

# SELF-COMPACTING CONCRETE REALIZED WITH BASIC TECHNOLOGY AND CONTROL

O. SUSA<sup>1</sup>, C. BADEA<sup>1</sup>, L. IURES<sup>1</sup>, R. CHENDES<sup>1</sup>, S. DAN<sup>1</sup>,  
A. MITE<sup>1</sup>, M. TIVADAR<sup>1</sup>

**Abstract:** *The present paper takes into account the usage of limestone filler and Sika special add mixture in obtaining a performing self-compacting concrete realized with site ordinary equipments which exist on construction site. Compression strength, L box, V funnel and slump flow tests have been made and also the smoothness of the resulting surface has been taken into account. The objective of this work was to obtain a versatile mixture using a rudimentary free fall mixer and high compressive strength. The final batch will be used to realize a concrete monument exposed into a village square.*

**Key words:** *workability, self-compacting, L box, V funnel, mechanical properties*

## 1. Introduction

Self-compacting concrete is a very important add-on to the construction material industry, offering a wide range of construction possibilities [1]. It has the property of compacting itself under his weight, uniformly without the need of a vibrating it. This enables the use in various forms and is a very simple solution to different and many problems. It also solves the numerous problems regarding the technical difficulties of vibrating the concrete mass, while obtaining thin elements and great detail.

One of the disadvantages of SCC is its cost [2], associated with the use of chemical admixtures and use of high volumes of Portland cement, which is not sustainable.

The present paper illustrates the properties of this special concrete and also details the mechanical results [3-6] of self-compacting concrete by using two

proposed recipes.

The self-compacting concrete has the following properties, unlike the usual concrete:

- low water/cement ratio;
- high concentration of powder or fine aggregates;
- less ratio of thick of big diameter aggregates;
- the use of add-mixtures that modify the viscosity of the concrete;
- the possible use of add mixtures that modify the workability of the final mix and that reduce the water quantity needed [7]

## 2. Materials

The materials used for this application were:

- portland cement – Lafarge CEMII/B-M(-LL) 42,5 N;

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<sup>1</sup> Politehnica University of Timisoara, Faculty of Civil Engineering, Romania

- aggregates from a near by grave pit- with the diameters: 0-4 about 50%, 4-8 x 13%, 8-16 x 37%;
- lime stone filler – 80 kg/ m<sup>2</sup>;
- admixture ViscoCrete VF 2011 supplied by Sika (through the kindness of Mr. Zeno Dan);
- ordinary water from public net..

In Fig.1 we can see the weighing of the aggregates.



Fig. 1. *Aggregates weighing*

The concrete was prepared using a freefall mixer- as depicted in Fig.2.



Fig. 2. *Concrete mixing*

These ingredients and procedures give the self-compacting concrete the role of preserving the cast mould details and replying them in the concrete mass.

Other properties resulting from the outlined characteristics are some of the following:

- the uniform spread of concrete without of the need of vibrating;
- the capability of passing through the highly dens rebar zones.

### 3. Experimental Work

The goal of this experimental work was to obtain a versatile mixture using a rudimentary free fall mixer (which exists on construction site) and high compressive strength.

#### The Spread

The spread of concrete mass is used to determine the ability of self-compacting concrete to free-flow without any hindrance. Following this determination of the diameter concrete mass spread, which is a measure of that determination. This determination is widely used because it allows a correct conclusion on the ability of self-compacting concrete mass to fill the spaces. The elements required can be seen in Fig. 3. Also this method can provide information on the trend of segregation of concrete. Fig.4 depicts the results of the test.



Fig. 3. *The cone spread equipment*



Fig. 4. *The Spread Test*

### V Funnel Test

By using a V funnel- we can test the cohesively of the concrete. As a result of this test we can determine if in the filling capacity of the concrete, whose aggregate diameter less than 20 mm. If the complete flow in a short period of time is good, then the filling capacity of the mixture is sufficient. A great time flow leads to a low deformability of concrete mass. The V funnel is depicted in Fig. 5.



