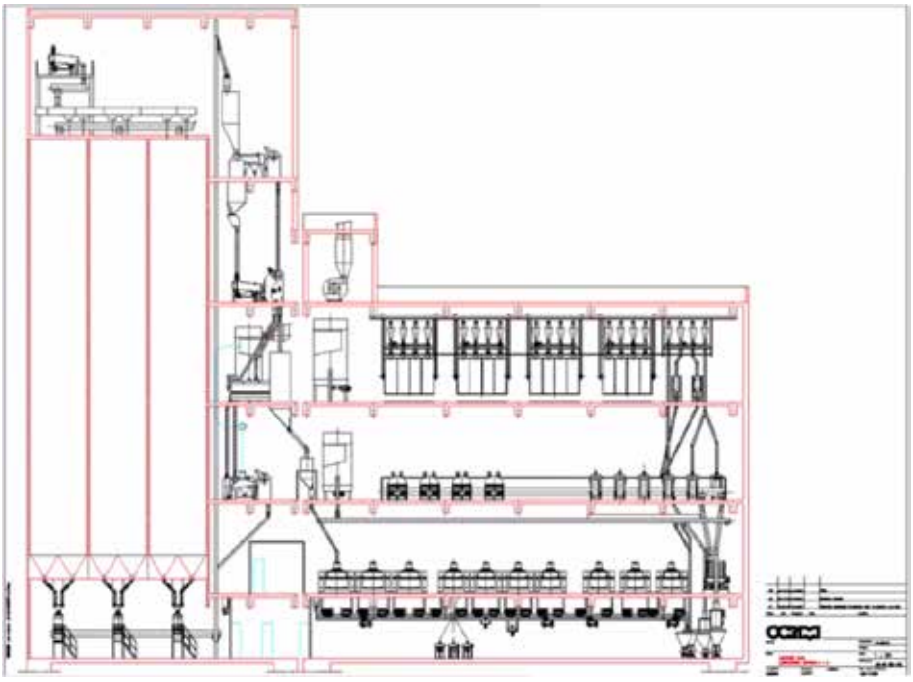
HOW TO BUILD A MILLING PLANT

Considerations for conjuring up a cost effective compromise

Ocrim Webinar



by Andrew Wilkinson,
Milling & Grain magazine

With the ripples of restricted movement continuing to be felt across our industry, the team at Ocrim were once again at our service with their very latest technical webinar.

Taking place on March 18, 2021, this edition was introduced and moderated by the ever enthusiastic food entertainer Anna Buffa, with speaking duties masterfully undertaken by Ocrim's Technical & Tendering Director, Mr Fabio Vuoto.

The main aims of this session were to educate those in attendance about several key aspects of building a milling plant, including:

The factors that should be taken into account while planning a milling plant building.

