Providing effective back up for terminal ‘muscle’

Container terminal productivity requires more than just the largest, most powerful equipment, writes Fredrik Johanson

In everyday language, we define productivity as metrics and measures of output from production processes per unit of input.

Depending on how a terminal’s performance indexes are defined, productivity can refer to containers per hour, moves per hour or cost per container, for example. It is not all that difficult to measure containers or moves per hour, system suppliers can help a terminal to operate its dockside cranes faster.

Cargo Systems consulting editor Brian Robinson presents a legitimate argument that with “muscle” alone, a terminal can be operated faster to reduce cycle times and to consequently increase productivity (CS, Dec 08, p43). This typically provides shorter ramp times and higher speeds for hoist operations, as well as optimal results in containers per unit of time.

However, this approach requires higher installed electrical power, with subsequent scaling up of motors, inverters, transformers and cables.

Furthermore, if the terminal does not have a sufficient number of vehicles to receive the containers off-loaded from the ships, crane hang times will become excessive, resulting in unnecessarily high idling and magnetising losses in motors and transformers. The anticipated gains from the productivity increase would be entirely or partially negated by increased costs for both operations and investments.

So what can the supplier of the electrical system do to influence crane productivity? Selling larger components – which has an upside for the system supplier – is not a good long-term solution for society as a whole, for the environment or for crane users.

Automation, training, service and support, spare parts, crane information management systems, preventive maintenance and integration are examples of some of the areas in which crane productivity can be increased.

A function used by some suppliers for several years is anti-sway. The function entails the operator being assisted in catching the sway and can thus focus on tasks other than controlling the sway of the suspended load. This can be combined with electronic load control (ELC), with the operator using a touch screen to choose the position to which the container or empty spreader is to move.

Rather than using anti-sway, many crane operators traditionally prefer to catch the sway themselves, if for no other reason than professional pride, and they are often highly skilled at this.

Load pendulation in the other direction – the skew direction – is significantly more complex for the operator to correct and it becomes more difficult to stop, the longer the ropes. An automatic skew control is now available that efficiently ensures that skew pendulation is minimised, and consequently contributes to shortening cycle times.

This function can be combined with a function that determines the position of the vehicle that a container is to be placed on, permitting vehicles positioned at an angle in the lane to be loaded without delay. The angle discrepancy between the load and vehicle is regulated to zero by the load being skewed on the way from ship to shore.

The result of automatic skew control is an actual productivity increase, in that the crane can move more containers per hour but with equally large frequency converters and transformers as previously. Moreover, the function assists operators by relieving them of a very difficult task.

With the help of a stack profiling system (SPS), the crane receives stack profiling data, which is updated on each cycle from the ship. The system can then calculate the lowest possible height of lift. This function not only reduces cycle times by the load not being lifted higher than necessary, it also minimises energy consumption, thus reducing the impact on the climate.

Sticklers for detail may object to the argument that the energy used to lift the load is regained during lowering, but it must be kept in mind that losses in motors, cables, transformers and gearboxes are never regained; these losses are only used to heat the planet.

If we now combine anti-sway, electronic load control, stack profiling systems and automatic skew control, we get something that ABB calls an automatic container landing system (Aclas).

Look no hands! ABB has produced an automatic container landing system (Aclas) that combines anti-sway, electronic load control, stack profiling systems and automatic skew control.
In brief, Aclas entails the operator monitoring only the process from the point where the load leaves a safe height over the ship to where it reaches a safe load height over the vehicle, with the correct skew angle and with no pendulation whatsoever. The operator can easily set the container on the vehicle and return to the ship for a new cycle.

For a conventional single hoist STS crane, the advantages of such automation systems are obvious, but these become even more so if one studies a dual hoist STS crane where non-beneficial portions of the cycle time can be expended for landing loads on vehicles. With the help of automation, which can determine the positions of vehicles while the crane is moving from the ship, there are major gains in time – and subsequently money – to be made for large and modern STS cranes.

The system supplier can help crane operators to work much more intelligently and economically, and with lower energy consumption, while shortening cycles. Increasing berth productivity, however, requires the landside transport of containers to or from the quayside to keep up, but this is a topic for several doctoral dissertations.

Naturally, the system onboard the crane must be the best possible and provide optimal availability, but even so, things can go wrong. And when they do, knowledge of how faults are to be remedied must be readily accessible.

Personnel in maintenance and engineering departments must possess solid knowledge of the system. An STS crane cannot be quickly replaced like a robot on a production line; it must be constantly maintained. This requires skilled personnel and management that understand the importance of time being allotted to maintenance, modifications or additions.

Because operational priorities at a busy box terminal can naturally cause preventive maintenance to be postponed, each terminal must conduct an analysis of its particular situation – there is no one-size-fits-all solution – and based on the results of the analysis, appropriately train its personnel.

Actually, mechanical breakdowns on cranes are rare; any problems that may arise are usually caused by minor faults in electrical systems. System suppliers can help out by continually improving knowledge of the systems through onsite training on the cranes and at strategically selected training centres, for example.

Upon delivery of new equipment or modifications, participation in commissioning must also be included as a part of training so as to provide terminal staff with the opportunity to familiarise themselves with the new equipment.

