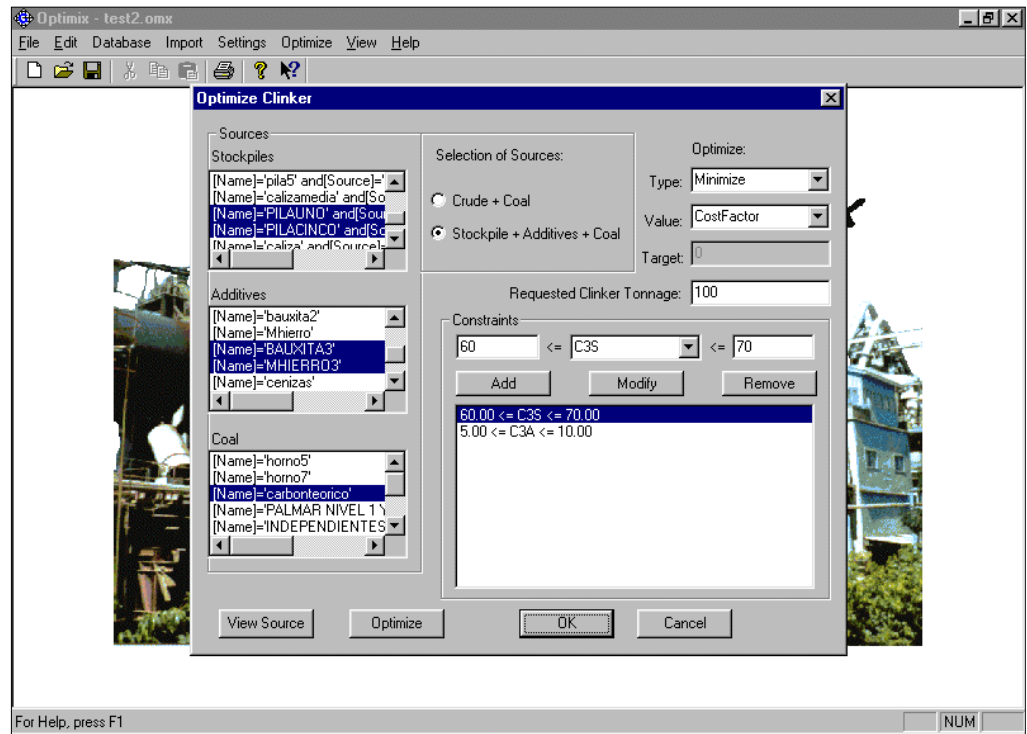


OPTIMIX

Crude and clinker optimization For the cement industry



- ◆ Short term planning of quarry production
- ◆ Minimization of additive costs
- ◆ Special characteristics for coal burning plants
- ◆ Linear programming with Simplex
- ◆ Access databases with Excel or ASCII import

Characteristics

Short term planning of quarry production

Normally, the daily production in a quarry comes from a mixture of high-grade material and low-grade material (of a given parameter). It is the typical way of using all of the material in the quarry without wasting and using a minimum of additives. With the "Blast combination" function, OPTIMIX carries out a comprehensive analysis of all the combinations of two blasts to yield a given tonnage corresponding to a given period like a day. It can be, for example, 5,000 tonnes of limestone with a 79% titration. OPTIMIX only keeps combinations that respect conditions like limits on another value (for example a MS between 2.8 and 2.9) or a minimum percentage of material taken from one blast. If there are many solutions, OPTIMIX can sort them according a given criteria like a value closest to a target or a minimum standard deviation of a given values inside the mix.

Optimizing blasts

If we have more than 2 or 3 blasts that can be mixed with some restrictions, OPTIMIX uses a linear programming method to solve the problem. Of all the possible solutions, the linear programming method selects the one that optimizes a function like minimizing or maximizing a given value or a value closest to a target value, for example, obtain 50,000t with a titration value between 78% and 79%, a MS lower than 3.0 and a MA closest to 0.8.

Optimizing stockpiles with additives

To solve the problem of mixing limestone (generally in stockpiles) with additives to produce a given crude, OPTIMIX also uses a linear programming method. Stockpiles and additives are selected from the available sources, constraints are applied on the resulting crude and an objective function is defined. In general, with additives of varying unit cost, the objective function attempts to minimize the cost of these additives. For example, one could optimize the mix of a high-grade limestone with a low-grade one with bauxite and iron additives to produce 10,000t of crude with a MS of 2.6 a LSF (saturation) of 1.06 and a MA lower than 1.0. One could elect to replace the bauxite which expensive with a cheaper additive and obtain the missing alumina from ashes, clay or kaolin, OPTIMIX might need to increase the contribution of the high-grade limestone because those additives contain a high percentage of silica.

Optimizing coal

Another application of OPTIMIX is the optimization of coal sources when coal is used as the energy source in the process. In addition to having a given caloric power (BTU) that determines the quantity of coal necessary to produce a clinker of a given power consumption factor (Kcal/Kg clinker), each coal has other values like %Ash, %humidity, %volatiles and %sulfur. These values become additives in the clinker process (like %SiO₂, %Al₂O₃, %Fe₂O₃) and it is possible to analyse their influence on the characteristics of the clinker produced. When optimizing coal, the problem is generally to obtain a given quantity of coal at the lowest cost given constraints on BTU, ash, sulfur or ash chemical values from an inventory of coals of given available quantity and cost.

Optimizing clinker

It is like an extension to the optimization of stockpiles but in this case, the constraints are defined on the values of the clinker as well as on the values of the crude. Typical clinker parameters like C3S, C2S, C3A and C4AF are used. Also, if the clinker process uses coal as energy, the coal ashes are taken into account. Like for the optimization of stockpiles, the optimizing function is generally the minimization of the cost additives and coal, if any.

Hardware requirements

This package needs the following hardware and software to run efficiently:

Pentium class computer with at least 64Mb of RAM.

Windows 95, 98, NT, 2000, XP operating system. Microsoft Access 97. Monitor with SVGA (800x600) mode with at least 256 colours resolution

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