

## QUALITY CONCRETE – PERFORMING CONCRETE PLANTS

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### ABSTRACT

*The buildings compositions quality, as well as resistance, stability and durability imposed by the law 10/1995 depends by the quality of concrete who should fulfil the conditions imposed by the Practical Code NE 012/99. The ensurance of buildings compositions quality is influenced by the preparing technology of the concrete.*

*The technical performances and characteristics of the concrete are connected with the quality of the technological process, with the achievement and testimony of the concrete components until his delivery.*

*Law 10/1995 refering to the ensurance of the buildings quality impose severe conditions to the buildings quality impose severe conditions to the concrete compositions, these could be respected only by using suitable technologies and equipments.*

*These technologies and equipments should be competent seeing the raise of the concrete building, the bettering of quality and raise of the concrete performances.*

### 1. Fresh concrete

The main factors which determines the quality of fresh concrete are : the resistance, the homogeneousness and power of work.

The concrete can be definite like an artificial conglomerate obtained by consolidation of mixture of water, cement aggregates and additives. All the components contribute at the obtain of the required resistances: the cement type; the ratio w/c; the quality of the mineral aggregates; the quality of the water and the quality of the additives.

The cement influences by quality and quantity both the fresh concrete characteristics and the hard concrete. If the aggregate and consistancy mantain constant at, a chosen concrete, then at the gradual raise of the cement dose we can see the next influences of the concrete characteristics:

- the resistance at compression raises as well as the cement dose, but not proportionally.

If we make the report between the concrete resistance at compression and the real dose of the concrete in which we can see how many kilos f means a kilo of cement we can obtain the next values:

Dose – kilo/m <sup>3</sup> k f/k c	100	200	300	400	600	800	1000
	0,30	0,5	0,77	0,76	0,69	0,55	0,47

From this table we can see the fact that by the 300-400 kilos of cement-mc concrete we obtain the most economical utilisation of the cement.

At the same dose the resistance of the concrete is more bigger as the used cement has a raised type.

-the resistance at flexure stretching raises like the dose until 400 kilos of cement-mc concrete.

For big doses this resistance stays a while then begin to fall.This fall exists because of the

raise of the drying contraction and appears the concrete fissure phenomena.

The mixture water:

- react with the cement for making the matrix;

- give moisture to the surface of aggregates and give consistency to the concrete.

For bond completely a cement we need a water quantity of maximum 25% by his weight and the most solid concrets by minimum 35% water reported to cement, always the water quantity in mixture is bigger than the water quantity needed for the cement hydratation this water surplus will disappear after the binder consolidation, leaving pores in his place.

The resistance of any material is so smaller as the concrete porosity is influenced by the water who did not bound up chemical with the cement.

For the same consistency concrets but with variable dose, the unbound water is in bigger quantities at concrets with smaller dose of cement than the concrets with bigger dose, because the water and cement ratio is so smaller as the cement dose is bigger. Result is that the negative effect of the unbound water is more stressed at reduced cement dose concrets. That is why is necessarily for the mixture water to be always a report w/c and not reported to all concrete.

- if we reduce the report w/c under the optimal values, the concrete composition is reduced and cannot be compact, she remain porous;

- if the report w/c is bigger than the optimal value the binder paste is very porous and with many capilar channels open from the outside. The couple of flaws lead to the mechanical resistances reducing of the concrete but they lead also to high sensibility at froze-thaw and corosion.

For concrets, granulosity remains for all the aggregation mixture.

We can see that:

- the aggregation mixture must contain so much sand as we require for the ensurance of the composition. Too much sand lead always to the enlargement of the report w/c and to the contraction at drying and the weight reduce and mechanical resistances reduce.

- the gravel is granulosity does not make any influence to the mechanical characteristics of the concrete if the mixtures are workable;

- the replacement of the gravel with broken rock make better the concrets resistances;

The gravel and the broken rock must be inert by chemical point of view for the born of the expansion phenomena, to not contain levigabils parts and to be dry. A big humidity of the

aggregates can lead to a raise of the water quantity in concrete and evidently to the negative effects reminded.

The water quality is an important factor for the obtain of a quality concrete, used for mixture which must not contain pest substances which may influence negatively the plug properties, the reinforcement of the concrete.

