiplication (·) ____ times/multiplied by _____ equals/is _____

12 : 3 = 4 division (:) ____ divided by _____ equals/is _____

Useful vocabulary

$\frac{9}{13}$	nine thirteenths or nine over thirteen
28 %	twenty-eight per cent
4^2	four squared
7^3	seven cubed
8^4	eight to the power of four
$\sqrt{3}$	square root of three
$x = \sqrt[n]{a}$	x equals the nth root of a
$a^2 + b^2$	a squared plus b squared
$(a + b)^2$	square of a plus b
(…)	brackets
<	is less than
≥	is greater than or equal
∞	infinity
$f(x)$	Function f of (argument) x
$\frac{dy}{dx}$	the derivative of *y* with respect to *x* (odvod)
$\int_a^b f(x)\,dx$	Definite integral of function (integrand) $f(x)$ on the domain $[a, b]$
32 °C	thirty-two degrees Celsius/centigrade
$10\ m\ x\ 10\ m = 120\ m^2$	ten metres by twelve metres (120 square meters)
$F = m \cdot a$	Equation (enačba) (Newton's second law)
1,623,457	one million, six hundred and twenty-three thousand, four hundred and fifty-seven
kN	kilo Newton
m A / mA	meter Amper / mili Amper
km/h	kilometres per hour

Table 2: Basic words from mathematics

Name the four basic processes of arithmetic and write equations in words.

- _____ $9 + 6 = 15$ _____
- _____ $10 - 3 = 7$ _____
- _____ $3 \cdot 6 = 18$ _____
- _____ $18 : 2 = 9$ _____

- $\frac{3}{8}$ _____
- $x = \sqrt[n]{a}$ _____
- $f\ (x)$ _____
- $2^4 = 4^2$ _____

Try this numbers quiz.

a) Name the first four **odd numbers** (liha števila).

_____ _____ _____ _____

b) Name the first four **even numbers** (soda števila).

_____ _____ _____ _____

c) Name the first four **prime numbers** (praštevila).

_____ _____ _____ _____

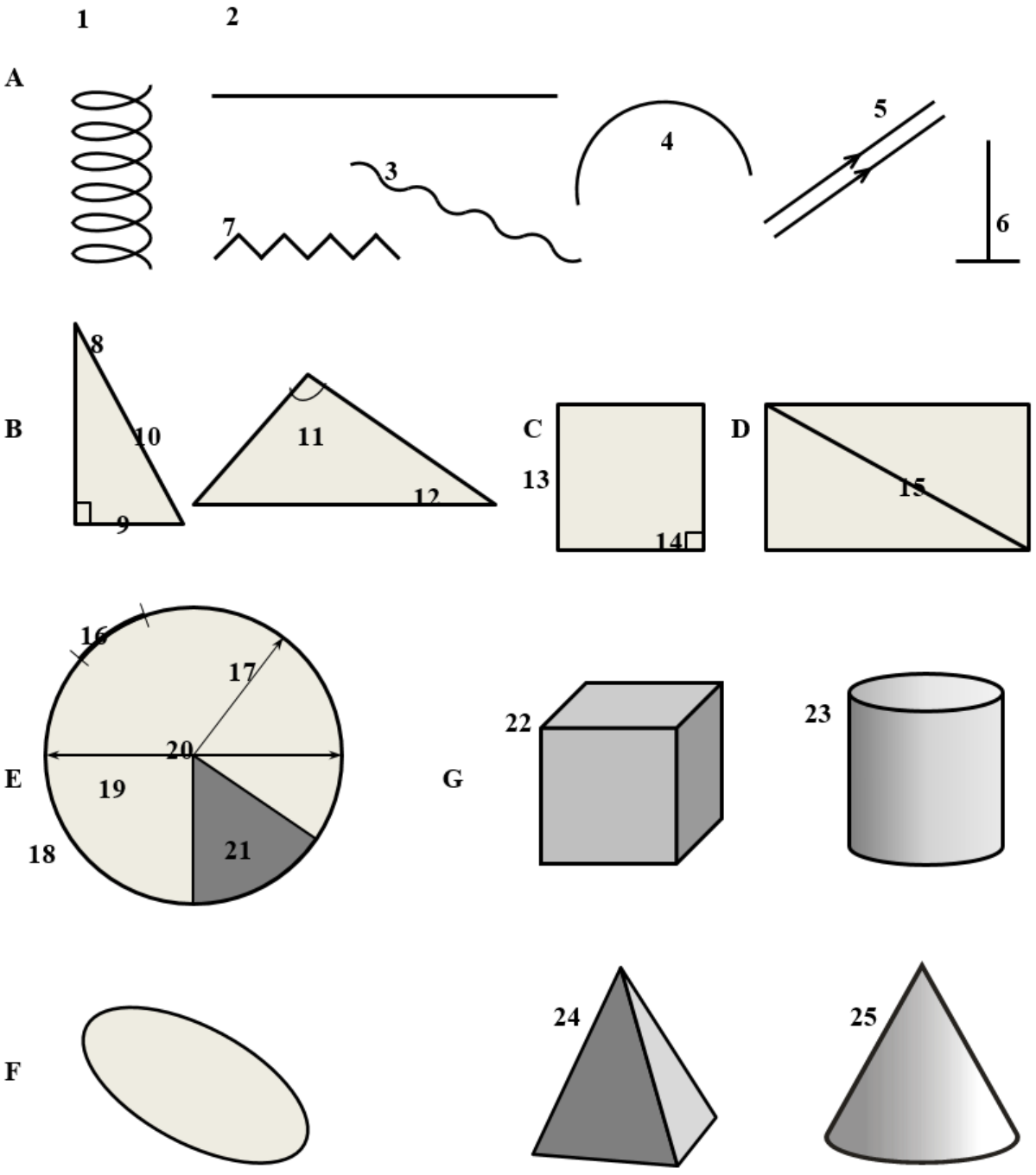
d) Give an example of a fraction where numerator (števec) and denominator (imenovalec) are both integers (cela števila).

_____

e) How do you read this formula and what does it represent: $E = mc^2$?

_____

3 Shapes



A. 1D - Lines 1 spiral 2 straight line 3 wavy line 4 (semi-circle) curve 5 parallel lines 6 perpendicular line 7 zig-zag	**B – E. 2D - Shapes** **B. Triangles** 8 apex 9 base 10 hypotenuse 11 obtuse angle 12 acute angle **C. Square** 13 side 14 right angle	**D. Rectangle** 15 diagonal **E. Circle** 16 arc 17 radius 18 circumference 19 diameter 20 centre 21 sector	**F. Oval/Ellipse** **G. 3D - Bodies** 22 cube 23 cylinder 24 pyramid 25 cone

Figure 1: Shapes (Županek, 2014).

Draw the following shapes.

1. A rectangle with diagonal lines (joining opposite angles).

2. A square and an oval in the middle of it.

3. A block (upright rectangular prism) of 3 cm by 1.5 cm by 1 cm.

4. A right-angled triangle with two equal sides of 2 cm in length. Draw a small circle at the centre of the triangle. Draw lines from the centre of the circle to each of the angles of the triangle.

Homework

Read the text Inventions and Discoveries and prepare short oral presentation of the theme **The most important inventors and inventions**

4 Inventions and discoveries (Županek, 2014)

According to Cambridge dictionary, an invention is "something that has never been made before, or the process of creating something that has never been made before". An invention may be a new machine, device or product. People who invent things are inventors. An invention is something originated by experiment. Many inventions have substantially improved the quality of human life (wheel, steam engine, computer, printing press).

What is the most important invention of the last 2,000 years and why?

According to hundreds of scientists, writers, philosophers and artists, the clear winner is the Gutenberg's printing press. "It was a device to rip off the Bible-reading public," said writer and columnist John Dvorak. But, said IBM researcher Clifford Pickard, we owe a big debt to Ts'ai Lun, who in 105 AD invented paper. He, or the Chinese peasant he stole the idea from, made it from mashed-up wasps nests and rags. Long before the internet, these wonderful sheets of paper allowed thought to be preserved and sent around the world. One might have expected that to have been followed by the internet, penicillin, the internal combustion engine and such like, but it was not.

Television got only two votes: "The single most powerful manipulative tool ever invented," said flautist Viviana Guzman. The contraceptive pill had several backers as the most important invention of them all. "It did more than just change the social role of women," said Oxford physiologist Professor Colin Blakemore. "It led to the conception that our bodies are the servants of our minds, rather than vice-versa."

Several suggested modern medical procedures, but J. O'Donnell of Pennsylvania named simpler inventions that might have saved many more lives than anaesthetics or surgery, such as adequate plumbing and soap. Someone even suggested the national flag, which binds us together and sends us to war.

Answer the questions.

a) What is an invention?

b) How do you comment the printing press being the most important invention?

c) What Is TV really the most powerful manipulative tool ever invented? Why (not)?

d) Why is plumbing an important invention?

e) What Decide which of the invention from the **webpage** (Wolchover, 2016, March 3) you find the most important and support your answer.

Useful vocabulary

Invention, discovery, breakthrough, ground-breaking, state-of-art.

Mind the difference between the first two words: while **invention** always denotes something completely new, **discovery** is something seen or learnt for the first time (but it has been there before, e.g. America, a planet). A discovery may be described as a **breakthrough.** People may say it is **ground-breaking** or that it breaks new ground. **State-of-art** is something very modern and makes the use of the very latest technology (Županek, 2014).

Example: In the 1940s, Griffin made the ground-breaking discovery that bats use radar navigation.

5 Past tenses

Past Simple (I studied)

Time indicators: last night/ week/ month, yesterday, in 1900, a few days ago… **(used for finished past actions)**

Past Continuous (I was studying)

Time indicators: at the same time last year, yesterday between 6 and 8… ***(used for continuous past actions)***

Past Perfect (I had studied)

Time indicator: after ***(for something that happened before another action or situation in the past; it denotes the 'earlier' past action)***

Fill in the blanks using the verbs in the correct form of past simple tense.

