# Reinforced Concrete (RC) Structures

## Topic 3.

## Notation of structural concrete

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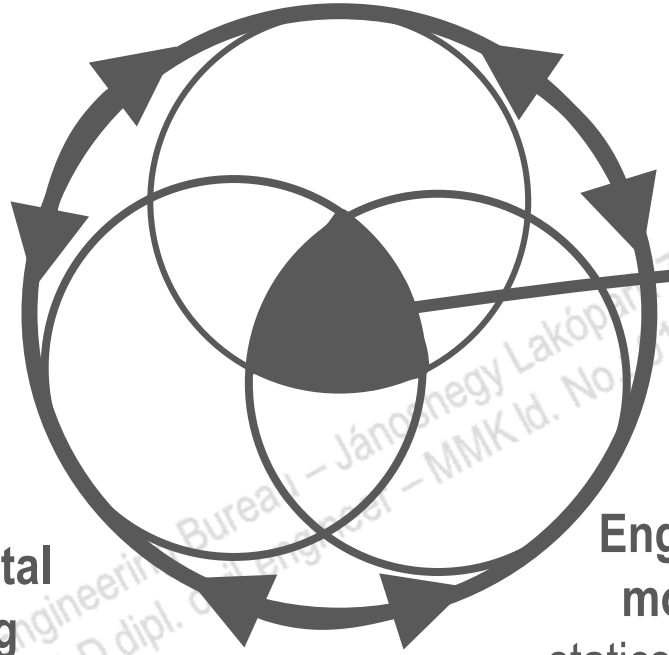
# Modeling of structural behaviour of RC members

**Numerical modelling**
linear, non linear, plastic, 1st order theory, 2nd order theory, etc.

**Material properties**
homogen, inhomogen, izotropic, anizotropic
elastic linear, non linear elastic,
plastic, viscous, reological properties, etc.



**Structural behaviour**

**Experimental modelling**
full-scale,
non full-scale, etc.

**Engineering modelling**
statics, strength of materials, elasticity, plasticity, dynamics, etc.

**Size effect**

**Environment**
effects, loads, durability properties, etc.

# Structural concrete in EN standards

**MSZ EN 1990 (Eurocode)** Basis of structural design

**MSZ EN 13670**
Execution of concrete structures

**MSZ 24803-1 and MSZ 24803-6-3**
Requirements for the appearance of building structural elements

**MSZ EN 1992 (Eurocode)**
Design of concrete structures

**MSZ EN 13369**
Common rules for precast concrete products

**MSZ EN 206** Concrete. Specification, performance, production and conformity

**MSZ EN 197-1 and MSZ EN 197-2**
Cement

**MSZ 4737-1 and MSZ 4737-2**
Special cements

**MSZ EN 1008**
Mixing water for concrete

**MSZ EN 12620**
Aggregates for concrete

**MSZ EN 450**
Fly ash for concrete

**MSZ EN 13263**
Silica fume for concrete

**MSZ EN 15167**
Ground granulated blast furnace slag for use in concrete, mortar and grout

**MSZ EN 13055**
Lightweight aggregates

**MSZ EN 934-1 and MSZ EN 934-2**
Admixtures for concrete, mortar and grout

**MSZ EN 14889**
Fibres for concrete

**MSZ EN 12878**
Pigments for the colouring of building materials based on cement and/or lime.

**MSZ EN 12350**
Testing fresh concrete

**MSZ EN 12390**
Testing hardened concrete

**MSZ EN 13791**
Assessment of in-situ compressive strength in structures and precast concrete components

**MSZ EN 12504**
Testing concrete in structures

# Designation of planned concrete and concrete of required composition

If the characteristics of the planned concrete are given in abbreviated form, **the following must be stated**:

- **compressive strength class** according to the compressive strength classes detailed in **Table 12** and **Table 13** of **MSZ 4798:2016** (**page 38 and 39**)

  e.g: **C25/30** (normal and heavy concrete)

  e.g: **LC25/28** (lightweight concrete)

  e.g: **$C30/37_{42\ day}$** (concrete tested at non 28 days of age)

