Computer-aided mining operations

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On Thursday the mine recorded good utilisation of production capacities on the morning shift but utilisation of worktime dropped down at the same time. In turn, a decrease of the Overall Equipment Effectiveness (OEE) parameter has led to an increase in fuel cost per tonne of production. All such information can be read in reports produced by the Total Management System (TMS).

The computer display presents several graphs. Yellow, green, red lines, some figures... – This report for a gravel mine is called ‘Daily snapshot’ and clearly demonstrates why the utilisation parameter for the mine has decreased. The reason for the case is the late start of the plant operation, explains Wiktor Kwiatkowski from TMS Poland that developed and installed optimisation systems at LAFARGE mining operations. – And here is another outcome. The OEE report that summarises the utilisation degree of the plant in the form of synthetic indices. You can easily see that good utilisation of production capacities was recorded for the morning shift, but utilisation of work time was worse.

We take a glance at subsequent tables, this time for a quarry. The production report provides quantification of production and efficiency of the plant – comparison between of transportation tonnage carried by haul trucks and overall production output of the operation...

Let us take a look how the history of the TMS system started at LAFARGE.

Implementation in 2008 and upgrade in 2015

The idea to launch the system at mining operations of LAFARGE was motioned by Dariusz Koczara who was employed at the Mechanical Engineer in chief at that time. One of the first plants where the TMS Standard system was implemented as a pilot project (initially only for loaders) was Sępólno gravel mine. The reason was simple: - We just needed information on fuel consumption, productivity and work time of operator – explains Bartosz Ostapko, the mine manager. – The second aspect was simply cost-effectiveness and economy. We wanted to check whether petrol-fuelled into loaders is entirely used for the operation of the machines – he adds.

Sępólno, Dubie... Soon the TMS system appeared on key mobile machines at 14 plants operated by LAFARGE. Several years afterwards, in 2015, again against initiative of D. Koczara, the Manufacturing Execution System (MES) tailored by TMS exactly for needs of Lafarge and was implemented on all conveyor weighing scales at 14 gravel mines and quarries owned by Lafarge in Poland.

Customised reports

A loader approaches a gravel heap and immerses its shovel into bulk aggregate. Then, it is turning back and dumping the material into a nearby truck. – We can easily analyse the operation of individual machines owing to compacted but sufficient information that is received on a current basis – says Maciej Piszczynski, the manager of Duba quarry where Devon dolomite has been excavated since 1963.
It enables focusing major attention on the continuous optimisation of expenses and improvement of production indices.

The amount and types of data to be processed depends on a specific mine where the system is in place. Personnel of Lafarge stresses that the set of reports generated by the TMS system was customised each time to individual features of every single plant whilst a seamless collaboration between the provider and users enabled development of optimised solutions.

A key component of the system customising consisted in the definition of performance reports where such parameters as Overall Equipment Effectiveness and Key Performance Indicators are displayed. On the other hand, the operative report called ‘Daily snapshot’ makes it possible to take a close look to locations and possible reasons for disturbances in production – Mr Marek Stanek from TMS Poland is adding.

The package of reports for plant performance and ‘Daily snapshot’ was defined individually for individual plants. – Each manager was keen to monitor other
HOW MUCH WAS CARRIED VIA THE EXHAUST?
Fuel consumption is rated among parameters that are the most crucial for mobile machines.

REDUCTION OF COSTS
The Total Management System is a tool that primarily makes it possible to reduce direct costs of a mining operation by improving productivity and efficiency of individual production plants, increasing the effective working time and quick identification of reasons for various disturbances.

parameters or to receive reports with slightly different layout and content – says Bartosz Ostapko.

Someone is curious how many litres of fuel a certain machine consumes per one tonne of output. For other people, it is more important to know how machinery operators perform. – Fuel consumption can be easily calculated by myself for mobile machines and in case of immobile ones I can see how many tonnes is recorded as the mine output, how many tonnes were weighed on scales and what the actual working time of operators was – stresses the manager of the Sępólno mine.

At his plant the reports start arriving automatically by emails at 6 a.m. – They are Excel spreadsheets and can be available for me and other persons from the mailing list holding managerial positions at various levels as well as for those who handle the operation of various machines - adds Mr Ostapko. In addition, consolidated reports are developed at the headquarter of the Polish branch of Lafarge for top management.

As compared to the primary revision the system was substantially enhanced after several years of operation when the mine started monitoring of also immobile machines, e.g. conveyors. – We have access to conveyor scales and can see the tonnage transferred by the system in every minute, how many tonnes are completed and how much time the machines run idle – the manager carries on.

Also, Maciej Piszcztyński receives daily emails with reports automatically generated by the system. – For me, the ‘daily snapshot’ is particularly valuable since I can see the performance of the entire production workflow on a single image and easily find out where bottlenecks are, and which components perform the best - stresses the manager of Dubie quarry.
**Benefits also for young employees**

The TMS system is a tool that primarily enables the mine to reduce its direct costs by improving productivity and efficiency of production plants, better utilisation of working time, quick troubleshooting.

– It enables elimination of ‘bottlenecks’, downtime and idle operation as well as enables monitoring of fuel consumption – itemises Mr Kwiatowski.

In such quarries as Dubie, TMS also contributes to the growth of material tonnage conveyed by haul trucks and a day-by-day increase of overall output from a production plant. The number of haul trucks loaded to full capacity and number of technological cycles increase as well.

– Please keep in mind that it is also an instrument that can be used by young operators of machines to monitor their professional development and compare their expertise against more experienced workmates – emphasises Marek Piszczynski.

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The market of aggregates subjects to continuous alterations with new challenges and priorities emerging. Can the TMS system catch up the changes?

– The task team made up of representatives from both Lafarge and experts from TMS Poland are continuously starving to develop subsequent, even more, advanced functionalities – Dariusz Koczara says. – Since the system is a really flexible tool it can be easily adjusted to changes in production and reporting. Management is a continuous process and must rest on reliable information provided by the system. Digitalisation of data and availability of comprehensive reports enable the quick taking of correct decisions and lead to better management of the mine operation – concludes the manager of Dubie quarry.

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**METHODOLOGY BASED ON USE OF DEDICATED REPORTS:**

The approach that assumes use of dedicated reports for improvement of the plant operation is a continuous process.

- The daily operational procedure for use of performance reports with such parameters as Overall Equipment Effectiveness (OEE) and Key Performance Indicators (KPI) has been defined.
- OEE reports and ‘daily snapshots’ are used every day to make the production process even more efficient.
- KPI reports are used for day-by-day monitoring of direct production expenses.
- At quarries, the additional comparison is made between tonnage of materials carried by haul trucks and overall output of the plant.
- Part of reports is used for daily meetings of the plant management with foremen.
Other reports are discussed during weekly meetings of regional managers with mine managers.
In addition, consolidated reports are developed at the headquarter of the Polish branch of Lafarge for top management.