## ACTION 3 – MANUFACTURING OF THE BARRIER (prototype nº2-SIGNUS)

### ACTION 3.1. Process of manufacturing of barriers report

#### 1. INTRODUCTION

Once adjusted the formulation of concrete, it will begin to manufacture the prototypes to carry out the pendulum test and the tests under laboratory conditions to determine the energy absorption capacity of the concrete.

The present document includes the description of the equipment used and the manufacture process of the samples to test, corresponding to prototype nº 2.

#### 2. OBJECTIVE

This action aims to produce the required number of prototypes for the early trials that will be later performed in the action 3.2.

#### 3. MANUFACTURE OF THE TEST SPECIMENS (PROTOTYPE Nº2).

For the manufacture of the prototypes, the conventional manufacturing process has been followed, and it has been used the industrial equipment of the company Prefabricados Alberdi, with whom SIGNUS has outsourced the services of barriers manufacturing. The advantage when using this equipment is that it can be conducted the verification of whether it is technically achievable to manufacture the rubber concrete with ELT rubber on an industrial scale.

### 3.1. Manufacture process of fresh-state rubber concrete.

The process of manufacturing the concrete consist in mixing all the components of its formulation in the proportions previously determined in the laboratory until it is reached a uniform mix according to a predefined order of aggregates that warrants the mix homogeneity. Afterwards, the concrete is poured over a mould to be cured.

- **Dosage equipments**

Dosage and weighing equipment must guarantee the required proportions of each one of the components of the concrete: aggregates, cement, water and additives.

The weighing systems of aggregate components tend to be a conveyor belt scales where each aggregate component is added, or an independent weighing hopper that measures each type of aggregate separately. In both cases the incorporated measuring devices are load cells.


**Gravel and sand storage silos**

**Cement storage silo**

Cement weighing is equally performed through a weighing scale or through a weighing hopper with incorporated load cells.

- **Mixing process**

The mixing process consists in combining the different materials that constitute the concrete to obtain a mix of uniform property.

The equipment in which this process takes places is named mixer. The order of introduction of the components in the mixer is of major importance since it can influence aspects such as: the correct spread of the components, the efficiency of the mixing, the optimal effect of the aggregates, the performance of the plant, the wear of the equipment and the cleaning of the equipment. It was used the industrial mixer equipment of *Prefabricados Alberdi.*

**Mixer industrial equipment**

### 3.2. Manufacture process of the test samples for the pendulum test.

For the pendulum test, two types of test samples have been manufactured:

| Description | Compressive strength (MPa) |
|---|---|
| **Conventional concrete** | 43 MPa |
| **Rubber concrete** | 39,6 MPa |

**Compressive strength**

- **Compacting and moulding**

Once concluded the mix process, the concrete is poured in the mould, already prepared for the manufacturing of the barrier, until it is fully filled.

**Dumping of the concrete in the mould**


**Compacting process through vibrator needle**

Afterwards, the fixing plate is placed as shown in the following figure.

**Placement of the fixing plate**

Finally, the mould is covered so the barrier is appropriately protected, and to ensure that the temperature and humidity are the proper ones, so it begins the curing process of the concrete.


**Completion of the moulding process**

- **Demoulding**

The EHE (Instruction of the Structural Concrete) Instructions establishes that once the samples have been produced, they will be kept in the mould for at least 16 hours and never longer than three days.

**Demoulded barriers**

### 3.3. Test samples manufacturing process for the establishment of the energy absorption capacity test.

After defining the formulation of the rubber concrete, some test are going to be performed to establish its energy absorption capacity facing an impact and later to contrast it with standard references of the conventional concrete.

**Image of a mould to manufacture a barrier with reinforcement**

**Moulds used to manufacture the laboratory sample**

Following the EHE Instruction, once the barriers have been produced, they will be kept in the mould for at least 16 hours and never longer than three days.

Down below are provided pictures of the samples already demoulded.

**Demoulded samples**

## 4. SUMMARY

In the manufacturing process of each one of the samples meant to carry out the early trials in the laboratory and to medium-scale, it has been used industrial equipment and it has been followed an industrial manufacturing process for the conventional concrete, that allowed to advance potential problems in the industrial production process.

For the pendulum test, two samples have been produced, one of them with conventional concrete acting as standard reference, and the other one with rubber concrete.

As complementary to the pendulum tests, other test will be performed to determine the energy absorption capacity, for which a total of nine test samples have been manufactured to be able to compare the behavior of the rubber concrete against the conventional concrete.