A Silly Experiment (Županek, 2014)

On July 2 1982, Larry Walters, a 33-year-old truck driver, _____ (fill) 45 weather balloons with helium and _____ (tie) them to an aluminium garden chair. Then he _____ (put on) a parachute and _____ (climb) into the chair with lots of supplies. He _____ (plan) to fly across the desert. The chair _____ (be) attached to the bumper of a friend's car with two ropes. But when his friend _____ (cut) one of the ropes, the other rope _____ (snap) too. Larry _____ (shoot) up into the sky at 300 metres per second. It _____ (be) so fast that his glasses _____ (fall) off. He _____ (climb) quickly to about five kilometres above the ground. Larry _____ (speak) to his friends on his radio. He _____ (want) to fly to the Rocky Mountains, but the wind _____ (take) him towards Long Beach Municipal Airport. Two pilots _ _____ (see) Larry and _____ (radio) air traffic control. The air _____ (be) thin three miles above the ground and Larry _____ (feel) cold and dizzy. He _____ (shoot) some of the balloons with his gun, the chair _____ (float) down, and he _____ (land) safely.

Fill in the blanks using the verbs in the correct form of past continuous tense.

Challenger (Županek, 2014)

It was 11:38 am on January 28, 1986. *Challenger* was ready for launch. Everything was going fine. The seven astronauts _____ (sit) in the shuttle, waiting to go into space. 3-2-1-zero. *Challenger* lifted off and climbed into the sky.

Millions of people _____ (watch) the launch on TV. Millions more _____ (listen) to the commentary on the radio. Inside the NASA control room in Huston, the launch team _____ (watch) the consoles and _____ (check) the flight. Inside *Challenger*, Mike Smith _____ (pilot) the shuttle and the others _____ (check) the instruments. Suddenly, 73 seconds after launch and 8 miles above the Atlantic, it all came to an end. The $869 million shuttle exploded. There were no survivals.

Complete the sentences using past perfect tense.

1. We arrived at work in the morning and found that somebody _____ (steal) our computers during the night.

2. Yesterday I was late for work. The car _____ (break) down.

3. This was my first flight. I _____ never _____ (fly) before.

4. After they _____ (write) the test, they waited for the oral exam.

5. Before the scientist stated the law, he _____ (make) hundreds of experiments.

6. Soon after they _____ (built) the bridge, it collapsed.

7. After Nobel _____ (invent) the dynamite, he felt guilty and founded a special prize.

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UNIT 3: BUILDING CONSTRUCTION

Parts of the house: Can you guess the correct word?

1. A room within a house used for keeping large typically household appliances such as a washing machine and dryer: u_____ room.

2. A room in the roof space of a house: a_____.

3. A space in the roof usually used only for storage: l_____.

4. A room below ground level without windows, used for storage: c_____.

5. A room below ground level with windows for living and working: b_____.

6. A flat area at the top of a staircase: l_____.

7. An open area as you come into a house: h_____.

8. A room for reading, writing and/or studying: s_____.

9. A covered area before an entrance door: p_____.

10. A paved area between house and garden: t_____ or p_____.

Match the below words with their definitions.

block of flats, bungalow, cottage, detached house, semi-detached house, skyscraper, terraced house, time-share, villa

1. A house which is not joined to any other house: _____
2. A house which is joined to one other house: _____
3. A house which is joined to several houses to form a row: _____
4. A small house in the country or in a village: _____
5. A house with only one storey: _____
6. A large house with big gardens: _____
7. A holiday flat or house where you have the right to live one or two weeks a year: _____
8. A large building divided into apartments: _____
9. A very tall multi-storey building: _____

Useful vocabulary

arch- lok	building construction – visokogradnja
building lot – gradbena parcel	building site – gradbišče
code – standard (to meet the code)	curtain wall – predelna stena
engineering structures – nizke gradnje	engineering works – nizkogradnja
flexure - uklon	footing – temeljna peta
loading - obremenitev	grid – mreža, rešetka
plinth - podzidek	slab / plate – plošča
rafter - škarnik, tram v ostrešju	sag – deformirati se zaradi lastne teže
settlement – usedanje	shear – strig
slope – nagib	structure - konstrukcija
tensile strength – natezna trdnost	tension – napetost
trench - kopati	zoning – coniranje, razdelitev na cone

Table 3: Glossary

Building construction ("Building Construction," 2014, July 14)

"Building construction is an ancient human activity to provide shelters and controlled environment, and to moderate the effects of climate. Today it is an important part of industrial culture.

Building construction is the process of erecting a structure on a building site and it includes design, financial and legal consideration (government building codes, structural requirements, safety factors, planning and zoning requirements, life-safety, sanitation and electrical requirements).

The first step in the actual construction is excavation. This is the process of moving earth, rock or other materials with tools, equipment or explosives. It can also include trenching, digging, dredging and site development.

The structural elements of the building are those which carry the weight or load, i.e. load-bearing elements or systems. They include footings, foundation, columns, beams, walls, slabs and roof. The members must be properly designed and constructed in order to support their own weight, and other effects applied on the structure.

A **foundation** is necessary to evenly distribute the entire building load on the soil so that no damaging settlements occur. Therefore, the foundation must be constructed on solid ground. The **footings** are placed under all load-bearing parts of the foundation (e. g. piers, columns).

A **plinth** is usually constructed just above the ground level and immediately after the foundation. It raises the floor above the ground level and herewith prevents surface water from entering the building.

A **beam** is generally a long horizontal structural element. It is subjected to transverse loading such as vertical loads, and gravity loads. These loads create shear and bending within the beam.

A long vertical member mostly subjected to compressive loads is called **column**. A structural member subjected to compression as well as flexure is called beam-column. A vertical network of beams and columns intersecting each other is called **frame** whereas, a horizontal network subjected to vertical loads is called **grid**.

Slab or **plate** is a horizontal plane element to carry the load and its own weight mostly in transverse direction.

Cables are usually suspended at their ends and are allowed to sag. The forces are then pure tension and are directed along the axis of the cable. **Arches** are similar to cables except that they are inverted and made of solid material. They carry compressive loads that are directed along the axis of the arch.

Exterior and interior walls are load bearing or non-load bearing vertical plane elements. Load-bearing walls carry the load of the ceiling and roof structure to the foundation whereas non-load bearing walls carry their own weight.

In any climate, **roof** protects other parts of the building and must be strong enough to withstand wind and snow. Roof slope and rigidness serve to drain water away from the building and to sustain applied load such as wind."

Explain the term building construction.

Write out all load-bearing elements from the text above.

Write out all non-load bearing members.

First study the meaning of the three verbs below (used to describe the relations between the structural elements) and then form meaningful sentences from the given words, related to these verbs (e.g. supporting beams)**.**

bear (bore, borne) = to support a weight or load, to hold up (adj. load-bearing)

carry = to support a weight of something without moving or breaking it (adj. load-carrying)

support = to bear the weight of something so as to keep it in place or prevent from falling (adj. supporting)

1. are fully supported / by the roof structure / metal roof coverings
2. are / one of the earliest forms / load-bearing walls / of construction
3. a structural element / is / mainly in bending / load/ a beam / that supports
4. the loads / are transferred to columns / carried by beams
5. skeleton frames / are designed / high-rise buildings / with supporting
6. the converted loft / to bear / the columns / the weight of / have been strengthened
7. is made up of / the load / and live load / all the dead / supported by foundations
8. and the time / there are / between the time / in-situ concrete is poured / 28 days / it can carry loads
9. of the atrium roof / a steel skeleton / the weight / is borne by
10. the building's weight / is the part / to the ground / the foundation / which carries / of a building / and transfers it

Read the text and form the correct words

Building _____ (construct) includes all procedures involved in the erection of various types of buildings and other structures for commercial, _____ (industry) and residential purposes.

The major elements of a _____ (build) are the following: (1) foundations, which support the building and provide _____ (stable); structures, which support all the imposed loads and transmit them to the foundations; (3) exterior walls, which may or may not be part of the primary _____ (support) structure; (4) interior partitions, which also may or may not be part of the primary structure; (5) _____ (environment) control systems, including heating, ventilation, air-conditioning, _____ (light) and acoustical systems; (6)

vertical transport systems like lifts, escalators and staircases; (7) _____ (communicate), which may include such subsystems as intercommunications, and (8) power, water supply and waste _____ (dispose) systems.

The loads imposed on a building are _____ (class) as either 'dead' or 'live'. Dead loads include the weight of the building itself and all main items of the fixed _____ (equip). They always act directly downwards and are _____ (add) from the top of the building down. Live loads include wind _____ (press), seismic forces, vibrations caused by machinery, movable furniture, stored goods, _____ (occupy) and forces caused by temperature changes. Live loads are temporary and can produce _____ (pulse), vibratory and impact stresses. In general, the design of a building must accommodate all possible live and dead loads to prevent the building from settling or _____ (collapse).

The structure is the load-bearing frame of a building, _____ (separate) into the substructure below and the superstructure above. The _____ (base) elements of any ordinary structure are slabs and roofs, columns and walls and bracings (i.e. diagonal elements) or rigid _____ (connect) between individual _____ (structure) elements used to give the structure stability.

1 Walls

Read a passage about walls and fill in the gaps the words from the box.

carry, external, heat, moisture, partition, strength, structure, structural, subdivide, weight

A wall is a solid, usually vertical _____ made of bricks, stone, concrete, timber or metal, which encloses and protects a building or serves to _____ buildings into rooms. Walls are defined as _____ or internal to characterize functional requirements, and as load-bearing or non-load bearing to characterize _____ requirements. Load-bearing walls are those that _____ the loads of floors and roofs, in addition to their own _____. In practice, the word _____ is generally used to describe non-load bearing internal dividing wall. The functional requirements for a wall include _____ and stability, resistance to weather and ground _____, durability, fire safety, resistance to the passage of _____ and resistance to the passage of sound.

2 Roof

Have a look at the picture of roof construction elements and match the terms with their descriptions.