Fig. 5. *The V funnel*

### The L Box Test

The L box test is used to determine the flow capacity and self-compacting concrete crossing. Also in this test we can determine if coarse aggregate stuck between rebar, and the tendency towards the segregation of concrete. The test is shown in Fig. 6.



Fig. 6. *The L box test*

### The Recipes

The proposed recipes have the following characteristics, as can be seen in Tab.1.

The main difference between the two recipes is the cement quantity and its influence on the concrete's performances and overall strength and durability. This can be seen in Tab.2 – containing the final data of the two recipes.

These recipes give the concrete its final performances and characteristics. They are the base of with we can estimate the overall durability and detail fidelity of the concrete.

*The Recipes*

Table 1

Materials	Self Compacted Concrete 25/30			
		V1		V2
Cement, [kg]		420.00		460.00
Water, [kg]		171.00		171.00
W/C		0.45		0.45
Sika Mixture ViscoCrete VF 2011, [kg]	2.50%	9.50	2.50%	9.50
Lime stone filler, [kg]		80.00		80.00
Total Aggregate, [kg]		1712.16		1712.16
0-4, [kg]	50%	856.08	50%	856.08
4-8, [kg]	13%	222.58	13%	222.58
8-16, [kg]	37%	633.49	37%	633.49
16-32, [kg]	0	0.00	0	0.00

The difference that adding less than 10% of cement can make in the compression strength of the self compacting concrete is

significant, as we can see in table Tab.2. In Fig. 8 the L-box test is illustrated.



Fig. 7. Spread after preparation

Fig. 7 illustrates the uniformity of the spread of concrete mass. The overall spread was in each case 80 cm.



Fig. 8. L box after preparation

The concrete poured through the rebar with no problem, and had the same height at both ends.

*Experimental results*

Table 2

Determination type:	Characteristics:	Batch:	
		V1	V2
Determinations on fresh concrete	Excess water	1.714	0
	W/C real	0.305	0.372
	Density	2390	2316
	Spread (cm)	80	80
	L box	9	8
	V Funnel (sec)	32	18
Determinations on fresh concrete – at 60 min	Spread (cm)	80	0
	L box	0 (OK)	0
	V Funnel (sec)	32	0
Characteristics on 2 day on hardened concrete	Mass	7.90	7.60
	fc medium (N/mm <sup>2</sup> )	30.49	27.63
	fc minim (N/mm <sup>2</sup> )	29.60	25.87
	Density (kg/m <sup>3</sup> )	2341	2252
Characteristics on 28 day hardened concrete	Mass	8.10	7.90
	fc medium (N/mm <sup>2</sup> )	57.72	44.95
	fc minim (N/mm <sup>2</sup> )	54.68	42.03
	Density (kg/m <sup>3</sup> )	2400	2341

Fig. 9 depicts the V funnel test- representing the cohesion of the concrete mass, due to the fact that it had not segregated and the flow of concrete was constant.

Fig. 9. *V-funnel*

In Fig.10 we can see the resulted test cubes of the two recipes and the uniform characteristics of both. There are no visual defects of the resulting blocks of concrete made out of the two self-compacting recipe

Fig. 10. *Tested cubes*

Curing conditions: the cubes of 15x15x15 cm were kept in water for 28 days and tested by compressing them in order to determine the compression strength- as depicted in Fig. 11.



Fig. 11. *Compression Strength determination*

### 3. Conclusions

The experimental researches lead to obtaining a performing self-compacting concrete realized with site ordinary equipments. The all properties of fresh self compacting concrete were achieved in condition to use ordinary site concrete equipment.

The compressive strength after 28 days was around 57 N/mm<sup>2</sup> for V1 batch.

The V1 batch will be used to realize a concrete monument exposed into a village square.

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