

Workshop on environmental aspects of coal ash uses

THE USE OF COAL ASH IN CONCRETE ACCORDING TO THE ISRAELI STANDARDS AND PRACTICE

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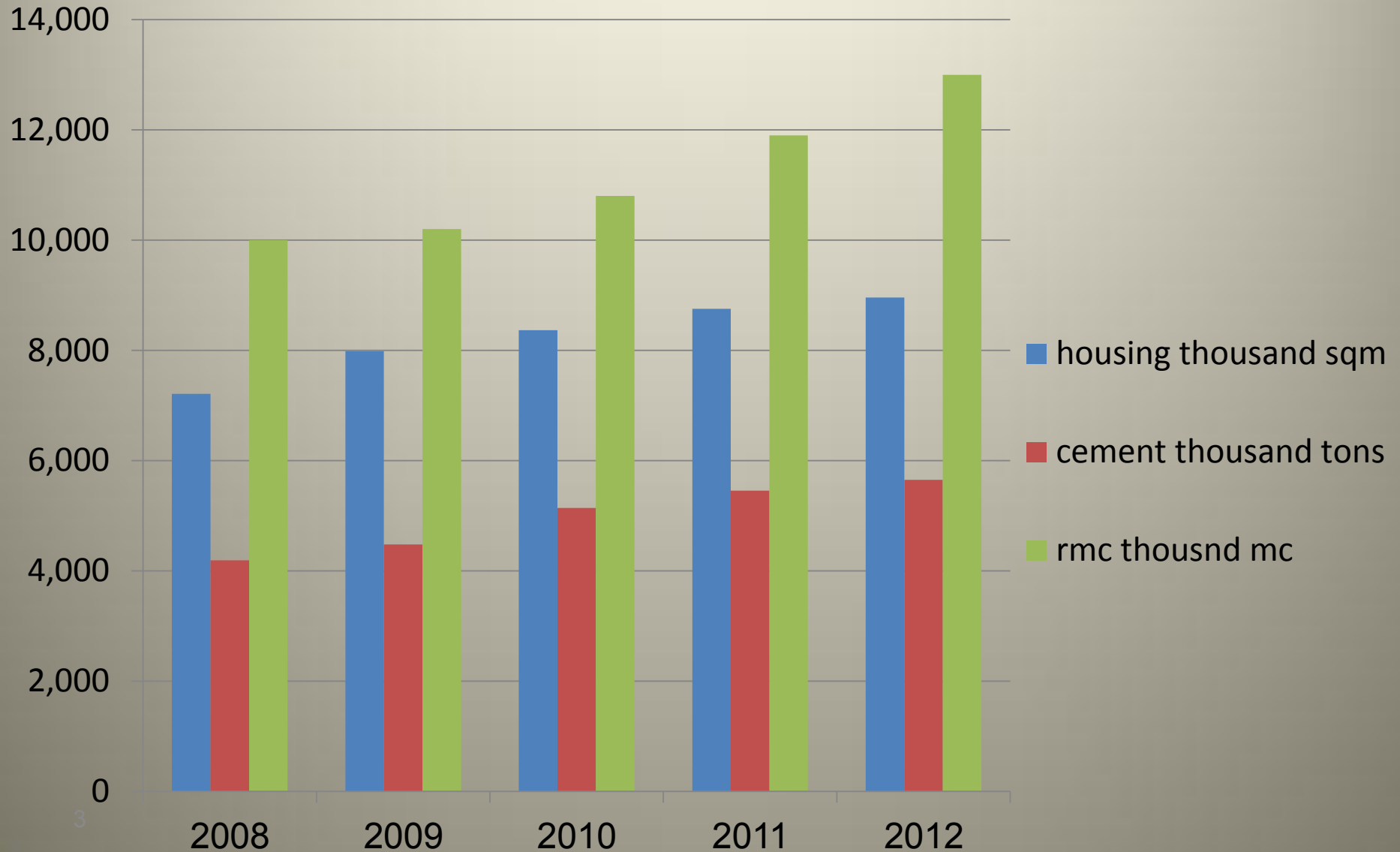
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THE UTILIZATION OF COAL ASH IN THE CONSTRUCTION INDUSTRY

(CEMENT AND CONCRETE)

- **CONCRETE MARKET 2008-2012**
BUILDINGS (sqm) CEMENT (tons) CONCRETE (M³)
- **THE MAJOR USERS OF COAL ASH IN THE CONSTRUCTION INDUSTRY**
- **THE RELEVANT STANDARDS (SI) WHICH DETERMINE THE USE OF COAL ASH IN CEMENT AND CONCRETE**
- **THE TECHNOLOGICAL RESTRICTIONS , THE ECONOMICAL AND ADMINISTRATIVE LIMITATION ON THE UTILIZATION OF FLY ASH**
- **SUMMARY AND “LOOKING FORWARD”**

