PROPERTIES OF CONCRETE WITH USE THE ASHES SLAG OF WASTE

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Abstract: *analysis of the data indicates that when added an ash as fine aggregate set to concrete mixtures,it contributes strength to the heat treatment conditions at 90^0 C. Thus, with increasing fly ash instead of sand 10 to 40% (50-200 kg) increases the strength of concrete samples by 0.9 - 2.5 times. Compositions of heavy concrete of brands 100 and 200, light concrete of brands 50 and 100 with use of ashes of hydroremoval of Zhezkazgansky combined heat and power plant are developed and their construction and operational properties are investigated.*

Keywords: *ashes slag waste, ashes of hydroremoval of combined heat and power plant, compositions of heavy concrete, compositions of light concrete, optimum structure.*

СВОЙСТВА БЕТОНОВ С ИСПОЛЬЗОВАНИЕМ ЗОЛОШЛАКОВЫХ ОТХОДОВ

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Аннотация: *анализ полученных данных свидетельствует, что добавление в бетонные смеси золы в качестве мелкого заполнителя способствует набору прочности в условиях тепловой обработки при 90 ^{0}С. Так, при увеличении количества золы взамен песка от 10 до 40% (50-200 кг) прочность бетонных образцов увеличивается в 0,9 – 2,5 раза. Разработаны составы тяжелых бетонов марок 100 и 200, легких бетонов марок 50 и 100 с использованием золы гидроудаления Жезказганской ТЭЦ и исследованы их строительно-эксплуатационные свойства.*

Ключевые слова: *золошлаковые отходы, золы гидроудаления ТЭЦ, составы тяжелых бетонов, составы легких бетонов, оптимальный состав.*

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Kazakhstan has accumulated a huge amount of ash of thermal power plants, which is increasing by 16 million tons annually. At full development only Ekibastuz fuel has already reached about 30 million tons of energy complex of the annual output volume of ash and slag waste, but the volume of use does not exceed 4%. in the country.

Issues of using ashes and slagsin the reinforced concrete production are devoted to numerous scientific studies of the Almaty NIIstromproekt [1.2]. Found that ash of CHP and GRES of Republic can be used for the production of agloporite, fly-ash aggregate, bricks, as an adsmixture for concrete instead of cement and sand parts, as fine aggregate for expanded-clay concrete, for binding material in the aerated concrete production, ash concrete, intended for livestock buildings, etc.

Installed hydraulic activity of a number of ashes and their performance instead of the cementparts. Developed and approved abasis for regulatory for the use of ashes in building materials. They are national construction norms for expanded-clay concrete preparetion RSN 32, national construction norms for preparation and application of heavy concrete with ash and slag mixtures and fly-ash of TPP RSN 33 and national construction norms for use ash and slag mixtures of TTP of Kazakhstan for construction mortar RSN 31.

Experience of using ashes shows the efficiency and expediency of their application. It is found that efficiency of cement in expanded-clay concreteis 10-30% and in heavy concrete up to 20%. In addition, a heavy sand in expanded-clay concrete is completely replaced and partially (30-50%) in a heavy concrete composition.

The aim of study is to develop consistency of heavy and lightweight concrete using fly ash hydroremoval of TPP of Zhezkazgan and determination of their construction and performance characteristics.

Selected a composition of heavy concrete grades 100, 200, and expanded-clay concretegrades 50 and 100. Optimization of compositions performed on the basis of the average level of strength and taking into account the actual concrete homogeneity.

1. Determined by B/B, depending on the required strength of the concrete by:

$$В/В = AR_в / (R_б + 0{,}5\,AR_в)$$

where:

$R_в$– cement activity;

$R_б$ – design grade of concrete:

A – material quality factor.

2. Estimated water consumption determined based on the required concrete consistency and coarse aggregate.

The concrete consistency for heavy concrete grade 100 (2-4 cm), concrete grade 200 (3-5 cm) and expanded-clay concrete grade 50-100 (1-4 cm) taken in accordance with technical data of the product.

3. Cement consumption is determined by:

$$Ц = В : В/Ц$$

where:

B – estimated water consumption.

4. Consumption of gravel is determined by:

$$Щ = 1000/\alpha(П_щ/\rho_{нщ}) + 1/\rho_щ$$

where:

$П_щ$ – porosity of gravel;

α – gravel grade spreading factor with grout;

$\rho_{нщ}$–bulk density of crashed concrete;

$\rho_щ$– effective density of gravel.

