COFASTRANS – A response to challenges with current STS container cranes

The Port Equipment Manufacturers' Association October 2020 webinar "Technical challenges for the new generation STS and yard cranes" brought up issues that were further reflected in World Cargo News article "Equipment Lifecycle and Crane Purchasing". The article serves as a mirror of challenges and problems of decades old STS concept currently operating over megacarriers.
There is now an alternative new concept to overcome presented issues – COFASTRANS.

50% productivity leap

The quest to achieve annual 180,000 cycles per crane is set out in this article to meet the need of 50% increase in productivity. Although it admits the consequence of shorter lifetime of currently operated cranes, it clearly fails in proposing any solution. Evolution by scaling up crane size, the effort of increasing operational speeds brings only marginal gain in productivity; the same can be said about further measures (cameras, lights, tandem lift etc.) that might be deployed.

Given the limitation that no more than 8 conventional STS cranes can be deployed alongside the current megacarriers, yet another constraint in productivity is evident. In conclusion, the only effective way for significant increase in productivity is to increase the number of hooks deployed over a ship. That can be achieved only by a concept change.

COFASTRANS provides the productivity leap by deploying 12 hooks over a single ship with just 3 cranes.

Problems of maintenance

The WCN article addressed several subjects each having many facets. From a technical perspective, it is understandable that up-scaling of current concept multiplies or creates new problems. Multifaceted as they always are, fatigue being in prominent position, solutions how to prevent or resist them are proposed in various ways.

COFASTRANS all-important attribute for control of potential issues is simplicity; simplicity of concept, mechanical equipment, movements and details; in fact, of all matters influencing long-term performance of the crane.

The new crane concept outlines significant difference: a portal consisting of 2 main beams with horizontal bracing, 2 cross beams, 2 legs with skew stays on fixed leg side and 4 self-propelled trolleys. The system is practically symmetrical providing corresponding transfer of vertical forces to the rails, notably at some distance from the fenderline. Considering the difference of maintaining 3 cranes instead of 8, the superiority of the new concept is evident with decreased number of locations requiring maintenance.

The two trolleys (semi-automatic or automatic) on each beam are designed to move in synchronous manner from the centreline of the ship to the quay side (or vice versa). By moving in opposite directions from each other the acceleration or braking forces are largely eliminated. Additionally, to adapt varying distances between bays on a ship, a shifting mechanism is provided on board of each trolley to adjust the hoisting position (along the ship) as required. Only under heavy lift operations (with 2 cranes side by side) the 2 trolleys on each adjacent beam are jointly moving in the same direction.

To minimize dynamic impact the trolley speed is planned to be 125 m/min, with reduced travel distance compared to a conventional crane compensating the overall performance. Benefits of this include reduced sway, wear and overall stressing of the structure. Hoist speed being dominant with vessels having 10+ high containers stacked on deck, common 90/180 m/min would be applied. Both speeds may be enhanced, but any significant increase would jeopardise some of the advantages for maintenance and longevity; this concept alone having plenty of productivity in reserve.

The new simple concept brings various benefits and further positive consequences:

- Elimination of rope towed trolley mechanism with machinery, ropes, numerous rope returning points and the tensioning system
- Elimination of hoist ropes support catenary trolleys
- Substantial shortening of hoist ropes
- Elimination of central machinery and electrical houses projection to wind as main e-elements are located inside structure. The same applies to principal staircase and the liftwell
- Elimination of boom raising system, machinery, ropes, suspension and rope reverse system, boom stays, boom-to-bridge girder hinges and trolley rail joints
- Numerous joints and hinges of other structural stays

Consequences of simplicity

The WCN article highlighting recommendations for review of drawings and calculations when acquiring a new crane are all well intended and correct but represent nothing new. This is just return to reality of older days where such checks were not only a question of safety, but in fact a matter of law.

Seen in practice, ever thicker and detailed specifications would not alleviate future problems; often just the opposite may be the result, leaving aside such aftereffects as increases in price and delivery time.

Would a request for new tools to monitor structural fatigue in real time foresee and solve coming problems? And last for 20 years? COFASTRANS approach may appear unsophisticated, but due to simplification it works. It does not “combat” fatigue but aims to “squeeze it out” by minimizing potential locations, with particular attention to detailing and rigorous supervision of fabrication and erection. Under such circumstances analytical review should be adequate for years without much to worry about, followed later by regular inspections. This is also our response to the quest for elevated number of cycles and concern of reduced lifetime.

It is obvious that the concept is radically new to current terminal design and infrastructure. However, the industry is well aware that any significant leap in productivity cannot be reached with incremental development of the current concept.

Would the container handling industry be ready to bring COFASTRANS into reality or just continue to be content with current problems and constraints?