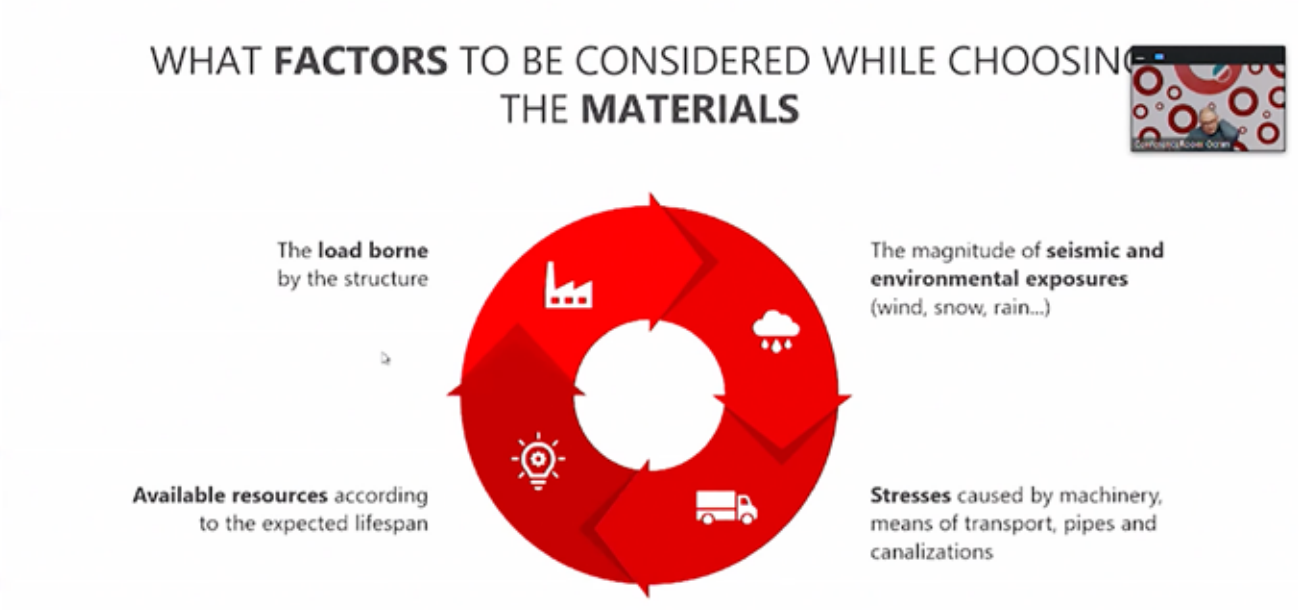
The aspects of the building that relate to energy-saving.

Maximising the return of investment on a new milling plant building.

Although this event was specifically addressed to sector managers and potential new investors, Ocrim also state that it is also suitable to anyone connected with our industry who likes to keep up to date with the latest news on milling plants.

How to build a milling plant

Following Ms Buffa's warm welcome, Mr Vuoto began his address by laying out the three questions that this webinar sought to answer. Beginning with the elements to consider in planning a



milling plant, he continues by examining the factors that should drive the choice for the highest return on investment, before then concluding by discussing the possible impacts of the planned timing on investment.

Seeking to answer the first question, Mr Vuoto briefly explains how designing a milling plant works and how this can be tailored in order to best comply with the customer request.

However, before we even get to the construction stage, we have a few analyses that we must first resolve at the design stage. These include a geological survey and an environmental survey. It is only when these have taken place that an analysis of the requirement of the customers can be carried out.

Today the main types of buildings on the market are made of reinforced concrete, metal and a mixture of reinforced concrete and metal. Steel and reinforced concrete are the most used materials in the construction sector, with their popularity being due to their extreme intrinsic qualities, states Mr Vuoto.

When choosing the materials Mr Vuoto believes that a selection of very specific factors should be first considered including the magnitude of seismic and environmental exposures (wind, snow and rain for example), the stresses caused by machinery (vibration, weight), means of transport - including pipes and canalisations, the load borne by the structure and the resources available in relation to the plant's expected lifespan.

Choosing the right flow sheet

The plant arrangement forms the most basic element of planning a milling plant. The conventional building forms follow the plant diagram and traditionally include demarcations for the wheat storage, cleaning, milling, finished product check and the finished product storage silo areas.

In the first example provided by Mr Vuoto, the plant flow sheet is almost replicated in the final construction. This layout incorporates the six stages of the milling process including the wheat mixing and tempering stage, the cleaning and milling sections, the finished product storage silo, finished product bagging section, with the finished product warehouse being on the right hand side of the flow sheet diagram.

In an effort to reduce construction costs, only one formwork is used to build wheat cells and it is disassembled and reassembled in the finished product storage silo. At least three cranes are required to assemble and lift the framework into place during the construction phase. No electromagnetic assembly is possible during this stage so financial and time costs both increase.

However, Mr Vuoto also proposes two alternatives (Options 2 and 3, pictured) which can reduce building costs and reduce construction time, so that the plant can start to produce and make money within a much shorter period of time.