A prerequisite is that all training is conducted by knowledgeable personnel, who are not only familiar with the latest advances in technology, but also have knowledge of older systems since, for example, many crane users have some older cranes with DC technology.

With the right personnel, properly trained for the tasks at hand, any downtime can be minimised and productivity maintained or improved due to the personnel being knowledgeable of the system.

Regardless of the skills, training and system familiarity of the maintenance department or whether maintenance is correctly conducted, support from the system supplier for an STS crane system may be necessary. First of all, this requires that such support exists, that it is accessible, and not least, that it is competent.

As a crane user, one must demand that the system supplier fulfils these requirements. Without this, crane availability can be negatively affected, and consequently, productivity. The provision of service and support are naturally a matter of balance with all day, everyday service costly both for the crane user and system supplier.

If there is an installation base in the geographic area, 24/7 support and service may be perceived as worth the investment by both parties since the costs can be distributed over several installations. Once again, this is not a one-size-fits-all matter; each terminal must analyse the situation based on its unique circumstances.

Reputable crane system suppliers provide support from crane-certified engineers with documented experience in the industry and knowledge of the systems.

The container handling industry is truly global and crane users are often global operators with world-class demands on service, support and spare parts supply. These world-class demands must be met by the system suppliers and often exceeded if they are to remain in business.
**SYSTEMS**: Quay crane technology

Even if the systems are designed and built with considerable demands on quality, spare parts may be needed. Between different terminals, as well as between operators, there are various philosophies about how spare parts should be purchased and the type of support the system supplier should provide.

That an operator is global entails that rumours and information quickly spread around the world, and if a supplier has problems at one terminal on a continent, it will not take long before knowledge of this has spread to other terminals within the group. Unfortunately, good news does not travel as fast. Nonetheless, this helps system suppliers to stay on their toes and supply spare parts in the shortest possible time.

The life cycle philosophy also has an effect on spare parts management, and not least, on the costs for spare parts.

Crane users must demand that their system suppliers have a plan for the products’ life cycles, for how obsolete systems and components are to be replaced in the future, and to ensure that new products are backward compatible with older products to a reasonable degree. A customer does not want to buy a system, only to be informed a few years later that the investment is now obsolete and that the price of spare parts has skyrocketed.

Spare parts management, and service and support go hand-in-hand, and with good support and efficient spare parts management at a level selected by the crane user, the system supplier has an unquestionably positive effect on the productivity of an STS crane. Moreover, this effect applies regardless of whether the crane is brand new or one that has been in service for a few years.

Increasingly more technically advanced cranes, perhaps with more automation, require modern maintenance that can support a modern crane information management system (CIMS). A CIMS is not intended to merely create long lists of errors; it should also effectively guide the person troubleshooting to the right location in the hardware or software documentation.

A CIMS is an important tool for reducing crane downtime, and a simple and user-friendly CIMS, which is also powerful and intuitive, helps to increase the productivity of STS cranes.

Receiving all information on an onboard crane maintenance station (CMS) from a land station located in an office or vehicle is today more the rule than the exception. Artificial intelligence systems that learn from their experiences are surely the dream for the majority of crane engineers and maintenance technicians.

Three-dimensional views in the land station over the docks and cranes are now routine and add additional information in the form of even better overviews of the cranes.

Even if a system supplier is able to build systems that are technically advanced, easy to maintain, inexpensive and that provide as high availability as possible, they nonetheless require maintenance. This maintenance is, or should be, moving increasingly towards working with preventive maintenance rather than making repairs when something fails.

An airplane, or even a modern automobile with indicator lights for service, is taken in for maintenance at specific intervals regardless of whether anything is obviously in need of repair. A modern CMS supports this way of working and there must be counters, timers and calendars to identify when certain service tasks are to be conducted.

The system generates histories, plans and reports that effectively support personnel in conducting maintenance at selected points in time. Proper maintenance results in fewer unscheduled failures for any device, and consequently higher productivity. A correctly designed and configured CMS gives STS cranes higher productivity.

Moisture, vibrations, dust, electrostatic discharges (ESD), loose connections and other difficulties in combination constitute a tough environment for which to produce electrical systems, especially when they are to be inexpensive, easy to maintain, and at the same time, provide high availability.

To a certain extent, it is about choosing components that can withstand the environment, especially outdoors, but it also involves developing in-house components that are designed solely for crane applications when nothing else on the market satisfies the demands placed on the system of an STS crane.

System suppliers prefer to undertake full responsibility for functionality due to their extensive experience in manufacturing electrical equipment for crane applications, resulting in reliable systems with high availability. Such systems should be modularly designed, easy to work with, electrician-friendly and have proper documentation that is prepared after commissioning and then preferably entered into a CMS for quick and efficient troubleshooting as necessary.

The integration concept also encompasses responsibility for the correct dimensioning of transformers, frequency converters and motors based on data provided, but also that the designs are based on the energy conservation approach with, for example, energy-efficient motors, good engineering practices, optimally sized equipment, sectioning of floodlights – the list is long.

Even in the integration of STS crane systems, the system supplier influences the productivity of STS cranes.

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