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CONSIDERATIONS REGARDING USING CONCRETE WITH DISPERSED REINFORCEMENT AND FERROCEMENT

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Abstract: *The paper presents some considerations about concrete with disperse reinforcement and ferrocement. Ferrocement is a cheap and quality material for construction, with very large scale applications, which can become an alternative material in the design and implementation of buildings.*

Key words: *dispersed reinforcement, finishing materials, ferrocement.*

1. Introduction

Lately in construction reveals a growing demand for building materials cheaper but with the proper quality. The concrete with disperse reinforcement or ferrocement can be tempting materials for building due to the simplicity of achievement, as well behaviour favourable to various stresses compared to reinforced concrete [1]. The ferrocement is a composite material that can be performed for various elements of building and can successfully replace diverse traditional building materials as: reinforced concrete, wood, brick, etc [5], [6], [10].

The ferrocement is a construction material with a good quality-price ratio, with a very large scale application and enables the construction elements with a virtually unlimited geometry, this material can become a worthy alternative considered in the design and implementation of construction [3], [7], [8].

Prefabricated elements are attempting to diminish its direct human role, and seeking solutions to achieve largely automated: carcass reinforcement, formwork, etc. We know that to achieve reinforcement carcass for concrete elements or prestressed concrete, the longest operation is tying their. An effective solution would be to remove partial the cross reinforcement using of the dispersed reinforcement or welded mesh.

2. Domains of Efficient Use of Dispersed Reinforcement or Ferrocement

Disperse reinforcing elements as well the ferrocement proved to have a good behaviour at: stretching and bending stresses, cracking, fatigue, wear and impact. These elements have proved that they are ductile, high capacity inelastic deformation, manufacturing technology is simple, specific weight is lower than the classic elements reinforced concrete, are more economical.

Due to these good characteristics physics - mechanicals, disperse reinforcement concrete can be used in the following areas

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of civil, industrial and agricultural:
- roof made of thin blades;
- as a substitute for heat insulation in roof framing and roof deck (Fig. 10);
- structural elements of the framework;
- precast panels for walls and floors;
- the panels fences;
- pavers and / or pavements (Figs. 4,8);
- pedestrian promenade (Fig.5);
- single-family houses (Figs. 1,7);
- structural elements: columns, beams, walls (Figs. 2, 7);
- animal shelters (Fig. 3);
- floorings;
- pools of water treatment;
- pools (Fig. 9);
- water reservoirs (Fig. 6);
- adduction pipe;
- drains (Fig. 4);
- bracket panels to capture solar energy;
- maritime constructions.

Fig. 1. *Single-family houses*

Fig. 2. *Structural elements: beams*

Fig. 3. *Animal shelters*

Fig. 4. *Pavement, drains*

Fig. 5. *Pedestrian promenade*

3. The Advantages of Disperse Reinforce-Ment Concrete and Ferrocements

Initially ferrocement was a material used for the construction of boats. Ferrocement has a wide range of applications: in industrial buildings, in civil construction, in agricultural buildings, water supply,

repair and strengthening of concrete structures.

Fig. 6. *Water reservoirs with ferrociment*

Fig. 7. *Structural elements wall*

Fig. 8. *Pavements*

Fig. 9. *Pool*

Fig. 10. *Roof deck*

The main advantages of ferrocement are:
- elements are made easy in the desired shape;
- material with low weight;
- no need to use formwork;
- prefabricated building elements can be made easily;
- execution time low;
- constituent materials easily found;
- is an economic material;
- composite material is good insulator;
- not necessary workforce with high skills;
- are not required sophisticated tools and equipment;
- damaged items can be repaired easily.

Many structures made of brick, concrete or stone blocks located in seismic areas, being rigid structure, designed to take only vertical loads resulting from efforts have been damaged by earthquakes due to

horizontal forces. To strengthen such structures was used ferrocement because:

- can achieve high performance in terms of ductility and strength;
- improves behaviour to cracking;
- it is possible to improve the mechanical properties of structures rehabilitated;
- modification and repair further ferrocement is not difficult;
- ferrocement additional weight of the building is small, which does not lead to the need to increase bearing capacity of the initial structure;
- thermal variations can be taken effectively,
- impermeability elements can be achieved that is applied without changing the architectural concept of the structure;
- higher tensile strength;
- it is a flexible solution regarding further modifications;
- it resists rodent and insect infestation.

Research on the use of ferrocement in repairs and consolidations have revealed that this material is suitable for the restoration of walls, columns, beams, overall strengthening of houses, strengthening tunnels, water tanks, swimming pools etc.

4. Component Materials

The concrete with disperse reinforcement is used type of mesh nets having small diameter wires arranged at reduced distances between them. Ferrocement elements are made with thin walls (10-40 mm) made of multiple rows of reinforcement.