CONCRETE MARKET 2008-2012



THE FLY ASH USERS AND FLY ASH ROLE IN THE CONSTRUCTION INDUSTRY

- **THE READY-MIXED CONCRETE INDUSTRY**

- ❖ REPLACING CERTAIN AMOUNT OF CEMENT IN THE CONCRETE MIX DESIGN
- ❖ REPLACING SAND IN THE CONCRETE MIX DESIGN
- ❖ SIGNIFICANT ITEM IN SPECIAL CONCRETE PRODUCT (CLSM, GROUT, SCC etc')

(approx.550,000- 600,000 tons in 2012)

- ❑ There are other users but with negligible quantities

THE FLY ASH USERS AND THE FLY ASH ROLE IN THE CONSTRUCTION INDUSTRY

• **THE CEMENT INDUSTRY**

- ❖ **AS AN INGREDIENT OF THE CLINKER ITSELF**
- ❖ **AS PART OF THE COMBUSTION PROCEDURE (fly ash and bottom ash)**
- ❖ **AS AN ADDITION TO THE CEMENT ACCORDING TO ITS CLASSIFICATION**

(approx. 550,000 in 2012)

THE RELEVANT ISRAELI STANDARDS WHICH DETERMINES THE USE OF FLY ASH IN CEMENT AND CONCRETE

- **SI 1209** : **FLY ASH FOR CONCRETE**
- **SI 1** : **CEMENT, COMMON CEMENT**
- **SI 466** : **CONCRETE CODE ,GENERAL PRINCIPLES**
- **SI 118** : **CONCRETE, SPECIFICATION PERFORMANCE AND PRODUCTION**
- **SI 5098** : **CONTENT OF NATURAL RADIOACTIVE ELEMENTS IN BUILDING PRODUCTION**

THE RELEVANT SI WHICH DETERMINES THE USE OF FLY ASH IN CEMENT AND CONCRETE

➤ **SI 1209 : FLY ASH FOR CONCRETE**

❑ **Based on the European Standard**

EN 450 ,451 and BS3892-1

❑ **Indicate the two fly ash types and their chemical and physical properties limitation**

❑ **The two primary parameters are – LOI (loss of ignition 0-3% and 0-7%) and PAI (pozzolanic activity index 75% in 28 days and 85% in 90 days)**

THE RELEVANT SI WHICH DETERMINES THE USE OF FLY ASH IN CEMENT AND CONCRETE

➤ **SI 1 : CEMENT,COMMON CEMENT**

- Based on the European Standard EN 197-1 (2007)
- 27 products in the family of common cements
- Out of which 8 products can contain fly ash between 6.0%-35.0% of the clinker
- Only 2 products are allowed to be used in Israel
CEM II / A-V (up to 10 % fly ash) ,**CEM II / A-M** (up to 10% fly ash and up to 10% slag)

THE RELEVANT SI WHICH DETERMINES THE USE OF FLY ASH IN CEMENT AND CONCRETE

➤ **SI 118 (2008) CONCRETE : SPECIFICATION, PERFORMANCE AND PRODUCTION**

- ❑ **Based on European Standard EN 206-1(2000) modified to the local Israeli conditions**
- ❑ **11 Exposure classes as in EN206**
- ❑ **Permission to use fly ash as a partial substitute to the cement in the concrete mix based on the following table**
approx. 65% of the Israeli concrete market can substitute a certain amount of cement in the concrete mix with fly ash (about 300,000 tons in 2011)

SI 118 : CONCRETE : SPESIFICATION, PERFORMANCE AND PRODUCTION

❖ CEMENT REPLACEMENT CRITERIA

The replaced fly ash in the mix design (kg)	Cement qua. that can be replaced (kg)	Min. cement content (kg/cm)	Exposure class
60	30	230	1
80	40	270	2
80	40	270	3
75	30	270	4

❑ In addition there is a possibility to extend the use of fly ash in exposure classes 5-11 by adopting the “equivalent functioning” principle

THE RESTRICTION AND LIMITATION ON THE UTILIZATION OF FLY ASH IN THE CONCRETE INDUSTRY

- **ONLY TO EXPOSURE CLASSES 1-4**
- **SHORTAGE AND IRREGULAR SUPPLY OF FLY ASH BY I.E.C**
- **INSUFFICIENT DATA FROM I.E.C**
- **INSUFFICIENT DATA ON THE MATCHING BETWEEN FLY ASH AND CEMENT**
- **MAX.100-120 KG IN A CM OF CONCRETE DUE TO MIX DESIGN LIMITATION**
- **SHORTAGE OF SILOS AND HAULAGE COST**
- **GOVERNAMENTAL REGULATION TO LIMIT THE FLY ASH QUANTITY IN A CM OF CONCRETE TO 160 KG**

SUMMARY

CONCRETE INDUSTRY

- ❖ **2012- over 15 years of utilizing fly ash, yearly consumption of approx. 600,000 tons .**
- ❖ **The best solution for fly ash disposal.**
- ❖ **Widening the utilization can accrue if :**
- ❖ **(1) additional knowledge and data base on fly ash will be handed over from I.E.C. and the Coal Ash Board.**
- ❖ **(2) I.E.C will adopt a classification system of the fly ash reducing its LOI and improving its fineness.**
- ❖ **The new method of coal combustion (SCR) and utilizing of gas instead of coal can decrease the availability of fly ash.**