- **environmental class(es)** with the designation of the class(es) according to **Table 1** (**page 28**) of **MSZ 4798:2016**:

  e.g: **XC3 XD2 XF1 etc.**

- **max. of chloride content:** with the class designation according to **Table 15** (**page 49**) of **MSZ 4798: 2016**:

  e.g: **Cl 0,10**

- **max. grain size of the coarsest aggregate** used in the concrete with $D_{max}$ [mm]:

  e.g: **24**

# Designation of planned concrete and concrete of required composition

If the characteristics of the planned concrete are given in abbreviated form, **the following must be stated**:

- in **case of lightweight concretes**, density by marking the class with the value according to **Table 14** of **MSZ 4798: 2016** or the planned value:

e.g: **D1,8**

- **consistency of concrete**: according to the consistency class given in **section 4.2.1** of **MSZ 478:2016** or by specifying the planned value and method:

e.g: **F3**

- **if the aggregate is not sandy gravel, the type of the aggregate** with which it is made, e.g crushed stone (detailed with e.g basalt, andesite, limestone, dolomite, rhyolite tuff, etc.), barite, expanded clay pebbles, expanded glass pebbles, etc., must be indicated in the environmental class before):

e.g: **basalt**

- reference to the relevant **standard**:

e.g: **MSZ 4798:2016**

# Designation of planned concrete and concrete of required composition

Also, **if it is required you must provide**:

- **type of cement** after the sign of the consistency class:

e.g: **CEM I 42,5–SR 0**

- name of **admixture**:

e.g: **silica fume**

- **design working life o**ther than 50 years:

e.g: **100 years**

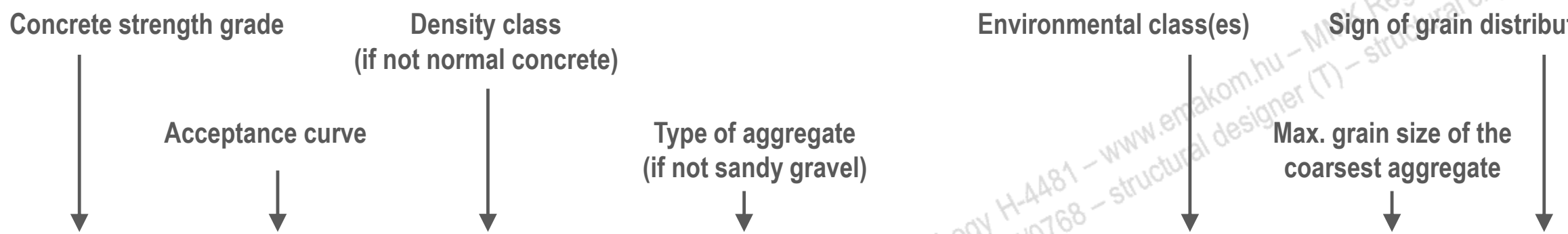
- **sign of grain distribution curve** of aggregate:

e.g: **B curve**

- **fineness modulus of aggregate**:

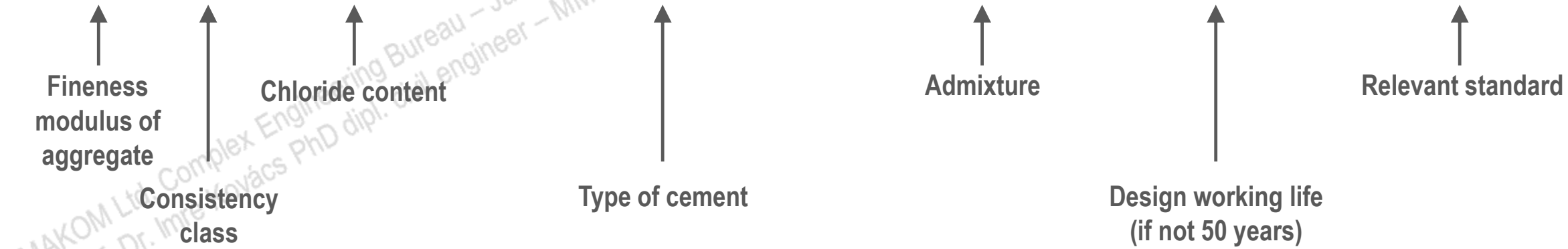
e.g.: **4,80**

# Designation of planned concrete and concrete of required composition




**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**



# Concrete strength grade in the notation of structural concrete

Concrete strength grade

➡ **Due to its importance it will be detailed further!**

**LC40/44** – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve – 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016

# Acceptance (characteristic) curve in the notation of structural concrete

Acceptance curve ➡

By using **the Acceptante Characteristic Curve**, we create a consistency between the **MSZ 4789: 2016 type of concrete as a material** and the **strength of MSZ EN 1992-1-1: 2010 type of structural concrete**, we apply it if possible !!!