The additives are chemical products which we may add in concrete in smaller or equal cuantities with 5% of dry substance in report with the cement weight, to modificate the concrete properties in fresh or reinforcement state.

The additives effect upon the concrete properties is in reality a complex phenomena next to the principal effect existing one or more secondary effects more or little pronounced.

The homogeneousness degree can be determined in function of S values and medium resistance  $X_n$  of a minimal 16 results registered in any period.

the homogeneousnes s degree	$\sqrt{\frac{S}{X_n}}$
I	<0,670
II	0,670....0,975
III	>0,975

$$S_n = \sqrt{\frac{\sum (x_i - \bar{x}_n)^2}{n-1}}$$

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$$l = 1, 14; 1, 125; 1, 11...$$

$$n_{probe} = 16; 17; 18....$$

$$\sigma \sqrt{\frac{S}{x_n}}$$

The workability means the fresh concrete capacity to be poured in different conditions and be compacted suitable. The workability is appreciated on the concrete consistency.

The concrete consistancy depends by the element type, the structural elements dimensions, the arming placing, the transport equipment and work is put of concrete, by the compact possibilities and medium conditions in turning time. The consistency can be measured:

- the cone settle (mm);

- the remodelling VE-BE (s);

- compact grade (Waltz, Ge);

- spreading (mm).

## 2. The strengthen concret

The concrete class is defined by the character of resistance  $f_{ck\ cyl}$  ( $f_{ck\ cub}$ ) which is the

compression resistance at age of 28 days, under his value being statistic maximum 5% of the results.

The resistance at water penetration release the impermeability grade needed for the concrete in function of the expose class which is made at 28 days and 60,90 and 180 days.

The resistance at froze-thaw represents the cycles number which the concrete does not modify his resistance.

The concrets density has a table: easy concrets ( $\rho \leq 900 \text{ kg/m}^3$ ), normal ( $\rho \leq 1201 \text{ kg/m}^3$ - $2000 \text{ kg/m}^3$ ), and hard ( $r > 2001 \text{ kg/m}^3$ ).

The concrete quality is not assured only by the materials quality but by the technological method quality and the technologic equipments quality which realises the complete process:

The determinant processes over the concrete quality are batching and mixing.

The gravimetrical batching must be assured by integral dynamical weighing systems, assisted and commended with the programable microprocessor help, in real time. The concrete components batching means, in reproduct of production conditions of weighing proportions setted in the lab with, as much possible, very little errors, for realise the concrete quantity saw in the projects or workbooks.

The batching process influences directly the next parameters: the consistency, the class of the density. The batchers must fulfil the next acquirements:

- the material feeding must be uniform and without volume jumping or weighing;
- the evacuation debit from the batcher must be driven by very sure methods;
- the material share at the end of the feeding cycle must be little by 0,5% ;
- the weight batching must be a technological operation very sure in her limits, assisted automatically or semiautomatically and informatised. The batching verification is made;
- for the batching precision, at least once a week, but not more than 50 hours of continual function;
- for the mentenancy state, at least 3 times per month, but at least 80 hours of continual function;
- for metrological certification it will make a verification once a year at continual function or trimensual, half;
- yearly when are interruptions in work,(very cold time, no commands etc.).

If we doesn't respect these demands we will see that:

- the concrete preparing cease in the batching cement or aggregates;

-the functioning limit at maximum 5 days, in water batching case or additives with graduated cylindres.

The mixture has role to make all particles of aggregate to cover at surface with cement paste and scatter all adds uniformly in their whole weight of concrete, the uniformity must not be disturbed by the descharge from the concrete mixer.

Must be mentioned the fact that for obtaining a concrete with uniform structure, so with a good resistance an important fact is the minimum time of mixture .

The mixture time is variable in function of the concrete mixer type which is used and in fact not the time but the number of rotations of the machine chest is important for an adequate mixture obtained.

Exists an optimal speed of rotation recommandes by the factor who produced it the number of rotations and the mixture time are interdependent.

For the mixture obtaining we use the malaxating machine in the concrete case we call her concrete mixer.

The concrete centrals can have concrete mixers with mixture by free fall, with forced mixture or combined mixture.