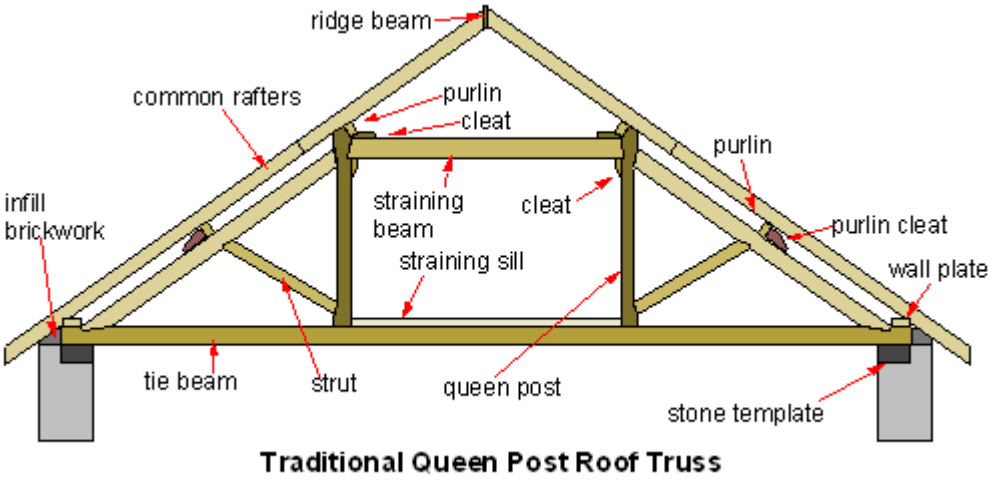

Figure 2: Traditional Queen Post Roof Truss
Source: Drawing by Bill Bradley.AKA builderbill billbeee (CC BY-SA 3.0), https://en.wikipedia.org/wiki/Truss#/media/File:Queen-post-truss.png

1. Roof Structure	An extra layer of protection beneath the shingles, helping prevent moisture from reaching the roof deck
2. Collar beam	Wooden boards or sheets fastened to the roof structure to form the roofing surface, used in milder climates
3. Felt Underlayment	Metal materials installed in a roof system to protect and cover various joints and valleys and prevent water seepage
4. Spaced sheathing	The external angle formed by two or more sloping roof planes, typically at the top of a roof
5. Flashing	The internal angle formed by intersection of two sloping roof planes
6. Ridge	The framework of the roof
7. Valley	A member making up the main body of the framework of all roofs
8. Rafter	A horizontal member between two rafters, which is mostly structural but may be used to frame a ceiling

3 Construction site safety

Explain these instruction signs and discuss the importance of safety at work with your neighbour.

		
Safety helmets must be worn	Ear protection must be worn	Foot protection must be worn
		
Eye protection must be worn	Safety mask must be worn	Hand protection must be worn
		
		
No access for unauthorised persons	First aid	No access for pedestrians

Table 4: Signs on a construction site

Sources:Pixabay.org

Watch the video about site safety (CSCS Health & Safety Training, 2013, December 28) **and answer the questions in a note form.**

1. What is the job of site management?
2. What must be done at the labourer's arrival?
3. What is site induction?
4. Name some specific information that should be given to workers.
5. Why is communication important?
6. Why should information be updated on daily basis?
7. Why should site rules be respected?
8. How is each task prepared safely?
9. What are worker's responsibilities?
10. When is it the right time to stop the activities on the site?
11. Why is constant learning essential?

Match the words with the warning signs.

		
		
		

a) explosiv
b) industrial vehicles
c) oxidizing
d) highly flammable
e) corrosive
f) radiation
g) general warning
h) toxic
i) harmful

Table 4: Signs on a construction site

Sources:Pixabay.org

Homework

Prepare a short oral presentation with the title **Buildings and Structures.**

4 Passive voice

It is frequently used in technical English, especially when describing procedures, instructions. When the agent is not known, unimportant or obvious, passive is preferred.

When I was on holiday, my office was broken into.

She is being treated in hospital.

The bridge will be built until the next July.

I can study math. ⟶ Math can be studied.

I could study math. ⟶ Math could be studied.

He must read the instructions. ⟶ The instructions must be read.

He had to read the instructions. ⟶ The instructions had to be read.

The structure

different tenses of BE + PAST PARTICIPLE

	ACTIVE	PASSIVE
Present Simple	**I study**	**It is studied**
Present Continuous	**I am studying**	**It is being studied**
Past Simple	**I studied**	**It was studied**
Past Continuous	**I was studying**	**It was being studied**
Present Perfect Simple	**I have studied**	**It has been studied**
Past Perfect	**I had studied**	**It had been studied**
'Will' Future	**I will study**	**It will be studied**

Table 6: Active and passive verb forms

Change these sentences into passive, mentioning the agent only when it is important.

1. Today we can produce composite materials to meet any kind of engineering requirement.

2. Engineers will have to develop better methods of material recycling.

3. As materials grow more complex, engineers are developing new manufacturing techniques.

4. Men first used ceramics some 13,000 years ago in Japan.

5. Harvard University and MIT discovered shape-memory effect approx. 80 years ago.

6. Figure 1 shows a graph of wear versus time for Mn-steel.

7. We rarely find pure metals in nature.

8. Somebody is using the computer at the moment.

9. They have not yet discovered an ideal superconductive material.

10. In the U.S.A. alone they make 30 million tonnes of plastics each year.

11. They have postponed the lecture.

12. We heated our rooms by electricity.

13. Someone has switched on the light.

14. You must not ruin all the walls.

15. They have built a new factory near the airport.

16. People use too many machines nowadays.

17. They should paint all the windows.

18. They make these frames of carbon fibres.

19. Who invented the steam engine?

20. You have to calculate the area of the longitudinal section of this cone

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UNIT 4: BUILDING MATERIALS

"Engineers are confronted with materials in manufacturing, processing, design and construction. When designing a structure, the suitability of the material should be taken into account. The fitness for purpose guarantees that material will behave the same in the construction phase as well as in a subsequent service. The most important criteria are strength, elasticity, ductility, deformation and durability. However, other aspects of the material behaviour such as water-tightness, speed of construction and malleability are also important for specific applications. Furthermore, aesthetics and environmental impact must be considered.

Materials are predominantly compounds, consisting of two or more chemical elements, and are classified into metals, ceramics, polymers, semiconductors and composites. Their behaviour is determined by their structure and properties. They have physical (density, hygroscopicity, thermal and electrical conductivity…), optical (transparency, index of refraction), mechanical (strength, elasticity, ductility, malleability…) and chemical properties (toxicity, flammability, corrosion resistance…).

Obviously, the number of available materials is enormous (160,000 or more) which means that more than one material satisfies the criteria of fitness-for-purpose. To solve this challenge, engineers use their experiences, consider material behaviour and capabilities; they think of compatibility with other materials, assembly and shape of the structure; they also calculate, compare weight and costs, and follow restrictive legislation and directives.

Wood and stone are the oldest materials used for constructional purposes. Even though wood has complex chemical nature, it is readily and economically available, easy machinable, amenable for

fabrication into an infinite variety of sizes and shapes using simple on-site building techniques. Despite its flammability it retains its structural integrity in fire. Moreover, wood is exceptionally strong, a good heat and electrical insulator and it is a renewable and biodegradable resource.

Portland cement is a hydraulic mineral binding material having cohesive and adhesive properties. It is the basic component for concrete. Portland cement consists of calcium, silicon, aluminium and iron oxides. Thus raw materials for manufacture of Portland cement are limestone, clay, shale, iron ore and bauxite.

Concrete is an artificial conglomerate stone, made essentially of Portland cement, water and aggregates. It is inexpensive and readily available, long lasting, hard material which can be moulded into desired shape. It is a great insulator, has great compressive but poor tensile strength. So, steel reinforcement is used to improve performance of concrete under tension – such concrete is called reinforced concrete. If compressive stresses are induced by high-strength steel tendons in a concrete member before loads are applied, we talk about prestressed concrete.

Building mortar is formed by mixing cementitious materials, fine aggregates, lime and water in an appropriate proportion. It is used to bind construction blocks together and fill the gaps between them in order to provide strength to the structure. It is also used for rendering.

Metals and **alloys** include steel, cast iron, aluminium, magnesium, zinc, titanium, copper, and nickel. They have good electrical and thermal conductivity, high stiffness, ductility or formability, and shock resistance as well as relatively high strength. Therefore, they are used for structural or load-bearing applications.

Glass is a brittle material which can be used to span a wide roof structure or cover the entire façade of a building (glass curtain walls).

Building plastic, mainly made from synthetic resin, can be moulded into various shapes under certain temperature and pressure and then it keeps unchanged in the normal conditions. It is lightweight and has high tenacity" (Illston & Domone, 2008).

Answer the questions

1. Name all building materials that appear in the text.

_____

_____

_____

_____

2. Why is wood an important construction material?

3. What kind of material is cement?

4. What is concrete made of?

5. Name the difference between reinforced and pre-stressed concrete.

6. Which are the ingredients of mortar?

7. What is metal used for?

8. Name advantages of aluminium.

9. What can be glass curtain walls used for?

10. Which are the properties of building plastic?

Read the text and form the correct words

The Advantages of Iron (Županek, 2014)

_____ (relative) speaking, end especially when compared to wood or copper, iron is _____ (extreme) strong. By _____ (heat) it, iron is relatively easy to bend and shape using simple tools. It can be _____ (magnetize), and thus used in _____ (create) of electric motors and generators.

5 _____ (%) of the Earth's crust is iron, so it is plentiful. It is quite easy to refine it _____ (use) simple tools.

If we compare iron and steel with aluminium, we see that iron is much _____ (easy) and _____ (cheap) to deal with. To refine aluminium, huge amounts of _____ (electric) are needed. To shape aluminium, you must either cast or _____ (extrusion) it. Iron has been _____ (use) to man for thousands of years, while aluminium was not.

The only real problem with iron is rust which can be controlled by painting, _____ (galvanize), chrome plating (technique of electroplating a thin layer of chromium onto a metal or plastic object) or sacrificial anodes (_____ (high) active metals to prevent a less active material surface from corroding).

In the future, iron may be _____ (replace) by other materials like aluminium, plastics, carbon- and glass fibres.

1 Corrosion (Županek, 2014)

Corrosion is one of the most frequent causes of material deterioration. It is a chemical process of changing the state of a metal as a result of **interaction with its environment**. It often occurs where water is present. Corrosion becomes worse when **impurities** are present in damp conditions. It never starts inside the material but on the **surface**.

A common example of corrosion is the **rusting** of steel. What happens here? Metallic iron is converted to a mixture of oxides and other compounds, which results in a change of the appearance of the metal and decrease in its cross-section.

Corrosion can be prevented or decreased in many ways. The most common **anti-corrosion** treatments are **plating, painting**, and the application of **enamel**.