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

The composition of the concrete is based on the mean compressive strength of concrete. Accordingly, concrete based on **EN 206** and **MSZ 4798:2016** may have a lower mean compressive strength – therefore may have a higher water to cement ratio, lower cement content, etc. – than concrete according to **MSZ EN 1992-1-1:2010 (Eurocode 2)**. Therefore, it cannot be ruled out that the cement stone of concrete according to **EN 206** and **MSZ 4798:2016** is more porous, with lower strength, ie having lower quality than its equivalent according to **MSZ EN 1992-1-1:2010 (Eurocoed 2)**!!!

# Density class (lightweight concrete) in the notation of structural concrete

**Density class**
**(if not normal concrete)**

LC40/44 – AC50(H) – **D1,8** – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve

– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016

| **Density classes for lightweight concretes according to MSZ 4798:2016** | | | | | | |
|---|---|---|---|---|---|---|
| **Density class** | **D1,0** | **D1,2** | **D1,4** | **D1,6** | **D1,8** | **D2,0** |
| Density range according to **MSZ EN 12390-7** [kg/m$^3$] | ≥ 800<br>≤ 1000 | > 1000<br>≤ 1200 | > 1200<br>≤ 1400 | > 1400<br>≤ 1600 | > 1600<br>≤ 1800 | > 1800<br>≤ 2000 |

# Type of aggregate (not sandy gravel) in the notation of structural concrete

**Type of aggregate**
**(if not sandy gravel)**

↓

LC40/44 – AC50(H) – D1,8 – **expanded clay pebbles** – XC4-XD2-XV2(H) – 24 – B curve

– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016

# Lightweight aggregate in the notation of structural concrete

**Type of aggregate**
**(if not sandy gravel)**
↓

LC40/44 – AC50(H) – D1,8 – **expanded clay pebbles** – XC4-XD2-XV2(H) – 24 – B curve

– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016

| | |
|---|---|
| Natural, mineral origin: | **volcanic tuff** (rhyolite tuff, dacite tuff, andesite tuff, basalt tuff), **lava slag** |
| Natural, organic origin: | **wood wool, wood chips, rice husk** |
| Artifical, industrial by-product origin: | **blast furnace slag, granulated blast furnace slag, fly ash, agloporite,** |
| Artifical, petroleum origin: | **polystyrene beads** |
| Artifical, waste eredetű: | **dexpanded glass gravel, construction demolition debris, brick fraction, mixed (concrete+brick) fraction** |

# Normal (not sandy gravel) aggregate in the notation of structural concrete

**Type of aggregate**
**(if not sandy gravel)**
↓

LC40/44 – AC50(H) – D1,8 – **expanded clay pebbles** – XC4-XD2-XV2(H) – 24 – B curve

– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016

| | |
|---|---|
| Crystalline rocks: | **granite** |
| Volcanic rocks: | **basalt, andesite, dacite, rhyolite, diabase** |
| Sedimentary rocks: | **grauwacke, sandstone** |
| Chemical sedimentary rocks: | **limestone, dolomite** |

# Heavy (radiation shield) aggregate in the notation of structural concrete

**Type of aggregate**
**(if not sandy gravel)**
↓

LC40/44 – AC50(H) – D1,8 – **expanded clay pebbles** – XC4-XD2-XV2(H) – 24 – B curve

– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016

| | |
|---|---|
| **barite** | (eruptive alluvial rock) |
| **magnetite** | (magnetic iron ore) |
| **hematite** | (red iron ore) |
| **limonite** | (braun iron ore) |
| **iron products** | (steel beer, regular shape clear steel scrap) |
| **serpentinite** | (transformed rock) |

