



# Istra 40 Aggregates for High Performance Concrete

Application of CALUCEM – Calcium Aluminate Cements

## INTRODUCTION

Where can ISTRA 40 AGG be used for mortars and concrete? Mortars and concretes with ISTRA 40 AGG are ideally suited for aggressive environments where durability is of utmost importance and Ordinary Portland Cement concrete fails. ISTRA 40 AGG, when mixed with ISTRA Calcium Aluminate Cement, offers superior performance against abrasion, chemical attack, high temperatures, mechanical impact and thermal shock.



Areas of application are:

**Industrial floorings:** When used in combination with ISTRA Calcium Aluminate Cement, ISTRA 40 AGG provides a hard and dense overall matrix, allowing high mechanical loading. The composite hardening effect ensures that the service life of the floor will last longer under constant exposure to heavy duty attacks i.e. high point load, acids, animal fats, oils and industrial wastes.

**Pressure sewers and pipes:** Combination of ISTRA Calcium Aluminate Cement with ISTRA 40 AGG increases the abrasion resistance of mortar lining particularly in areas of high turbulence along the sewage networks.

**Hydraulic structures:** ISTRA 40 AGG is a sound material to be used in areas of high abrasion i.e. flushing gates and spill ways. It provides excellent protection from water erosion in high wear zones.

**High temperature tolerance places:** ISTRA 40 AGG has found usage in furnace floors, slag pits and storage facilities in metallurgical industries where temperature requirements could reach up to 1200°C. ISTRA 40 AGG has proven to be stable in the conditions of extreme thermal cycling from below zero to 1000°C.

ISTRA 40 AGG is the ideal choice for high performance concrete. Especially in applications when high mechanical strength is needed in combination with additional resistance to chemical corrosion and/or thermal attack. Fields of application for ISTRA 40 AGG with different aggressive environments are displayed in table 1.

	Mechanical Attack	Chemical Attack	Thermal Attack
Cast House and Foundry Areas			
Burning Pits and Ash Boxes			
Factory Floors			
Industrial Sedimentation Tanks			
Sulphur Pits			

Table 1: Fields of application for ISTRA 40 AGG

external stress:

high

low

ISTRA 40 AGG is an exceptional aggregate. It is designed for ISTRA Calcium Aluminate Cement mortars and concretes and offers outstanding properties to improve benefits to the customer.

### PROPERTIES OF ISTRA AGGREGATES

ISTRA 40 AGG is a very dense and extremely hard synthetic aggregate with 40 % alumina. It is available in grain size fractions 0-4 mm and 4-10 mm. ISTRA 40 AGG and ISTRA 40 Calcium Aluminate Cement have the same mineralogical composition. Exceptional abrasion resistance, high strength and additional corrosion resistance is gained when ISTRA 40 AGG is mixed together with ISTRA 40 Calcium Aluminate Cement in a mortar or concrete. Istra 40 AGG is hard and dense, has high refractoriness, high abrasion resistance and resistance to mild acid corrosion.

#### Physical properties of ISTRA 40 AGG

- > Density: 3.14 g /cm<sup>3</sup>
- > Open porosity: none
- > Hardness (Mohs): > 7 (Quartz)



## PROPERTIES OF ISTRA 40 AGG – MORTARS AND CONCRETE

Early compressive strength development of ISTRA 40 AGG mortar with similar consistency to EN 14647 mortars has been tested under standard conditions.