On the other hand, some materials are corrosion resistant. An example is aluminium and its alloys; they can be exposed to air and water without corroding.

Complete the sentences.

1. In corrosion, metals change state because _____.
2. Factors that encourage corrosion are _____.
3. The signs of corrosion can always be found on _____.
4. Rust is _____.
5. Rust may be dangerous to a structure because_____.
6. Corrosion can be prevented by _____.

Watch the video (AirForceTheCircuit, 2009, April 21) **and insert the missing words**

1. A student of mechanical engineering invented _____.
2. Micah Toll is _____ years old.
3. The new material is made of _____.
4. His construction beams are _____ in order to provide shelter for people living in 3rd world countries and _____.
5. When Micah was young, he always liked _____.
6. He's an inventor with _____.
7. Short of getting a vespa, he decided to _____.

8. After testing some engineering concepts, Micah had an idea for a building material that was _____.
9. To make a beam, you start with a _____, and then you fold it up into _____.
10. Forming box is made of _____.
11. Liquid foam expands in just _____.
12. To get different shapes he uses _____.

Homework

Find out more about one of the building materials and prepare a short oral presentation.

Read the following text on "**Building materials**" (Quint, 2014, August 8) and underline any vocabulary items that can be used to describe graphs and tables.

Shortages of Key Building Materials Have Eased in 2014 (Quint, 2014, August 8)

BY ROSE QUINT

Unlike recent news that builders continue to face serious difficulties finding lots and labor to build new homes, a survey conducted by NAHB in July shows that shortages of key building materials have actually eased in 2014. In fact, only 15% of builders reported some or serious shortages of trusses or clay bricks, the highest incidence among the more than 20 materials builders were asked about. Fourteen percent reported shortages of each windows/doors, gypsum wall board, and cabinets.

The graph below shows the complete list of the 23 building materials and products in the survey, sorted by the share of builders reporting shortages.

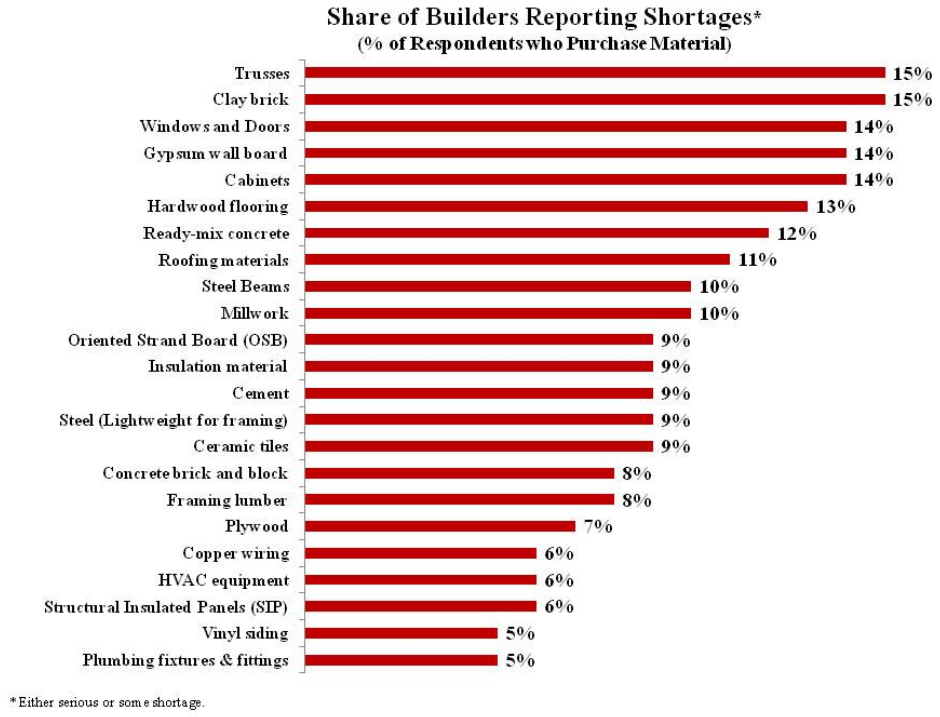


Figure 2: Share of Builders Reporting Shortages. (Quint, 2014, August 8)

For a number of key materials, the share of builders reporting any kind of shortage was lower in July 2014 than in May 2013. For example, while 18% of builders reported shortages of plywood, and 22% of Oriented Strand Board (OSB) in May 2013, those shares fell to 7% and 9%, respectively, in July 2014. Likewise, the share of builders reporting a shortage of framing lumber went from 18% to 8% during this period, while for wall board the share dropped from 20% to 14%.

2 Describing Graphs, Charts and Tables

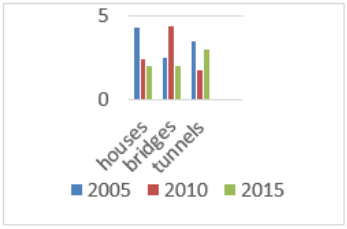
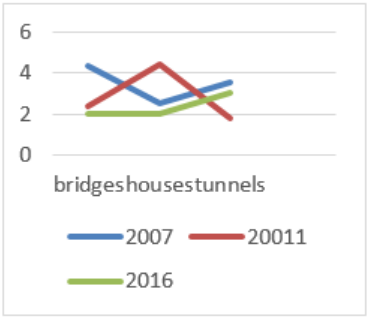
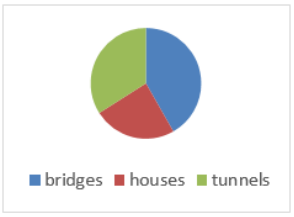
		
bar chart	**graph**	**pie chart**

Table 7: Different forms of diagrams

A chart is a diagram that makes information easier to understand by showing how two or more sets of data are related. There are two common types of charts, a pie chart and a bar chart. A **pie chart** is a circle divided into segments. It is usually used to show percentages.

A bar chart is a **diagram** that makes information easier to understand by showing how two or more sets of data are related. It is divided into columns**.**

Name of product	Number of sales
A	10
B	25
C	50

Table 8: Product and sales figures

A table is a set of facts and figures arranged in columns and rows. A table is a very useful way of organizing numerical information.

A graph is a diagram, usually a line or curve, which shows how two or more sets of numbers or measurements are related. The vertical axis can be called the y axis, and the horizontal axis the x axis. Different **types of line** are often used on a graph. Different sets of numbers or measurements can be plotted on the same graph and this helps us compare information:

_____ **solid line**

…… **dotted line**

---------- **broken line**

Listen to this video (Intenga 4 english learners, 2012, May 6) **on describing graphs and tables in English and complete the following sentences:**

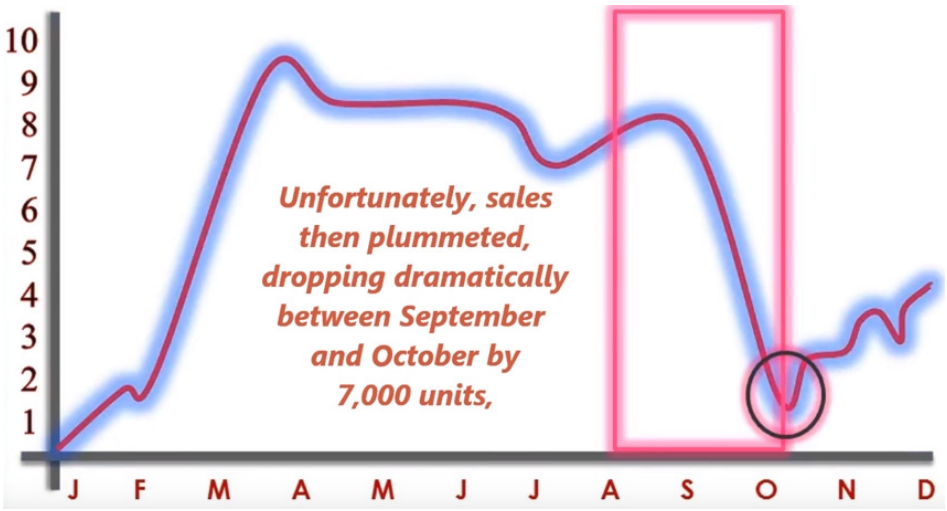


Figure 3: Sales in 2011. Source: https://www.youtube.com/watch?v=N1uAImH4GwA.

A. _____, *2011 was a rather turbulent year for us, with a lot of ups and downs.*

B. *After launching our product, there was* _____ *in sales.*

C. *Following* _____ *in February, we commenced an advertising campaign.*

D. *The advertising campaign resulted in sales* _____ *by 8,000 from around 2,000 to* _____ *of just under 10,000.*

E. *There was* _____ *at the end of March before sales* _____ *and remained* _____ *throughout April and May.*

F. *In July, sales* _____ *to approximately 7,000.*

G. *Unfortunately, sales then plummeted,* _____ *between September and October.*

H. *He used verbs like* _____ *and* _____

I. *To increase means to* _____

J. *To decrease means to* _____

K. *What clarifies the meaning of verbs is* _____*to tell us if the figures have risen very* _____ *and* _____

L. *What clarifies the meaning of nouns is* _____

M. *Sales increased rapidly can be put as* _____

N. *Sales dropped slowly can be put as* _____

O. *There was a gradual rise can be put as* _____

P. *There was a sharp increase in sales can be put as* _____

Q. *The most commonly used prepositions in describing graphs are* _____

3 Describing trends

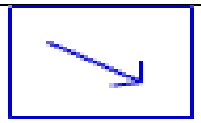
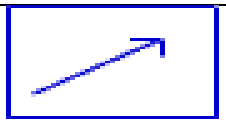
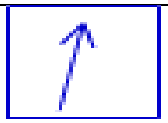
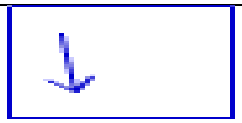
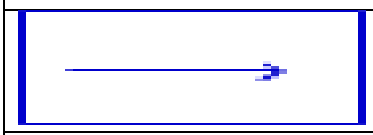
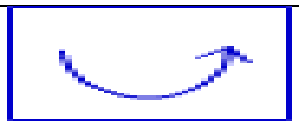
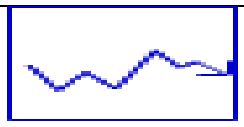
			
decline decrease drop fall slide	rise increase climb go up grow	soar rocket jump leap	crash collapse plummet plunge sink
			
flatten out hold steadily level off stabilise remain stable remain constant stagnate	bounce back rally recover revive	fluctuate	

Table 9: Verbs used to describe graphs

Find a noun

flatten out	_____	grow	_____
hold steadily	_____	increase	_____
stabilise	_____	stagnate	_____
recover	_____	fluctuate	_____
revive	_____	climb	_____

Choose the correct verb or noun form in each of the following sentences. Be careful with the tense when using a verb.