The constructives parametres and functional of any concrete mixer, who influences the concrete mixer, who influences the concrete quality are:

- the configuration and the geometrical dimensions of the machine chest;
- the place and the palettes; the dispose ray, the angle in report with the horizontal and vertical plane;
- the training tree revolution;
- the maximum speed and seed distributions on all the palettes;
- the cover grade of the palletes, on the active surface of machine chest.

The detailed mode of determination and verification of the technological parameters, which certifies the capacity of the concrete mixer to prepare valid concrets for the free fall concrete mixer.

- the filling grade of the concrete mixer, measuring beforehand, the geometrical and useful, of the concrete mixer.

$$g_u = \frac{V_{beton}}{V_{toba}}$$

- drum revolution determination-we can measure the drum revolution for the extreme values in vacuum and in work.

- the inclination angle of the drum-we can measure it with a rapporteur.

- checking of the vacuum type of the concrete mixer drum.

For concrete mixers with forced mixture the determination, functional and technological parameters checking factors are:

- determination of the filling grade of the concrete mixer;
- determination of palettes revolution –for the extreme values, in vacuum and in work;
- determination of inclination angle of the palettes;
- vacuum type checking of concrete mixer drum
- we unload the concrete by key action and we control the unload efficiency and the shutting-opening type of this.

The mixture length is established experimentally for each mixing formula:

- at free fall concrete mixer:
  - for plastic concretes  $\cong 60$ s;
  - for solid concretes  $\cong (100-120)$ s;
- at forced mixture concrete mixer:
  - for plastic concretes  $\cong 45$ s;
  - for solid concretes  $\cong (50-60)$ s.

The mixture for a long while makes the water from the mixture to evaporate, to reduce the workability and to raise the resistance.

Another secondary effect is breaking up the aggregate, especially when that is more ephemeral. The aggregate granulosity becomes more delicated and workability more reduced.

In concrete which contain entrapped air case, any long length mixture makes it to reduce air structure with 1/6 in an hour (in function of the training agent type), and a postponement of the work putting without any continual mixture has as effect reduce of the air contain with only 1/10 in an hour.

If until now we analysed the parameters of the concrete quality a special problem is the ensurance of the processing equipments security, that means the man protection and the environment protection.

By man protection we assure optimal conditions for work:

- noise level;
- vibration;
- dust emanation;
- dust protection;
- electric protection;
- bad weather protection (rain, cold,ice);
- mechanical protection elements;
- illumination ;
- visibility;
- air conditioning.

An important role has the environment protection and that s why we take measures of: Water discharge elimination, cement and aggregates wastes from the supply depots and silos in charging moment, on feeding route of dose install and on their unload in the concrete mixer.

The silos will have cement filters and indicators for the maximum level of loading.

The concrete mixer will have a retain system of the dust (cement and delicate aggregates).

For the environment protection , the platform which has the concrets factory will have water settlers for the sewage waters leaking from the storing platform of the aggregates. For the vehicles used at concrete transport washing, wasted waters must be evacuated in a brightner pool. The brightner aggregates can be recovered and reintroduced in technological process.

Because of the concrete stations importance them will work only like a certificate released working time, and periodical at 2 years on any evaluation .In the time between procedures of cerificate and recertificate the one who have concrets stations must make the autoevaluation, to mantain permanently functional exigences and of technical quality imposed at the certificate.

In the concrete station all equipments will be technical certificated by CNAMEC and RMEC. These concrete stations will be leaded by a station chief certificated by ISCLPUAT who makes territorial inspection.

Because a big part of the concrets stations has used equipments, the concrete does not obtain the quality requests we impose the next measures:

- modernisation of dose installation;
- technological flux automatization;

The concrete prepared in concrete station with automatized command of the whole flux, can and must obtain the optimal condition watching the concrete quality, realising a maximum capability, as following of any phases from the technological process with the interblocking producing needed.

The automatization installation from the concrete station must assure:

- the materials level from the depots;
- automatically dose with big precision of the components;
- automatically corection of water and aggregate dose;
- automatically program of the prescription;
- mixing time can be programmed in function of the concrete class and the used capacity of the machine chest.

By technological process automatization we eliminate the human subjectivism dose abnormal, mixing time reduced.

## References

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- [3]ISO 2736-85 – *Concrets tests*;
- [4]Law 10/1995 **watching the buildings quality**
- [5]Neville A.M. *The concrete properties*;
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