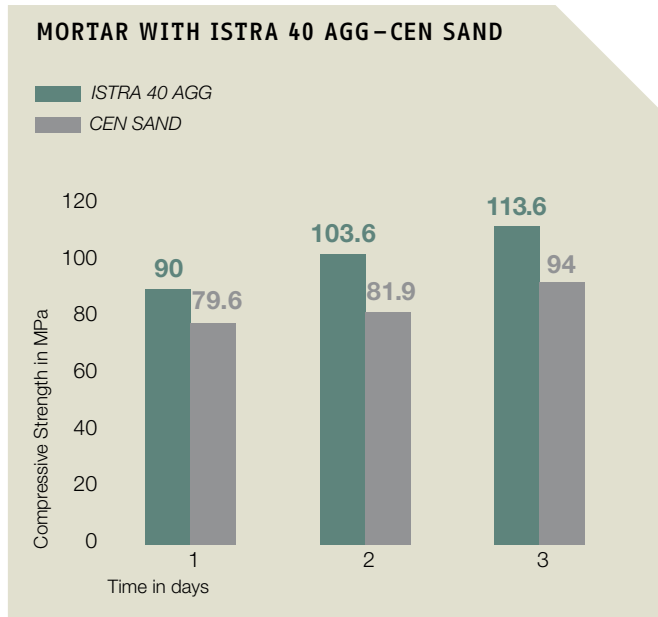


Figure 1: Compressive strength of standard mortar and ISTRA 40 AGG mortar

The compressive strength of ISTRA 40 with CEN sand reaches 79.6 MPa after one day and is higher than that of high grade Portland cement CEM I 52.5 R after 28 days. The mortar with ISTRA 40 AGG generally shows at least 13 % higher compressive strength within the time period of testing than the standard mortar containing CEN sand as aggregate. Due to the fact that ISTRA 40 cement and ISTRA 40 AGG are mineralogical the same, a strong physical and chemical bond between both is established. The result is the superior strength of the ISTRA 40 AGG mortar.

## ABRASION TEST WITH ISTRA 40 AGG

Abrasion resistance of ISTRA 40 AGG concrete has been tested according to EN 1338. The test classifies the resistance of concrete pavestones e.g. for industrial areas including docks and harbors, runways for airports, motorways, petrol stations and bus stations. A sample of ISTRA 40 AGG concrete with aggregates 0-4 mm and 4-10 mm was mounted on a horizontal rotating metal plate. Corundum (hardness: 9 according to Mohs) was used as abrasive. This mineral is the secondary hardest found in nature after a diamond with a hardness of 10 (Mohs). A weight was put on the ISTRA 40 AGG concrete to give the correct grinding pressure according to standard conditions. The abrasion resistance of the concrete stone was determined according to the loss of volume. ISTRA 40 AGG concrete has the highest classification (I) according to abrasive resistance according to EN 1338.

## EXPERIENCES WITH ISTRA 40 AGG - CONCRETE

### Cement plant (Croatia)

The clinker storage at the cement plant was originally made of Ordinary Portland Cement Concrete and had to be in maintenance several times a year because of extreme constraints:

- temperature up to 800°C from manufactured clinker
- abrasion during unloading cement clinker
- abrasion from heavy industry equipment

The decision was made to manufacture the clinker storage with ISTRA 40 cement / ISTRA 40 AGG concrete. This solution was estimated to offer the best cost/performance ratio.

### Blast furnace cast house (US)

During relocation of a blast furnace, the decision was made to use ISTRA 40 AGG concrete for the area of a blast furnace cast house. ISTRA 40 AGG has to withstand extreme constraints:

- thermal shock from molten iron
- point load from hot metal vessels
- abrasion from heavy industry equipment

ISTRA 40 AGG concrete is still in good service after two years of blast furnace operation without maintenance periods.



## BENEFITS

Beside the excellent mechanical strength, wear resistance, ease for repair and less downtime, ISTR A 40 AGG concrete offers unique additional properties in the field:

- › extended service life
- › very good resistance to point load, impact and abrasion
- › excellent resistance to thermal shock
- › resistant to sulphate, oil, industrial liquids and dilute acids (pH  $\geq$  3.5)

## START FORMULATIONS

Starting formulations for ISTR A 40 AGG concrete and mortars are available upon request.

## MORE INFO

For additional information about ISTR A Calcium Aluminate Cements, please visit the CALUCEM web site at [www.calucem.com](http://www.calucem.com) or contact us worldwide.

# www.calucem.com

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