1. The Euro _____ at a rate of about 1.6 Euros to the pound with only minor fluctuations.
   has stabilisation/ has stabled/ has stabilised/ stabled

2. The number of people watching television rose steadily throughout the day. There was _____ at 7.30 p.m. when twelve million people were estimated to be watching.
   rocketed/ a peak/ peaked/ a rocket

3. After a poor summer, the usage of the sports centre _____. when the students returned from their summer holiday.
   rally/ a recovery/ rallied/ rallied

4. The price of our product _____ since 1999.
   declined/ a decline/ has declined/ declining

5. Sales of the sun cream produced by the Lobster Red Corporation _____ by 200,000 in July 2001 compared to the same period in the previous year.
   falled/ failed/ fell/ a fall

6. The number of babies called David born in Manchester Hospital _____ by 56% after David Beckham scored the winning goal in the World Cup match against Germany.
   rose/ a rise/ rise/ raised

Find an adverb

Sometimes we need to give more information about a trend, usually about the degree or speed of change, e.g.

The year started with a ***steady*** *decline in sales and stabilised in September.*

Sales increased ***slowly*** *during January and then declined* ***steadily*** *until the end of the financial year.*

Adverbs and adjectives can be used to modify verbs and nouns of change.

Adverbs can modify the verbs of change and usually end in 'ly' (to increase substantially), and adjectives can modify nouns of change (a substantial increase). Adjectives always come before a noun and adverbs usually come after a verb.

considerable	_____	dramatic	_____
slight	_____	sharp	_____
moderate	_____	gradual	_____
significant	_____	slow	_____
substantial	_____	fast	_____

Choose the most appropriate option to complete each statement, which describes the table and graphs.

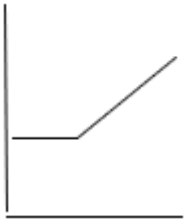
Car production shows

	Car Production
Jan	2.899,841
Feb	2.700,010
Mar	2.700,124
Apr	2.700,200

a) a slight decline. b) a dramatic increase. c) a slight increase.

Production

a) reached a peak and then fell down rapidly. b) rocketed and then reached a peak. c) reached a peak rapidly and then fell.



a) rose substantially and then held steadily. b) held steadily and then rose substantially. c) held substantially and then stabilised.

Use some of the phrases to describe the graph below.

The graph shows … / The pie chart compares … / The bar chart deals with …

The graph represents the **fluctuation** in the number of …

There is a **sharp increase** between …

After this, the numbers **drop quickly** to / **fall significantly,** with only a **slight increase** again …/ **grew slowly** in the second quarter / **rose by** …% / **reached a low**

There is then a **rapid rise** to a **peak** of … / was **a fall** in the second quarter

There was a **sudden growth** in ... / a **rise of** …

A **slow drop** was recorded in … / compared with the same period …

In the period between …, **an upward trend** was recorded in …

Remember!

Rise, rose, risen: The price has already risen. Prices rose yesterday. Prices are rising.

Raise, raised, raised: They raised the prices.

Arise, arose, arisen: Many problems have arisen. A crisis is arising.

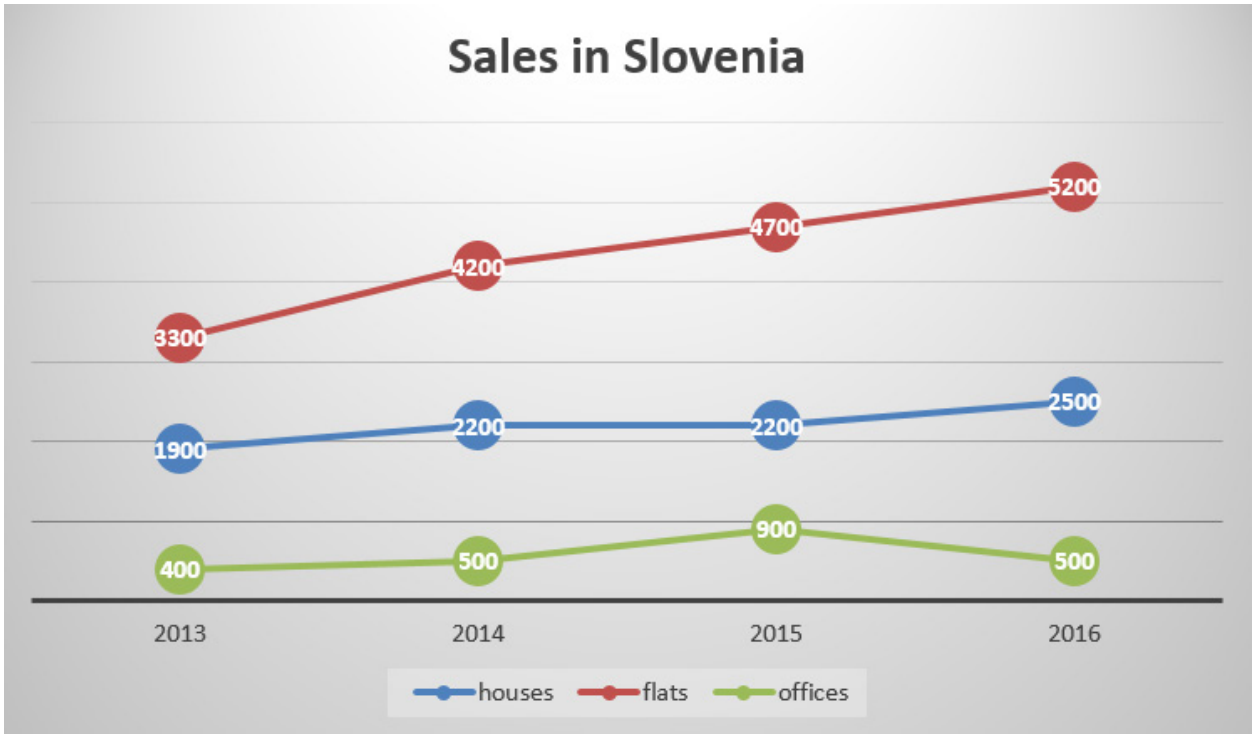


Figure 4: Sales in Slovenia (source: author)

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UNIT 5: BRIDGES AND TUNNELS

1 **Bridges** (Brkan, 2009)

"A **bridge** is an engineering structure that spans rivers, bodies of water, valleys and railroads. Designs of bridges vary depending on the function of the bridge and the nature of the terrain where the bridge is to be constructed. A bridge must be strong to support its own weight and the weight of the people and vehicles passing over it. Besides, the bridge must resist such natural occurrences as wind load and earthquakes.

Designing bridges is a real challenge for civil engineers. Depending on construction principle used, different types of bridges are identified."

Have a look at <u>ten most famous bridges in the world</u> ("10 Most Famous Bridges In The World", 2018)**. What kind of bridges are they?**

Bridge	**Bridge type**
Golden Gate Bridge, San Francisco, USA	
Tower Bridge, London, England	
Sydney Harbour Bridge, Sidney, Australia	
Brooklyn Bridge, New York, USA	
Ponte Vecchio, Florence, Italy	
Rialto Bridge, Venice, Italy	
Millau Viaduct, Millau, France	
Charles Bridge, Prague, Czech Republic	
Akashi Kikyo Bridge, Japan	
Great Belt Bridge, Denmark	

Watch the video about Phu My Bridge (Othello Khanh, 2010, July 22) **in Saigon, Vietnam and answer the question in a note form.**

1. How long did the construction last?

2. What is the name of the river under the Phu My Bridge?

3. How was the project funded?

4. Which countries took part in construction?

5. Was the bridge built in time?

6. What kind of bridge is the Phu My Bridge?

7. How long did the transfer operation last?

8. How long is the bridge?

2 Types of Bridges

Characterize the main bridge types by matching their names with the descriptions.

Bridge types:

a) cantilever bridge	d) steel-truss bridge	g) tensegrity bridge	j) pontoon bridge
b) suspension bridge	e) girder/beam bridge	h) movable bridge	k) deployable bridge
c) arch bridge	f) cable-stayed bridge	i) covered bridge	

Descriptions:

1. _____: A bridge carried by girders or large beams supported by piers at the ends. Originally, it was built of wood or iron, now usually of steel or concrete.

2. _____: Any bridge with straight cables from masts connected directly to the deck girders without suspenders. All these bridges are of striking appearance.

3. _____: A bridge with movable spans that can be raised to allow ships to pass under it. Movable spans may be bascule/drawbridge, swing or vertical lift type depending on local requirements.

4. _____: A symmetrical three-span bridge. Each of its outer spans is anchored down at the shore and overhangs into the central span about one third of the span. The suspended span, resting on the cantilever arms, forms the remaining one third of the central span.

5. _____: A bridge consisting of a steel frame, built up from members in tension and compression. It is very common in bridge building because of it low cost.

6. _____: A temporary or permanent bridge which floats on pontoons anchored to the riverbed. Permanent bridges are built in this way when the foundation material is very poor. In this case they may be of reinforced concrete.

7. _____: A bridge hung from ropes, chains, cables or steel or iron bars passing over towers at each bank. The cables or ropes are held by anchor blocks or solid rock behind the towers. The track or road is hung from the cables above by the suspender – rods or ropes carrying the weight.

8. _____: A bridge consisting of a timber truss, typical of the 19th century New England. To prevent the supporting structure from rotting, the bridge was covered and roofed.

9. _____: A bridge of this shape, i.e. a curved top on two supports. Such bridges are made of any solid material but usually of concrete, steel, stone or masonry.

10. _____: This bridge is a lightweight structure, composed of struts in compression and tensioned cables.

11. _____: This bridge can be rapidly constructed from prefabricated elements packed into a transportable kit. It is used after natural disasters like flood or in military operations.