# Special aggregate in the notation of structural concrete

**Type of aggregate**
**(if not sandy gravel)**
↓

LC40/44 – AC50(H) – D1,8 – **expanded clay pebbles** – XC4-XD2-XV2(H) – 24 – B curve

– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016

| | |
|---|---|
| Radiation shielding hydrate concrete: | **bauxite** (**not** the so-called bauxite concrete!) |
| Fire resistance concrete: | **chamotte crumbs and chamotte flour** |
| Extreamly wear-resistant concrete: | **silicon carbid, corundum, boron carbide, cast iron** |
| Waterproofing filler: | **trass**, **rock flour**, **bentonite** |

# Environmental class(es) in the notation of structural concrete

**Due to its importance it will be detailed further!**

MSZ EN 1992-1-1:2010

MSZ 4798:2016

Environmental class(es)

LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – **XC4-XD2-XV2(H)** – 24 – B curve

– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016

| | |
|---|---|
| **No risk** of corrosion or attack: | X0 XN(H) X0b(H) X0v(H) |
| Corrosion induced by **carbonation**: | XC1 XC2 XC3 XC4 |
| Corrosion induced by **chlorides**: | XD1 XD2 XD3 |
| Corrosion induced by chlorides from **see water**: | XS1 XS2 XS3 |
| **Freeze/thaw** attack: | XF1 XF2 XF2(H) XF3 XF3(H) XF4 XF4(H) |
| **Chemical attack** (natural soils and ground water): | XA1 XA2 XA3 |

# Environmental class(es) in the notation of structural concrete

**Due to its importance it will be detailed further!**

Environmental class(es)

MSZ EN 1992-1-1:2010

MSZ 4798:2016

LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – **XC4-XD2-XV2(H)** – 24 – B curve

– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016

| | | | | | |
|---|---|---|---|---|---|
| Chemical corrosion (other agressive environment): | XA4(H) | XA5(H) | XA6(H) | | |
| Wear-resistant concrete: | XK1(H) | XK2(H) | XK3(H) | | |
| Waterproof concrete: | XV0(H) | XV1(H) | XV2(H) | XV3(H) | |

# Max. grain size of the coarsest aggregate in the notation of structural concrete

**Max. grain size of the coarsest aggregate**

↓

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

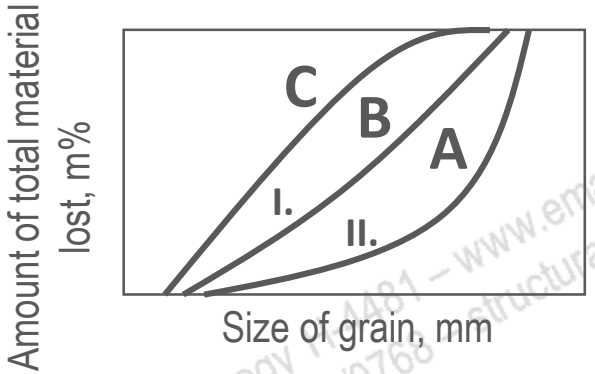
**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

Typical maximum grain sizes [mm] of concrete aggregates according to **MSZ 4798:2016:**

**…..8…..12 (11,2)…..16…..20…..24 (22,4)…..32 (31,5)…..48 (45)…..63…..**

# Sign of grain distribution curve in the notation of structural concrete

| | |
|---|---|
| $D_{max}$ = 8 mm | MSZ 4798:2016 NAD E1. figure |
| $D_{max}$ = 12 (11,2) mm | MSZ 4798:2016 NAD E2. figure |
| $D_{max}$ = 16 mm | MSZ 4798:2016 NAD E3. figure |
| $D_{max}$ = 24 (22,4) mm | MSZ 4798:2016 NAD E4. figure |
| $D_{max}$ = 32 (31,5) mm | MSZ 4798:2016 NAD E5. figure |
| $D_{max}$ = 48 (45) mm | MSZ 4798:2016 NAD E6. figure |
| $D_{max}$ = 63 mm | MSZ 4798:2016 NAD E7. figure |