5. Consumption of sand is determined by:

$$П = [1000 - Ц/\rho_ц + В + Щ/\rho_щ]x\rho_п$$

where:

Ц, В, П и Щ – cement, water, sand and gravel consumption, kg;

$\rho_ц$, $\rho_щ$, $\rho_п$ – effective density of cement, gravel and sand.

As control compositions in the manufacture of concrete compositions made without the addition of ash.

Natural sand in expanded-clay concreteis completely replaced, and from 10 to 50% in heavy concrete.

During the preparation of sample batches, concrete composition mixtures adjusted to obtain specified consistency. If cone slump was less than specified, then was added 2 - 3% to prepared mixture of designed amount of cement and water, while keeping recieved as constant. If consistency is greater than specified, added in small portions (3 - 5% by weight) sand and gravel, while keeping the relationship between them, by a predetermined calculation.

Determined density of concrete mixture in a compacted state (it should not differ from the designed value more than 2%) and refined compositions. As when adjusting the volume of the sample batch has changed, we established its actual volume.

Analysis of the data indicates that when added an ash as fine aggregate set to concrete mixtures,it contributes strength to the heat treatment conditions at 90^0 C. Thus, with increasing fly ash instead of sand 10 to 40% (50-200 kg) increases the strength of concrete samples by 0.9 - 2.5 times.

Adding fly ash to expanded-clay concreteinstead cement part (15-20%) with the complete replacement of heavy sand, a beneficial effect on the properties of concrete, increasing the strength characteristics, consistency and the uniformity of the mixtures.

This is due to the activity of the ash, which is manifested by steaming and plasticizing properties, and it is consistent with the published data [3].

The average density of expanded-clay concrete 50-100 kg lower than compared to the expanded-clay concrete on natural sand.

Optimum compositions are shown in Table 1.

Segregation of concrete mixture grade 200 when OK = 5-6 cm and 100 grade with OK = 5-6 cm was determined according to GOST 10181.4. Indicator of separation solution of concrete mixture grade 100 and 200, respectively, of 3.78 and 3.85%.

Table 1. Optimum concrete compositionsusing ash hydroremoval of Zhezkazgan TPP

Concrete type	**Concrete grade**	**Cone slump, sm**	**Consumption per 1 m3 of concrete, kg**					**Average density, kg/m3**
			Cement	**Ash**	**Sand**	**Gravel**	**Expanded clay aggregate**	
heavy	100	5-6	180	220	600	1260	-	2300
	200	5-6	250	190	600	1170	-	2280

light	50	1-4	180	110	-	-	670	1000
	75	1-4	200	200	-	-	670	1100
	100	1-4	220	270	-	-	670	1200

Concrete water separation was determined by sedimentation in a cylindrical vessel for 1.5 hours. After selecting separate water line, water separation was determined concrete mixture. Dehydration of concrete grade 100 OK = 5-6 cm and 200 grade with OK = 5-6 cm, respectively, were 2.5 and 3.6 l / m3.

Tests in accordance with GOST 10181.4 shows that separation of the concrete mixture is within the allowable. Dehydration of the concrete mixture at the same P2 mobility increases with increasing dosages of binder.

The actual average strength and uniformity performance of concrete strength was determined according to GOST 18105.0. The definitions of homogeneity of concrete strength showed that the coefficient of variation of heavy concrete grade 100 and 200, respectively, of 5.62 and 4.15%.

The coefficient of variation of heavy concrete of all grades, in accordance with GOST 13015.0 "Design and articles of concrete and reinforced concrete prefabricated" should be not more than 9%. The data show that the selected homogeneity of concrete strength compliance.

Thus, the selected optimal compositions of heavy and lightweight concrete using fly ash hydroremoval of Zhezkazgan TPP. Use of fly ash in heavy concrete reduces the cement consumption by50 kg (15%) and 40% of sand. Adding fly ash to expanded-clay concretereduces the cement consumption by 20% and reduces the average density of 50 - 100 kg.

References / Список литературы

1. *Ajapov U.A.* Issledovanie v oblasti mestnyh vjazhushhih materialov // Trudy Almatinskogo NIIstromproekta. Vyp. 12. Almaty, 1999. 210 s.
2. *Kuatbaev K.K. i dr.* Mineral'no-syrevye resursy respubliki Kazahstan dlja proizvodstva stroitel'nyh materialov // Sbornik trudov ZAO «NIIstromproekt». Almaty: KazGOSINTI, 2011. Kn. 1. S. 18-20.
3. *Bozhenov P.I. i dr.* Ispol'zovanie pobochnyh produktov v proizvodstve cementa // Cement. № 9, 2004. S. 22-24.