Ferrocement is achieved by locating the small intervals of multiple rows of nets and / or thin bars micro-concrete impregnated cement. While elements of concrete poured into forms, ferrocement elements can be achieved by direct application of micro-concrete on the reinforcement in its final form without the use of formwork. Another variant design of precast elements ferrocement is a single reinforcement thin mesh nets having to up to ϕ1 in diameter winding around an insulating material like polystyrene.

For fixing the mesh and for hardening element assembly must be provided especially at corners independent bars with diameters between ϕ4-ϕ10. Polystyrene is a internal lost formwork serves as well the insulating layer. Polystyrene can be replaced by other more economical materials, even the type of recyclable plastic bottles.

Concrete with disperse reinforcement and ferrocement use the following materials:

- steel bars for reinforcement frame;
- wire nets;
- concrete matrix materials: cement, sand, aggregates, lightweight aggregates with small aprons (clay) and water;
- additives;
- material applied to the surface with finite element role of protective coatings.

õ Reinforcement Nets

Reinforcement elements are used for various types of wire mesh, braided or welded small diameter of the wires (0.5-1 mm) and mesh sizes from 5-25 mm.

Role of wire mesh and reinforcement bars in the initial phase is to support providing form and supporting micro-concrete in his state fresh and stage cured is to take tensile structure that micro-concrete alone does It can take [12].

The material used to create steel wire mesh is soft white with tensile strength of 280-420 N / mm^2.

It is recommended that the number of nets in a cross section to be n> 0,16h, where h is the thickness of the item [9], [11].

Nets wire represents 1% - 8% of micro-concrete and specific surface optimum

value is between 1.4 to 2 cm^2 / cm^3.

õ **The framework of Reinforcing Bars**

The framework of reinforcing bars is used in general for making the casing structure form, that provide attaching to him the layers of wire mesh and micro-concrete. Steel bars are spaced up to a maximum 300 mm are provided for supporting and reinforcing wire mesh.

In case the distances between the axes are smaller steel bars up to 75 mm it fulfils a role of main reinforcement elements [2], [4].

In the steel casing it's generally used soft steel bars like OB37 and diameter ranging from 4-10 mm.

The casing reinforcement can be achieved and the STNB.

It is recommended that the maximum diameter of reinforcements to occupy not more than 50% of the thickness of the item.

õ **Matrix**

The ferrocement matrix is used to achieve a micro-concrete containing Portland cement, water and aggregate, fine aggregate is sand with a continuous granulometric curve having a grain size up to 3 mm.

If the mesh size of nets and the distance between rows are allowed, can enter the mix of aggregate with larger diameters (5-7 mm).

The matrix handle a larger volume of approximately 95% that of the element, so having a major influence on the behaviour of the final product.

The proportions recommended for usual elements micro-concrete mixture are:

- the ratio between the amount of sand and cement ranges between 1.5 and 2.5;
- water-cement ratio varies between 0.35 and 0.5
- additives.

The additives are used to:

- reduce the amount of water used in the preparation of matrix effect in increasing resistance and reducing its permeability;
- entrapped air entrainment, which leads to increased freeze-thaw resistance;
- improving workability and degree of impermeability;
- adjustment curing process (delay or acceleration) depending on technological requirements;
- enlargement durability;
- improving micro-concrete homogeneity**.**

5. Conclusions

The concrete with disperse reinforcement is a particular form of concrete that can be used in structural as well non-structural elements. Reinforcement is used type of mesh nets having small diameter wires arranged at reduced distances between them. It may be made of steel wires or other materials suitable for this purpose, fibre glass mesh alkali resistant, polypropylene textile or fabrics from natural materials like bamboo and jute.

Ferrocement elements are made with thin walls made of a reinforced cement micro-concrete continue and multiple rows of reinforcement.

Concrete with disperse reinforcement as well ferrocement is considered to be an extension of the use of reinforced concrete. Due to the uniform distribution of nets reinforcement in composite materials and the behaviour of different from reinforced concrete, ferrocement must be considered as a building material separately.

Concrete with disperse reinforcement and ferrocement, although still not widely used, possessed premises of resistance properties, ductility, durability and conductivity comparable or better than

those of reinforced concrete.

These properties are achieved in structural thickness of the walls generally around 25 mm size that is unthinkable to the elements in concrete. For better efficacy walls are proposed to take the form of a membrane closed around an insulating material.

If the wire nets are made of steel and ductile, reinforcing a percentage of around 8% allowing substantial improvement in ductility characteristic matrix of concrete. Also, dispersion reinforcement in micro-concrete makes the material to be characterized by high elasticity and resistance to cracking.

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