**Sign of grain distribution curve**

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

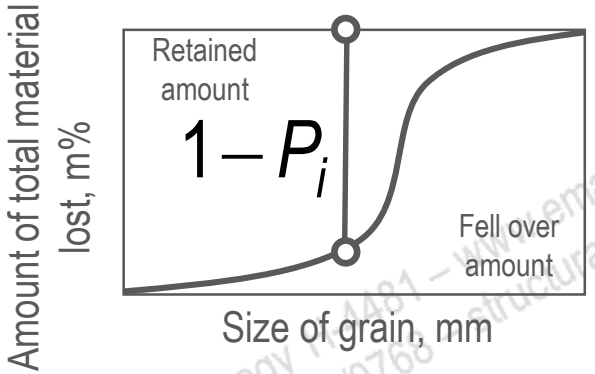
**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

According to **MSZ 4798:2016**, the grain distribution curve of the concrete aggregates can be referred to in several ways:

**…..”A”…..”B”…..”C”…..”AB”…..”BC”….. I. ….. II. …..**

# Fineness modulus of concrete aggregate in the notation of structural concrete

| | |
|---|---|
| $D_{max}$ = 8 mm | MSZ 4798:2016 NAD E1. figure |
| $D_{max}$ = 12 (11,2) mm | MSZ 4798:2016 NAD E2. figure |
| $D_{max}$ = 16 mm | MSZ 4798:2016 NAD E3. figure |
| $D_{max}$ = 24 (22,4) mm | MSZ 4798:2016 NAD E4. figure |
| $D_{max}$ = 32 (31,5) mm | MSZ 4798:2016 NAD E5. figure |
| $D_{max}$ = 48 (45) mm | MSZ 4798:2016 NAD E6. figure |
| $D_{max}$ = 63 mm | MSZ 4798:2016 NAD E7. figure |




$$m\% = \sum_{i=1}^{n} \frac{(1-P_i)}{100}$$

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

**Fineness modulus of aggregate**

**Fineness modulus of coarse aggregates** represents the **average size of the particles** in the coarse aggregate by an index number. It is calculated by performing **sieve analysis** with standard sieves. The cumulative percentage retained on each sieve is added and subtracted by 100 gives the value of fine aggregate. Higher the aggregate size higher the fineness modulus hence fineness modulus of coarse aggregate is higher than fine aggregate.

# Consistency class of fresh concrete in the notation of structural concrete

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

**Consistency class**

# Consistency class of fresh concrete in the notation of structural concrete

| | |
|---|---|
| Slump class: | **S1** (10-40 mm) , **S2** (50-90 mm) , **S3** (100-150 mm) , **S4** (160-210 mm) , **S5** (≥220 mm) |
| Compactability class: | **C0** (≥ 1,46) , **C1** (1,45-1,26) , **C2** (1,25-1,11) , **C3** (1,10-1,04) , **C4** (< 1,04) |
| Flow class: | **F1** (≤ 340 mm) , **F2** (350-410 mm) , **F3** (420-480 mm) , **F4** (490-550 mm) , **F5** (560-620 mm) , **F6** (≥ 630 mm) |
| Slump-flow class: | **SF1** (550-650 mm) , **SF2** (660-750 mm) , **SF3** (760-850 mm) |

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

**Consistency class**

| | |
|---|---|
| Slumping test according to: | **MSZ EN 12350-2** |
| Degree of compactability according to: | **MSZ EN 12350-4** |
| Flow table test according to: | **MSZ EN 12350-5** |
| Slump-flow test according to: | **MSZ EN 12350-8** |

# Consistency class of self compacting conc. in the notation of structural concrete

| | |
|---|---|
| Viscosity (slump flow test), $t_{500}$ classes: | **VS1** (< 2,0 s) , **VS2** (≥ 2,0 s) |
| Viscosity (V-funnel test), $t_v$ classes: | **VF1** (< 9 s) , **VF2** (9,0-25,0 s) |
| Passing ability (***L*** box test) classes: | **PL1** (≥ 80, with 2 piece of brakes ) , **PL2** (≥ 80, 3 piece of brakes) |
| Passing ability (***J*** ring test) classes: | **PJ1** (≤ 10, with 12 piece of brakes) , **PJ2** (≤ 10, 16 piece of brakes) |
| Sieve segregation resistance classes: | **SR1** (≤ 20 m%) , **SR2** (≤ 15 m%) |

