Meltshop Expansion Modeling

Question

We are contemplating adding another ladle furnace to our shop. Our caster currently has three strands but has room for a fourth strand. Our shop area is quite cramped but has the room for the new equipment. How can we predict the production from the new arrangement under varying conditions and normal production upsets? Will we need to purchase additional ladles and install another crane if we complete the expansion? F.S. Malaysia

Answer

Use of computer simulation is strongly suggested in this situation. Positioning equipment and predicting production levels from a plant expansion is always a difficult task. Logistics, production schedules and downtime conspire to prevent a new facility from operating at full capacity. Dynamic digital based monte-carlo simulation packages have been developed to allow unlimited animation of production operation.

Steel making processes tend to run in regular predictable patterns. Even delays run in predictable patterns. This allows a production planner to make out a schedule. Gantt type charts have been used for years to illustrate the order of melt shop production. While these charts are useful to examine the ultimate production potential of a shop, often minor fluctuations in the production engine render Gantt charts useless. Once the production chain is broken, the effects last far beyond just the immediate problem.

All steelmakers have run into this problem. A five minute delay in picking up a ladle at the ladle furnace results in a broken casting string. The EAF must then shut down to accommodate the time needed for a caster turnaround. Everything starts to cool. Production is lost and additional energy is consumed. The five minute delay on the crane results in a one hour upset in production.

Simulation is very effective at both preventing and fighting production delays. On the job training in production planning and melt shop operations can be started at a computer terminal rather than in the expensive territory known as experience.

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Dynamic digital based monte-carlo simulation provides for a more detailed analysis of shop utilization. The processing time probability distribution becomes a critical factor in coordinating activities between the various units. Processing times at the EAF, LF and CC can be characterized by a normal distribution. Delay times typically follow an exponential distribution.

Logistical conflicts can be easily examined using simulation. For example, cranes on the same track cannot jump over one and another to pickup a ladle. No more than one ladle at a time can be heated at a ladle furnace. You cannot tap the EAF unless there is a ladle under the taphole.

Random breakdowns can be programmed into the model. Situations such as one strand out of service on the continuous caster or a ladle furnace breakdown can be used to determine alternative output schemes. Production levels achievable with the current number of ladles or cranes can be accurately predicted and used to determine the need for more ladles or a new crane. As an added bonus, once the simulation model is completed it can be easily modified to study future production scenarios.

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