Pair work: Together with your neighbour, discuss the following questions.

1. How did the earliest bridges in history look? What type and materials were used?
2. Which are the most common materials for bridge building nowadays?
3. Which bridge type is the easiest and cheapest to design? Which is the most complex?
4. Which bridge type(s) would you use in the following cases?
   - over a shallow lake with muddy foundation ground, at a length of approximately 800m
   - to span a steep mountain valley in a nature reserve
   - as a motorway bridge over the Drava River
   - to connect an island in the sea with the mainland (distance of 3km)
   - to carry light rail in a suburban environment
   - over the Elbe River where ships need to pass under the bridge

Read a passage about the Solkan Bridge ("The stone railed bridge in Solkan," n.d.) **and translate it.**

"The Solkan Bridge is the most prominent bridge on the Bohinj Railway route between Jesenice and Gorica, and one of the most famous bridges in Slovenia. The bridge has the longest stone arch spanning over a river in the world and the longest stone arch among railway bridges. The span of the main arch is 85m; the length of the whole object is 220m. The bridge was under construction for two years, from spring 1904 until December 1905. The work was hindered mainly by the Soča River, which rose several times. For the main arch, 4533 exactly fitted stones of limestone were needed".

Watch the video Building a rope bridge with flying machines (Augugliaro, 2015, September 18) **and complete the text with *is* or *are*.**

The video shows quadrocopters autonomously assembling a rope bridge. This _____ part of a body of research in aerial construction, a field that addresses the construction of structures with the aid of flying machines.

In this work, a rope bridge that can support the crossing of a person _____ built by quadrocopters, showing for the first time that small flying machines _____ capable of autonomously realizing load-bearing structures at full-scale and proceeding a step further towards real-world scenarios. Except for the required anchor points at both ends of the structure, the bridge consists exclusively of tensile elements and its connections and links _____ entirely realized by flying machines. Spanning 7.4 m between two scaffolding structures, the bridge consists of nine rope segments for a total rope length of about 120 m and _____ composed of different elements, such as knots, links, and braids. The rope used for these experiments _____ made out of Dyneema, a material with a low weight-to-strength ratio and thus suitable for aerial construction. Of little weight (7 g per meter), a 4 mm diameter rope can sustain 1300 kg.

The vehicles _____ equipped with a motorized spool that allows them to control the tension acting on the rope during deployment. A plastic tube guides the rope to the release point located between two propellers. The external forces and torques exerted on the quadrocopter by the rope during deployment _____ estimated and taken into account to achieve compliant flight behavior. The assembly of the bridge _____ performed by small custom quadrocopters and builds upon the Flying Machine Arena, a research and demonstration platform for aerial robotics. The arena _____ equipped with a motion capture system that provides vehicle position and attitude measurements. Algorithms _____ run on a computer and commands _____ then sent to the flying machines via a customized wireless infrastructure.

In order to be able to design tensile structures that are buildable with flying robots, a series of computational tools have been developed, specifically addressing the characteristics of the building method. The design tools allow simulating, sequence, and evaluating the structure before building.

The location of the scaffolding structure _____ manually measured before starting the construction. The primary and bracing structure can then be realized without human intervention. Before realizing the stabilizers, the locations of the narrow openings of the bridge are measured and input to the system, which adapts the trajectories accordingly.

Have a look at the drawing of a suspension bridge and match terms on the left to the descriptions on the right

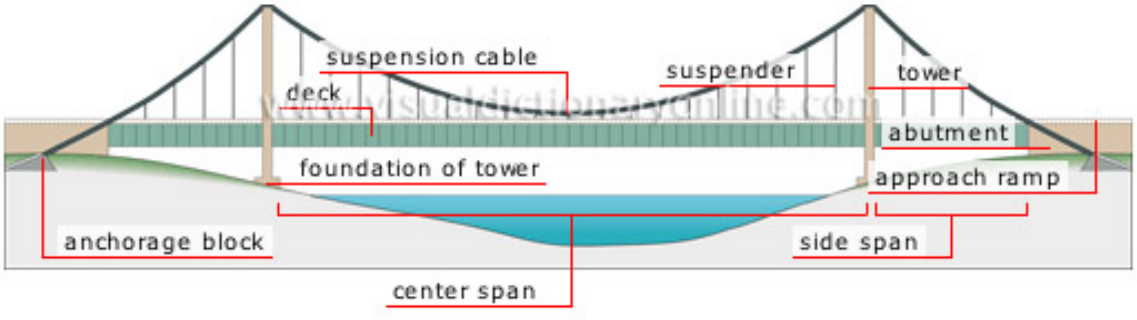

Figure 5: Suspension bridge

(source: http://www.visualdictionaryonline.com/images/transport-machinery/road-transport/fixed-bridges/suspension-bridge.jpg)

Side span	a) a solid concrete base, anchored in the ground
Foundation of tower	b) a cable that runs between the towers of a suspension bridge
Suspenders	c) a concrete structure on each side of the abutment, buried deep in the ground
Abutment	d) a lane for accessing the bridge
Anchorage block	e) cables that run between the main cable and the roadway
Centre span	f) a section of the span between the tower and the abutment
Tower	g) a part of the bridge on the shore to give support
Deck	h) an elevated structure made of metal or reinforced concrete which supports the cables
Suspension cable	i) a section of the deck entirely suspended between the towers
Approach ramp	j) a set of components making up

Fill in the gaps using the appropriate verb

bear, range, transfer, support, span, extend, run, resist, hold up, design, stretch

1. The majority of bridges are _____ by at least two supports.
2. The structure is strong enough to _____ the weight.
3. The bridge collapsed, as it could not _____ strong winds.
4. Pontoon bridges are _____ by flat-bottomed rafts.
5. The main span of the new bridge _____ more than 300 metres.
6. A roadway may _____ on top of trusses or through them.
7. Suspension bridges can _____ the longest distance.
8. The spans _____ up to 550 metres long.
9. The columns _____ the load of the roadway to the arch.
10. The main span of a suspension bridge _____ between two towers.
11. Bridges must be _____ so as to support dead and live loads.

3 Tunnels

A **tunnel** is a tube hollowed through soil or stone. Constructing a tunnel is one of the most complex challenges in the field of civil engineering. Tunnels are a solution for railways, roads, public utilities and telecommunications.

Read the text about Chanel Tunnel (GetLink Group, n.d.) **and complete the sentences below.**

The Channel Tunnel is the longest undersea tunnel in the world. The section under the sea is 38km long. The three tunnels, each 50km long, were bored at an average 40m below the sea bed, and link Folkestone in Kent to Coquelles in Pas-de-Calais.
Eurotunnel shuttles, Eurostar and national freight trains run in the two single track and single direction tunnels. These are connected to a central service tunnel by cross-passages situated every 375m. The service tunnel allows access to maintenance and emergency rescue teams and serves as a safe haven if passengers need to be evacuated in an incident. The service tunnel is a road tunnel used by electric and diesel-powered vehicles. Air pressure is higher in the service tunnel to prevent the ingress of smoke in case of a fire in one of the rail tunnels.

The two rail tunnels are 7.6m in diameter and 30m apart. Each rail tunnel has a single track, overhead line equipment (catenary) and two walkways (one for maintenance purposes and the other for use in the event of an emergency evacuation and on the side nearest the service tunnel). The walkways are also designed to maintain a shuttle upright and in a straight line of travel in the unlikely event of a derailment.

The service tunnel is 4.8m in diameter and lies between the two rail tunnels 15m away from each of them. In normal operations shuttles use the south tunnel in the France – UK direction, and the north tunnel when travelling from the UK to France.

Two undersea crossovers bring flexibility of operation as trains can pass from one tunnel to the other during night maintenance periods to isolate a section of tunnel.

The track in each rail tunnel has two continuously welded rails laid on pre-cast concrete supports embedded in the concrete track bed.

Fixed equipment in the tunnels comes under four categories: electricity and catenary, rail track and signalling, mechanical systems and control and communications.

Cooling pipes, fire mains, signalling equipment and cables are fixed to the sides of the tunnels and are fed by cooling plants at Samphire Hoe in the UK and Sangatte in France.

The overhead catenary supplies traction power to the shuttles as well as to other trains using the Tunnel, e.g. Eurostar and international rail freight trains. The catenary is divided into sections, so that maintenance work can be carried out in stages. Electrical power supplying the tunnels, drainage

pumps, lighting and the trains, is provided by substations on each side of the Channel. In the event of loss of power from one side, the entire system can be supplied from the other side.

The fixed lighting installations can be switched on from the control centre or manually from within the tunnels. Various fire-protection and detection systems are installed at points along the length of the tunnels.

1. The longest undersea tunnel in the world is called _____.

2. Each tunnel has a length of _____.

3. The two single track and single direction tunnels are linked to _____.

4. Electric and diesel-power vehicles use _____.

5. One walkway is used for _____ and the other for _____.

6. Normally, the south tunnel is used to travel _____.

7. Isolation of a section provides _____.

8. Electricity and catenary, rail-track and signalling, mechanical systems and control and communications are _____.

9. Cooling plants feed _____.

10. The control centre can switch on _____.

Convert the following text to Passive to make a description of tunnel construction.

Construction engineers use a number of methods to make tunnels. They employ a simple cut-and-cover method for shallow tunnels. They use explosives to tunnel in very hard rock. They use a tunnel boring machine (TBM) to make deep tunnels in soft rock. The TBM protects workers and machinery. A rotating cutterhead at the front cuts the rock. Machinery at the rear removes the refuse. Hydraulic jacks push the TBM forward. The segment erector builds a new tunnel ring every 1.5 – 2 metres. It places concrete segments in the right position to form a ring.

4 Machinery and equipment

Construction machinery and **equipment** is used for executing construction tasks such as earth movement, excavation, deep foundation, lifting, and mixing.

Read texts ("Building Construction," 2014, July 14) **on equipment and machinery and form correct words**

A backhoe loader is an _____ (engineer) vehicle which consists of a shovel/bucket and a small backhoe on the back. It is used for digging shallow _____ (excavate)/trenches, general grading, lifting loads and loading and carrying materials.

An excavator consists of a bucket on the front only. It is used for excavating below/above natural surface of ground, digging bigger trenches and pits for basements, general _____ (grade) work, loading onto haul units and lifting.