Reducing construction costs

According to Mr Vuoto, the number of floors is another factor which effects both the cost of construction and the cost of running the plant. In the lifespan of a building, the correct design can positively impact of as much as 15 percent.

Of all of the design options that are currently available, Mr Vuoto believes that the seven-floor plant is the very best solution for reducing energy consumption. Ideally a milling plant should be built on seven floors:

- Ground floor
- Roller mills floor
- Spouting floor
- Purifiers and bran finishers floor
- Sifters floor
- Receivers floor
- Filters and fans floor

During the cleaning process stage of production, the seven floor design allows for maximum use of the drop for sequential loading of the machines, whilst also minimising the required number of mechanical lifts using elevators.

In the mill itself, the seven floor design also allows for maximum use of the drop pipe to transport the product, thus minimising the lift required from the pneumatic suction conveyor. The size and power of the fan required for the installation is also reduced due to the nature of this design, says Mr Vuoto.

However, this is also the most expensive design solution as it requires an incredibly large amount of steel and reinforced concrete, with Mr Vuoto adding that the ideal solution would be to strike a compromise between the two extremes, ergo reducing costs for the business.

Striking a compromise that reduces costs

The first of the compromises suggested by Mr Vuoto is a plant design that omits the filter and vertical receiver floors from the flow sheet entirely. He believes that an absence of extra management costs and the fact that there will be one or two floors less, this should lead to savings on running and construction costs.

The second option offered by Mr Vuoto includes the elimination of the roller mills floor and install roller mills on the ground floor with internal pneumatic recovery. He believes that this adjustment will cause building process costs to decrease as the roller mills are the most heavy and expensive machines.

However, Mr Vuoto states that this flow sheet design can lead to higher running costs. This is because the energy required by the pneumatic transport used for aspiration can increase by as much two percent.

The third adjustment proposed by Mr Vuoto is to forego the gravity flow spout. Although he believes that this adjustment will lead to a reduction in initial building costs, the increase in ongoing running costs will negate any initial savings made.

These running cost increases include an uptick in electric consumption from the pneumatic suction transport, due to more pneumatic liftings and as much as a 10 percent more power required for the plant's ventilation system.

Lower initial investment equals long term expense

As stories from mill owners across the globe can no doubt stand testament to, lower initial investment for the sake of lower initial investment often leads to the burden of avoidable expense in the long term. Ongoing issues such as costly maintenance, machine stops and poor efficiency, can continue for the entire life cycle of the plant.

On this subject, Mr Vuoto provides the example of a 300-350 TPD mill, with the estimated cost for one complete building floor is about €172,800 (US$204,045).

In a 300 tons per day mill, the extra energy consumption (10.0%) of a 132 Kw pneumatic transport fan is €211.217 (US$250) per week.

€211.217 (US$250)/week x 47 weeks = €9,927.20 (US$11,718.17) Total extra management costs: €9,927.20 (US$11,718.17) /year x 30 year = €297,816 (US$351,574) > of €172,800 (US$204,045).

In a 350 tons per day mill, the extra consumption (10.0%) of a 160.0 Kw pneumatic transport fan: €240.019 (US$283.20) /week. Therefore, €240.019 (US$283.20)/week x 47 weeks = €11,280.90 (US$13, 321.28) /year.

The total extra costs to manage: €11,280.90 (US$13, 321.28)/year x 30 years = €338,427.00 (US$400,000) > of €172,800 (US$204,019.78)

The fourth and final option provided by Mr Vuoto is a building design that features internal roller mills and without the manoeuvring plan. Even this relatively minor adjustment can cause costs to increase by as much as 12 percent, with investment savings of €172,800.00 (US$204,019.78) x 2(two floors) = €345,600.00 (US$408,039.56).

When designing a milling plant, care should be taken to ensure that initial construction cost savings don't translate into energy cost and maintenance headaches at a later date. What we save now, may very well be taken from us anyway further down the road.