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

**Consistency class**

| | |
|---|---|
| Viscosity (**slump flow test**), $t_{500}$ classes according to: | **MSZ EN 12350-8** |
| Viscosity (**V-funnel test**), $t_v$ classes according to: | **MSZ EN 12350-9** |
| Passing ability (***L* box test**) classes according to: | **MSZ EN 12350-10** |
| Passing ability (***J* ring test**) classes according to: | **MSZ EN 12350-12** |
| Sieve segregation resistance classes according to: | **MSZ EN 12350-11** |

# Chloride content in the notation of structural concrete

| | | |
|---|---|---|
| **No steel bars** or other embedded metals, except corrosion-resistance lifting lugs: | **Cl 1,00** | (1,00 cm%) |
| **Steel bars** or other embedded metals: | **Cl 0,20** | (0,20 cm%) |
| | **Cl 0,40** | (0,40 cm%) |
| **Prestressing materials** in direct contact with concrete: | **Cl 0,10** | (0,10 cm%) |
| | **Cl 0,20** | (0,20 cm%) |

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

**Chloride content**

The **amount of chloride ion in the concrete**, expressed as a **percentage of weight of the cement** – ie the chloride content of the concrete – shall not exceed the amount given for the class in **Table 15** of **MSZ 4798**

# Type of cement in the notation of structural concrete

**Notation of cement (I.-V.):**

| | |
|---|---|
| **I.** | portland cement |
| **II.** | composite portland cement |
| **III.** | slag portland cement |
| **IV.** | pozzolanic cement |
| **V.** | composite cement |

**Ratio of the main components (A, B, C):**

| | |
|---|---|
| **CEM I:** | homogen A, B or C |
| **CEM II:** | A (6-20%), B (21-35%) |
| **CEM III:** | A (36-65%), B (66-80%), C (81-95%) |
| **CEM IV:** | A (11-35%), B (36-55%) |
| **CEM V:** | A (36-60%), B (62-80% |

**Main components near clinkers (K):**

| | |
|---|---|
| **V / W** | acidic or basic fly ash |
| **S** | granulated slag |
| **D** | silica fume |
| **P / Q** | natural or artificial pozzolan (trass) |
| **L / LL** | limestone |
| **T** | burnt shale |
| **M** | composite cement: near (K) min. 2 other comp.) |

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

**Lower characteristic value of the compressive strength:**

| | |
|---|---|
| **32,5** | N/mm$^2$ |
| **42,5** | N/mm$^2$ |
| **52,5** | N/mm$^2$ |

**Type of cement**

**e.g: CEM II B-M (V-L) 32,5 N**

**Initial strength:**

| | |
|---|---|
| **N** | normal initial strength |
| **L** | low initial strength |
| **R** | high initial strength |

**Indications of sulfate resistance**:

| | |
|---|---|
| **MSR** | moderately sulfate resistance |
| **SR** | sulfate resistance |

**Low heat generation:**

| | |
|---|---|
| **LH** | low heat generation |

# Admixture materials in the notation of structural concrete

**I. Type: inert (chemically not reactive) admixture materials:**
Limestone flour (filler material)
Quartz flour (filler material)
Fibres (for fibre reinforced concrete)
Pigments (coloring materials)

**II. Type: pozzolanic or latent hydraulic admixture materials:**
Soot (latent hydraulic)
Silica fume (latent hydraulic)
Trass (pozzolanic)
Slag (latent hydraulic)
Hydraulic lime (hydraulic)

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

**Admixture**

# Design working life in the notation of structural concrete

| Design working life category | Indicative design working life (year) | Examples |
|---|---|---|
| 1 | 10 | Temporary structures(1) |
| 2 | 10-25 | Replaceable structural parts, e.g. gantry girders, bearins |
| 3 | 15-30 | Agricultural and similar structures |
| 4 | 50 | Building structures and other common structures |
| 5 | 100 | Monumental building structures, bridges and other civil engineering structures |