A forklift loader is a potent _____ (industry) truck that is used to lift and transport material by steel fork, inserted under the load. They _____ (normal) move loads and equipment that is stored on pallets.

A truck is used to transport excavated materials over a distance at fairly low costs.

A telescoping-boom truck mounted mobile crane: Its full revolving superstructure is mounted on a truck with multi section-telescoping boom. It is used to hoist and place material and _____ (machine). This crane can travel on public roads between projects with minimum or no _____ (dismantle) and reassembling.

A concrete truck is a mobile concrete mixer truck which transports the concrete from the factory to the _____ (construct) site. The mixer tank keeps rolling during _____ (transmit) to prevent setting of the cement.

A pneumatic air compressor is a _____ (portability) air compressor that converts _____ (electricity) power into kinetic energy. It is designed to work with various tool _____ (attach) in order to provide pneumatic power.

A borehole machine is used to dig borehole and to test the soil on site. Soil _____ (investigate) are necessary for engineering structures founded in deep excavations. They also provide important information on the soil and ground water condition.

5 Tools

A building labourer must use a proper **construction tool** in order to do the work quickly, accurately, and safely.

Measuring tools include tape measures and laser meters. Tape measures are _____ (retract) rulers, made of thin metal which have a long notch on one end of the tape to hold the tape to an object. Most also lock in place so that the tape does not retract while the user records a measurement. Laser meters employ a laser beam to calculate the _____ (long).

Clamps are _____ (relative) simple tools used to hold glued pieces of wood together while the glue dries or to hold a piece of concrete or stone in place.

Hammers serve many purposes that make them _____ (suite) for various kinds of construction works. Carpenter hammers are designed to drive nails into wood and remove them. Mason hammers are designed to break up bricks and stonework, with a blunt end for greater force and a sharp end for _____ (chip).

Screwdrivers give construction _____ (work) the torque that they need to place screws into wood and remove them as well.

Homework

Find out more about one of the bridges or tunnels and prepare a short oral presentation.

6 Prepositions

Time: after, at, before, between, by, from, in, on, since, until…

Place: above, across, at, at the back of, at the side of, at the top of, behind, below, beside, between, far from, in, in front of, on, opposite, over, near, under…

Movement: across, along, down, from, off, into, onto, out of, past, through, to, up…

Other: about, by, for, with, of, against…

Insert the right preposition.

1. There's so much _____ offer, you hardly know what to choose.
2. The Blacks have sold their business, _____ a huge profit.
3. _____ average there are more than a hundred fatal accidents each year.
4. I never worry when I have to be in the house _____ my own.
5. You have to apply for a visa _____ person.
6. We haven't dealt with your application yet, but it is _____ hand.
7. My car's _____ your disposal any time you'd like to use it.
8. You have to write an account of the accident _____ detail.
9. She must be fed up _____ studying.
10. What are the advantages _____ speaking foreign languages?
11. Never overtake when _____ doubt.
12. This screwdriver is only _____ small screws.
13. I'm looking _____ my sister's baby.
14. Look _____ this graph. How interesting!

15. I can't live either _____ or _____ you.

16. We drove _____ Cardiff _____ London.

17. He was standing _____ his mum and his dad.

18. Do you see the building _____ the road? It's my faculty. There is a tree _____it.

19. What's the biggest dam _____ the world?

20. What do you think _____ John's latest project?

Read the text and supply the missing prepositions.

THE MISPLACED ENGINEER

An engineer dies and reports _____ the pearly gates. St. Peter checks his dossier and says, "Ah, you're an engineer - *You're* _____*the wrong place.*"

Pretty soon, the engineer gets dissatisfied _____the level of comfort _____ hell, and starts designing and building improvements. _____a while, they've got air conditioning and flush toilets and escalators, and the engineer is a pretty popular guy.

One day God calls Satan up _____the phone and says _____a sneer, "So, how's it going down there _____hell?"

Satan replies, "Hey, things are going great. We've got air conditioning and flush toilets and escalators, and there's no telling what this engineer is going to come _____with next."

God replies, "What? You've got an engineer? That's a mistake - he should never have gotten down there. Send him back _____."

Satan says, "No way. I like having an engineer _____the staff, and I'm keeping him."
God says, "Send him back _____here or I'll sue!"

Satan laughs uproariously and answers, "Yeah, right. And just where are you going to get a lawyer?"

Form sentences by adding the proper prepositions.

each trust consists / steel rods

the main span stretches / the two towers

abutments support the bridge / the shore

drawbridges, /the roadway is moved / allow ships / pass

a bascule bridge opens / tilting / one or both arms / an angle

cantilever arms extend / opposite sides / the river and meet / the centre

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UNIT 6: SURVEYING AND ROAD CONSTRUCTION

"Improved living standards call for thorough knowledge of the scene of our life – the Earth's surface. This surface bears the living-houses, schools and factories; it is the scene of agriculture; people travel on the surface of the Earth enjoying its beauties – the mountains and valleys, the rivers, villages and cities. Many people make long journeys to distant countries to view nature's beauties; thousands of foreigners visit our country to see our famous landscapes and regions.

The wise and well-prepared tourist has a highly important travelling companion – the map and some of the GNSS (global navigation satellite system) equipment. The traveller measures the distances on the map, reads the coordinates, the mountain altitudes, sea depths on boat trips, etc. The map is also an indispensable tool for the engineers. Without a map, no town planning can be realized. The designing of industrial plants, roads and railroads, the construction of water or gas pipelines, and sewage networks, the regulation of rivers and irrigation projects all require good maps and plans. Since map-making is based on the work of surveyors, an important purpose of surveying is to determine the boundary lines and characteristic points of natural formations and landmarks as well as those of man-made structures in a manner enabling their representation in mapping and safe use.

The surveyor has to deal with the determination of the Earth's shape and dimensions. This task is performed by a special branch of surveying – geodesy, with the application and use of special equipment, measurements and computational procedures. Furthermore, another task of surveying is to carry out various measurements that will provide the basis of the engineering design work, to lay

out and measure the accurate points in the field of planned engineering projects such as the centre-line of roads and railroads, the edges of banks and dikes, the corner points of planned buildings, the boundary lines of building sites, the accurate sites of industrial projects, the accurate points in deformation analysis... For their work surveyors use state of the art equipment such as total stations with automatic target recognition and laser plummets, CCD cameras in photogrammetric tasks, GNSS equipment, 3D laser scanners and other very sophisticated instruments.

Therefore, to carry out the above function, the surveyor must have versatile knowledge. According to the nature of jobs, geodesy has a number of branches, the learning, which requires different levels of mathematical, physical education and other skills" (Szentesi, 1978).

Write a short summary of the text above

Read the text and form the correct words

_____ (survey) is the technique of measuring the earth's surface. Such _____ (measure) should be as accurate as possible. A survey of the site must be made before any civil _____ (engineer) project is undertaken. There are different kinds of surveying. Plane surveying does not take into account the _____ (sphere) form of the earth. Therefore, it is only accurate within areas of about 20 kilometres. For larger areas, however, geodetic surveying must be used which takes into _____ (consider) the curvature of the earth.

_____ (survey) measure distances, elevations (heights), boundaries (both man-made and natural) and other _____ (physic) characteristics of the site. Measurements can be in a _____ (horizon) or in a vertical plane. _____ (high) are measured in relation to a point called bench mark. The bench mark is a point determined at sea level; it is the average of tides in a given area.

1 Geodetic datum and coordinate system

Find the definitions for the following terms, then read the text on geodetic datum (Szentesi, 1978)**.**

coordinate system _____
sea level _____
navigation _____
cartographer _____
satellite navigation system _____
latitude _____
longitude _____
altitude _____

For orientation in space, **a geodetic datum** is required.

A geodetic datum or geodetic system is a coordinate system, and a set of reference points, used to locate places on the Earth (or similar objects). An approximate definition of sea level is the datum WGS 84 (World Geodetic System from 1984), an ellipsoid, whereas a more accurate definition is Earth Gravitational Model 2008 (EGM2008). Data are used in geodesy, navigation, and surveying by cartographers and satellite navigation systems to translate positions indicated on maps (paper or digital) to their real position on Earth. Each starts with an ellipsoid (stretched sphere), and then defines latitude, longitude and altitude coordinates.

Because the Earth is an imperfect ellipsoid, localised data can give a more accurate representation of the area of coverage than WGS 84. Local can mean a continental, national, regional or even personal datum for a specific project. In Slovenia, there is so called Gauss-Krüger (GK) and UTM (Universal transverse Mercator) mapping system and coordinates. GK coordinates are based on GK cylindrical,

transverse, central, conform projection with 3° (at latitude) wide zones. All together there are 120 zones.

Slovenia lies in meridian zone with middle meridian 15° of longitude eastern from Greenwich prime meridian (London). Middle meridian 15° of longitude goes through the town Zagorje and almost whole Slovenia lies in 5th zone (15°/3 ° = 5) – Fig. 5.

In your own words, explain the Fig. 5.

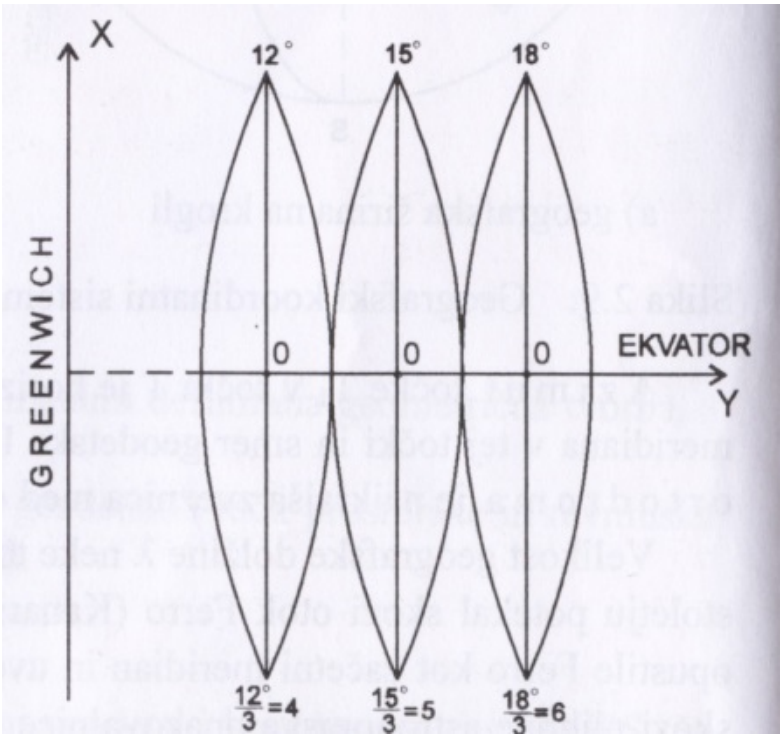


Figure 6: Meridian zones;
(author: Rok Kamnik)

Watch the Video Becoming a Land Surveyor (Study.com, n.d.) **and answer the questions in a note form.**

1. Which fields does land surveying relate to?

2. What can surveying professionals measure and map to establish boundaries and limitations?

3. What important information is provided by land surveyors?

4. What does each state mandate?

5. Why is specialized equipment used?

6. Why should a land surveyor be in good physical condition?

7. What degree of study is required by employers?

8. How long do surveyors, completing the first exam for the licence, mostly work under direct supervision of a more experienced surveyor?

9. Where do most land surveyors work?

10. What areas do land surveyors play an important role in?

Write the correct forms of the verbs in brackets.

1. Before the construction of the bridge is _____ (undertake), a survey of the site must be _____ (make).
2. A surveyor _____ (take) accurate measurements of both river banks.
3. When a steel tape is _____ (use), temperature readings are also _____ (take).
4. Levelling devices _____ (keep) a theodolite in a horizontal plane.
5. For the measurements to be accurate, the ends of the tapes had to be _____ (level).

Read the text and insert the missing words

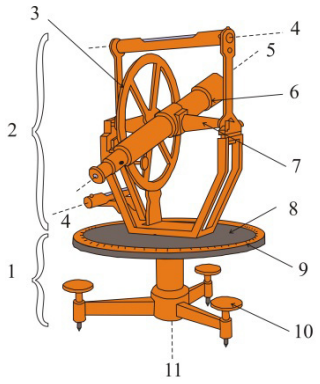
abscissa, direction, east, north, south, west

In geodesy, geodesic rectangular coordinate system is used in which its positive direction of axis x (abscissa) is turned to cartographic _____; negative x axis is turned to_____. Positive direction of axis y (ordinate axis) heads against _____ and negative axis y against _____. In coordinate system the point is determines with rectangular coordinates y (ordinate) and x (_____), of which sign +/- depends on the quadrant of this point. The size of a direction angle is between 0° and 360°, numbered from positive x axis in clockwise _____.

Pair work: Read the general description of angle measurements and describe the Figures below to your neighbour.

In geodesy, angle and distance measurements are mainly performed to measure horizontal and vertical (height) angles. A horizontal angle is an angle between two points on the fictive horizontal plane.

The instrument for such measurements is theodolite and nowadays a total station. The horizontal angle is obtained by the subtraction of the second sideshot reading from the first side shot reading on the horizontal circle (Fig. 6 and 7). In Fig. 7 only one horizontal angle is measured (two directions or side shots) but from one station point *n* side shots and *n*-1 angles can be obtained (Fig 8).



1 – the base plate
2 – alidade
3 – vertical circle
4 – alidade axis L
5 – X axis of the telescope
6 – telescope
7 – Y axis – turning axis of the telescope
8,9 – horizontal circle
10 – levelling screw
11 – vertical axis

Figure 7: Theodolite;
(author: Rok Kamnik)

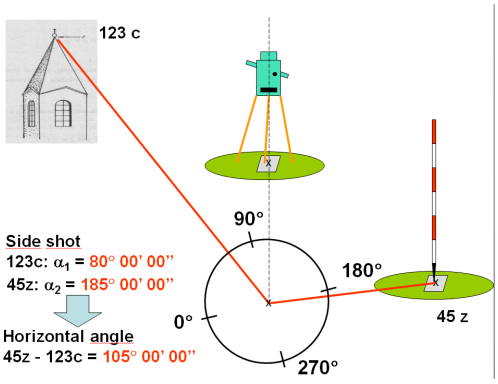


Figure 8: Side shot readings and horizontal angle calculation;
(author: Rok Kamnik)

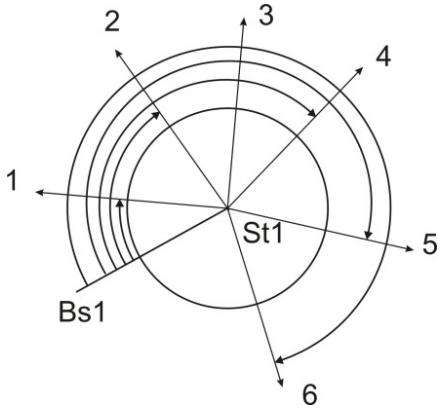


Figure 9: Direction (side shot) measurements;
(author: Rok Kamnik)

Homework

Find out more about one of the surveying tools and/or equipment and prepare a short oral presentation.

2 **Road design** (author: Tomaž Tollazzi)

Read the text and complete the sentences below.

Free section

The geometric design of roads is the branch of highway engineering with the positioning of the physical (design) elements of the roadway according to standards and constraints.
The basic objectives in geometrical design are to optimize efficiency and traffic safety while minimizing cost and environmental damage.

Geometric roadway design can be split into three main parts: horizontal alignment, vertical alignment, and cross-section. Combined, they provide a three-dimensional (spatial) layout for a roadway.

The horizontal alignment is the route of the road, defined as a series of horizontal tangents, clothoids (transitional curves) and curves.

The horizontal alignment is the vertical aspect of the road, including crest and sag curves, and the straight grade lines connecting them.

The cross section shows the position and number of vehicle and bicycle lanes and sidewalks, along with their cross slope or banking. Cross sections also show drainage features, pavement structure and other items outside the category of geometric design.

Intersection and Interchange

An intersection is an at-grade junction where two or more roads meet or cross. Intersections may be classified by number of road segments, traffic controls, and/or lane design.

In accordance with Slovenian legislation, there are just three types of at-grade intersections: perpendicular three-arm "T" intersection, perpendicular four-arm "+" intersection, and roundabout.

A roundabout is a type of circular intersection in which road traffic flows in one direction around a central island. Roundabout requires entering traffic to give way to traffic already on the circulatory carriageway. Today, several different types of roundabouts exist.

An interchange is a road junction that typically uses grade separation, and one or more ramps, to permit traffic on at least one highway to pass through the junction without directly crossing any other traffic stream. It differs from a standard intersection, at which roads cross at-grade. These days several different types of interchanges are known.

(Source: written by dr. Tomaž Tolazzi)

1. The positioning of the physical (design) elements of the roadway should meet ….

2. Efficiency optimization, traffic safety, cost and environmental damage minimization are …

3. Horizontal alignment, vertical alignment, and cross-section form …

4. Clothoids are …

5. The horizontal alignment comprises…

6. The cross section includes…

7. Classification of intersections depends on…

3 Business letters

General

Learn how **business letters** (Erickson & et al., n.d.) should be written and put into the right order the following:

- Name of city and postcode
- Number and name of the street/road/square/avenue
- Name of the house or the building
- Name of the country
- Name of town or the person and/or the company

4 Business letter format

Example

By using **the sample** ("Sample Letter Requesting Information," n.d.) write a letter requesting information.

[Your Name]
[Street Address]
[City, St Zip]

[Today's Date]

[Name of Recipient]
[Title]
[Company]
[Address]
[City, St Zip]

Dear [Name of Recipient]: (If unknown, use To Whom It May Concern:)

[Short introduction paragraph, stating purpose]

[Additional information]

[Closing information, summary or thank you as appropriate]

Sincerely,

[Sign here for letters sent by mail or fax]

[Your Name]
[Title – if applicable]

Enclosures: #
CC:

5 Business e-mails

- An e-mail is much less formal than a written letter. E-mails are usually short and concise.
- If you are writing to someone you don't know, a simple "Hello" is adequate. Using a salutation such as "Dear Mr Smith," is formal.
- When writing to someone you know well, feel free to write as if you are speaking to the person.
- Use abbreviated verb forms (He's, We're, He'd, etc.)
- Include a telephone number to the signature of the e-mail. This will give the recipient the chance to telephone if necessary.
- It is not necessary to include your e-mail address as the recipient can just reply to the e-mail.
- When replying, eliminate all unnecessary information. Leave only the sections of the text that are related to your reply. This will save your reader time.
- E-mails may be formal or less formal, depending on the writer's relation to the receiver/reader.

Example 1: Formal

Dear Mr Pitt,

I read on your web site that you offer good quality computers. I'd like to inquire about the technical data and price of the model *HP ENVY 27*. Are the files transferred online, or by standard mail? How long does it usually take to produce approximately 500 computers? Are there any discounts on such a large quantity?

Thank you for taking the time to answer my questions. I look forward to your response.

Sincerely,

John Gates
Sales Manager, Young Talent Inc.
(0061) 58-77 – 3498

Example 2: Less formal

Hello Tom,

Listen, we've been working on the Smith account and I was wondering if you could give me a hand? I need some inside information on recent developments over there. Do you think you could pass on any information you might have?

Thanks

Peter

Peter Thompsen
Account Manager, Tri-State Accounting
(0061) 345 - 7843

6 **Curriculum vitae (CV)** (European Union, 2018)

Personal information	
First name(s) / Surname(s)	Matej Breznik
Present address	25, Za vinogradi, 2000 Maribor
Telephone number	00386 2 57 89 99
E-mail	matej.breznik@com.si
Nationality	Slovene
Date of birth	13 May 1988
Gender	Male
Work experience	
2015 – present	unemployed
June 2010-Dec 2014	Sterling Construction Company
Education and Qualifications	
2002- 2006	Secondary School of Engineering
2006 – 2010	The Faculty of Civil Engineering, Transportation Engineering and Architecture Bachelor of Engineering
Additional information	My interests include computing. While working I attended various evening courses for German.
References	Tutor Mr. B. Jeremy, Assistant Director Pikus, Ltd., Maribor

(Ltd. = limited liability – družba z omejeno odgovornostjo)

Write your own CV according to *Europass Curriculum vitae*:

University of Maribor Press

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