**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**

**Design working life**
**(if not 50 years)**

# Relevant standard in the notation of structural concrete

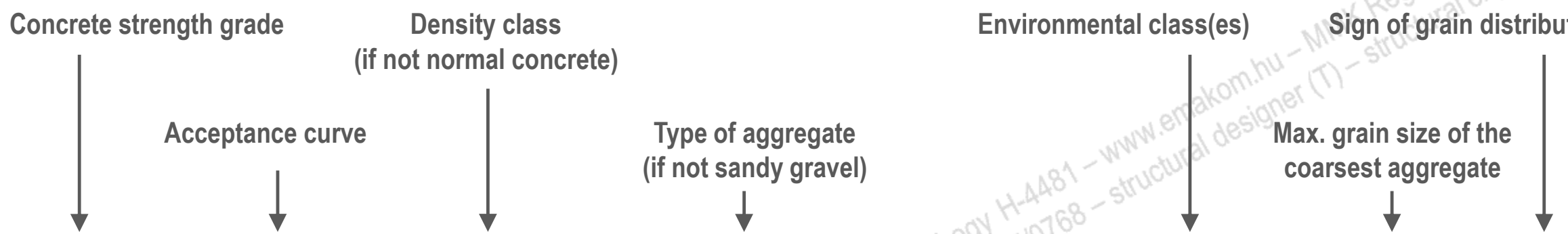
The standards **MSZ EN 206-1:2002** and **MSZ 47981:2004**, after more than a decade of use - taking into account the practical experience of concrete construction - are understood to be updated and modified both in Europe and in Hungary. The standard **MSZ EN 206-1: 2002** has been replaced by the standard **MSZ EN 206: 2014** and the standard **MSZ EN 206: 2013+A1:2017**. Replacement of the national application document **MSZ 47981:2004** with new standards **MSZ 4798:2016** and **MSZ 4798:2016/1M:2017** was necessary. At the same time, this made it possible to incorporate newer Hungarian concrete technology aspects into the **MSZ 4798:2016** standard and to refine them in the **MSZ 4798:2016/2M:2018** standard.

**LC40/44 – AC50(H) – D1,8 – duzzasztott agyagkaviccsal – XC4-XD2-XV2(H) – 24 – B görbe – 4,80 – F 4 – Cl 0,10 – CEM I 42,5 N-SR 0 – metakaolin – 100 év – MSZ 4798:2016**

Relevant standard

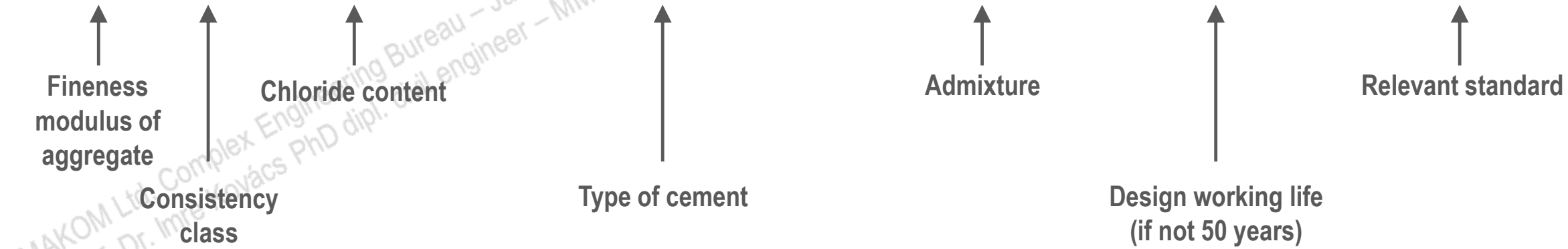
http://www.betonujsag.hu/lapszamok/cikk/2084/
a-betonszabvanyok-valtozasa-2014-es-2018-koezoett

# Designation of planned concrete and concrete of required composition




**LC40/44 – AC50(H) – D1,8 – expanded clay pebbles – XC4-XD2-XV2(H) – 24 – B curve**

**– 4,80 – F4 – Cl 0,10 – CEM I 42,5 N-SR 0 – silica fume – 100 years – MSZ 4798:2016**



# Examples for concrete notation – MSZ 4798:2016 – Chapter 11. – pages 98.-99.

**Example 1:** The designation of the concrete of compressive strength class **C30/37** (standard concrete) to be used for a reinforced concrete frame structure (environmental class **XC3**), with a nominal maximum grain size $\mathbf{D_{max}}$ **= 24 mm**, with a **plastic** consistency and it being known at the time of design that the consistency will or should be determined by means of a **slump test** and that the slump should be between **50 and 90 mm**, i.e. consistency class **S2**, is as follows:

**C30/37 – XC3 – 24 – S2 – MSZ 4798:2016/2M:2018**

**Example 2:** The designation of a **C40/50** compressive strength class, manufactured without air-entraining admixtures, abrasion-resistant (normal) **basalt** concrete used for the reinforced concrete paving of outdoor container yards subject to frost and melting salt attack and abrasion (environmental class: **XC4, XF4(H), XK3(H)**), with a nominal maximum grain size of $\mathbf{D_{max}}$ **= 32 mm**, the plastic consistency with a flow range of **420 to 480 mm**, consistency class **F3**, is:

**C40/50 – basalt – XC4-XF4(H)-XK3(H) – 32 – F3 – MSZ 4789:2016/2M:2018**

or

**C40/50 – basalt – XC4-XF4(H)-XK3(H) – 32 – F3(450±30) – MSZ 4789:2016/2M:2018**

# Examples for concrete notation – MSZ 4798:2016 – Chapter 11. – pages 98.-99.

**Example 3:** The designation of lightweight concrete of compressive strength class **LC12/13**, having a body density in the range **1600 to 1800 kg/m$^3$** in the solid state, aggregated with **expanded clay pebbles**, and used to construct an internal load-bearing wall of lightweight concrete (environmental class: **X0b(H)**), with a nominal maximum grain size **$D_{max}$ = 16 mm**, with a consistency on the borderline between **slightly péastic** and **plastic**, with a consistency class sign **C2**, expressed by the symbol for the degree of compaction, as follows:

**LC12/13 – D1,8 – expanded clay pebbles – X0b(H) – 16 – C2 – MSZ 4798:2016/2M:2018**

or

**LC12/13 – D1,8 – expanded clay pebbles – X0b(H) – 16 – C2(1,25-1,11) – MSZ 4798:2016/ 2M:2018**

# Examples for concrete notation – MSZ 4798:2016 – Chapter 11. – pages 98.-99.

**Example 4:** The designation for a concrete of compressive strength class **C40/50** (standard) used to make prestressed reinforced concrete beams in places protected from rain (environmental class: **XC3**), with a nominal maximum grain size $\mathbf{D_{max}}$ **= 24 mm**, with a **plastic consistency** and an flow test result between **420 and 480 mm**, with a consistency class **F3**, with a **permissible chloride content** of **0,10 % by weight of cement**, made with portland cement of strength class **CEM I 52,5**, with a service life of **100 years**, is :

**C40/50 – XC3 – 24 – F3 – Cl 0,10 – CEM I 52,5 – 100 years – MSZ 4798:2016/2M:2018**

or

**C40/50 – XC3 – 24 – F3 (450±30mm) – Cl 0,10 – CEM I 52,5 – 100 years – MSZ 4798:2016/2M:2018**

# Examples for concrete notation – MSZ 4798:2016 – Chapter 11. – pages 98.-99.

**Example 5:** The designation of concrete compressive strength class **C35/45** (standard) used for the construction of industrial waste water settling basins (environmental class: **XC4, XD2, XA5(H), XV2(H)**), with a nominal maximum grain size of $\mathbf{D_{max}}$ **= 32 mm**, a consistency of highly plastic and the flow test result between **490 and 550 mm**, a consistency class of **F4**, made with sulphate-resistant portland cement of type **CEM I 42,5 N-SR 0** and a **methakaolin admixture**, with a design life of **100 years**, is :

**C35/45 – XC4 – XD2 – XA5(H) – XV2(H) – 32 – F4 – CEM I 42,5 N-SR 0 – metakaoline – 100 years – MSZ 4798:2016/2M:2018**

or

**C35/45 – XC4 – XD2 – XA5(H) – XV2(H) – 32 – F4 (520 ± 30 mm) – CEM I 42,5 N-SR 0 – metakaoline – 100 years – MSZ 4798:2016/2M:2018**

# Reinforced Concrete (RC) Structures

## Topic 3.

## Notation of structural concrete

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Thank you for your kind attantion!