### engineering

John Lund, Sales and Marketing Director (Global) Visy Oy takes a comprehensive look at how advancements in Optical Character Recognition (OCR) and Gate Operating Systems (GOS) are changing quayside operations.

or the modern GOS, it makes little difference if we are talking about quayside, truck gate, rail, or even yard processes. The access and area management requirements for each of those operational areas are fundamentally the same:

I) Identify assets (trucks, CHE, cargo, people, etc.)

2) Digitise and share relevant data with 3rd party systems such as the TOS.3) Allow the assets to move against the reference of a correct workorder or create an exception handling event if there is a conflict.

When we use the term "process automation" in the context of a GOS, those three overarching aspects may have different implications depending which part of the operation is in focus. Below we will explore the details of quayside process automation using a modern GOS, and what it means for the terminal's IT and operations teams.

#### The Visy Ecosystem

The Visy Access Gate (VAG) platform is uniquely positioned to manage all aspects of access and area control in a single ecosystem. As a platform, it allows for an unlimited number of interfaces to 3rd party systems such as a TOS, RFID systems or appointment system, and will interface with any existing equipment such as weigh-in-motion scales, CHE PLCs or radiation portals.

The VAG platform is flexible enough that it can operate in the background, and therefore let existing IT infrastructure take a lead role, or it can be the front-end platform and GUI that unites subsystems and shares all relevant operational data with the TOS. With such a range of data collecting and sharing options in a single system (from a single vendor), VAG meets all conceivable requirements of IT and operations to produce scalable, predictable, profitable, and future-proof operations.

The primary goal of the VAG "quay-gate" module is to improve specific KPIs, namely: 1) Cost per lift.

2) Cycle times / lifts per hour.

3) Berth productivity.



# How to improve quayside KPIs

## Expand vision

While each terminal may have site specific requirements to improve those KPIs (and there are more specificities if we look at loading vs discharging operations), the VAG function is to automatically identify assets, reference the TOS, and confirm workorders or create an exception handling event. The quay-gate module is unique suited to improve these KPIs because of features found only in the VAG platform such as the Visy Deep Neural Network (DNN), TopView (spreader OCR), and automatic damage detection as described next.

#### Visy LaneView & TopView for Process Automation

Identifying cargo and CHE is critical in quayside operations. In process automation, this function is performed with vision technology and OCR. Visy uses a subset of Artificial Intelligence (AI) called "Deep Learning" for all vision technology, including OCR.As a pioneer in OCR for logistics applications, the Visy DNN meets all operational data collection requirements with guaranteed results.Additionally, the DNN collects and shares relevant event data faster and more accurately than a human, resulting in improved KPIs.



The Visy DNN functionality includes:

- Container codes
- Verification of check digit
- ISO codes
- IMO labels
- IMDG/ADR labels
- Dangerous goods labels presence/classification
- Seal presence and type (bolt, zip)
- Door orientation
- Container weight (max, tare, payload)
- Container volume
- Automatic damage detection (structure, dents, bulges, extreme rust, large holes)

- Open doors
- 00G
- Flats
- Hatches
- Bundles
- Terminal Tractor ID
- Twistlock detection
- Lifting type

To achieve reliable process automation for such an extensive list of attributes, 3 - 5 side imaging is required. The Visy Crane OCR system includes LaneView, a series of pan-tilt-zoom (PTZ) cameras mounted on the sill beams and portal beams, and TopView spreader OCR system. PTZ cameras are utilised because the system interfaces with the crane's PLC to track the spreader's flight path in live operations, therefore the system always has "eyes on the cargo" and takes images at the right time. This smart-system approach allows the crane operator to work how they believe is the best, and the system conforms to their style. The other advantage of smart PTZ cameras is that if a camera breaks or malfunctions, another camera can take over and therefore avoid disruptions in the operation.



Multiple camera views coupled with a smart-camera system offers multiple levels of redundancy in the OCR process, and therefore maximises uptime. Visy TopView (spreader OCR) also interfaces with the crane's PLC and extends the notion of "smart devices." As the spreader is the common denominator in container movements, giving it "eyes" has clear benefits:

- Automatically links box ID to a specific spreader on each move

- Boosts OCR read rates with 5th side image(s)
- Automatic twin-20 detection
- Early alert if wrong box is being moved

- Roof picture for damage inspection/claim management

- The roof pictures may also be used for automatic damage detection

- Spreader OCR is the only way to bring mobile harbor cranes into the quayside automation system

- TopView is applicable on all CHE (RTGs, RMGs, reach stackers, etc.), in any part of the operation, without additional cabling. Furthermore, since the cameras are on the spreader, the type of operation or the flight path are immaterial. Hooking boxes on the vessel, between the legs, on a platform, in the back reach area, or during shuffling, makes no difference to TopView. The system takes images of the boxes at the right time, digitises the relevant data, and shares the data with 3rd party systems as required for site-specific process automation.

Linking the workorder to the horizontal transportation is an important part of quayside process automation.VAG operates with OCR or RFID to identify terminal tractors (TTs) on the quay and automatically make the association with the cargo ID.When OCR is used,TTs have numbers painted on the roof of the driver cabin. Cameras placed on the STS cabin point down and automatically identify the roof-top TT number. This asset ID is verified for the workorder, and the TOS receives an update. When RFID is integrated into the system, long range readers are placed on the crane frame and each TT is equipped with an RFID tag.

When the tag is excited, the system knows that the TT associated with that tag is executing a workorder.VAG receives the RFID information, associates it with the box ID and updates the TOS. Clerks and operators automatically receive workorder information and don't need to manually input data thus saving time and possible errors on every transaction.

#### **Digitising Damaged Cargo**

The Visy Automatic Damage Detection System (ADDS) is the latest feature that can be utilised in any part of the VAG ecosystem. With ADDS, the Visy DNN assess the condition of containers, digitises the assessment, and creates alerts for containers that are in an unsafe or unacceptable condition. Imagine that during a discharge operation, a box is coming off the ship and it has severe structural damage.Visy ADDS "sees" the damage, digitises the information, and creates an exception handling event for that box so that it doesn't go into the stacks. Similarly, if boxes are coming off the ship and have bulges, dents, extreme rust or holes, the system logs the damage before the box touches the quay and therefore exonerates the terminal of liability. The proactive nature of ADDS allows operators to take control of incoming damaged cargo and share that information with their customers before the problem escalates. ADDS is a software add-on that does not require any additional system hardware. It provides operators with the ability to supply value added services to their customers with minimal investment.

#### Limitations

While VAG for quayside operation is the most advanced system of its kind due to the single-platform ecosystem coupled with unique tools such as TopView, ADDS and the Visy DNN, this type of system is not without limitations. The first limitation is regarding seal numbers. Unfortunately, there is no vision technology system available today that can read seal numbers while boxes are in flight to a level that is acceptable for process automation. If the seal is dirty or turned in such a way that the numbers are not visible, it simply cannot be read with a camera system.

The second limitation is that in twin, tandem or quad lifts, some sides of the boxes will be obscured by the other boxes in the lift. For example, in a twin-20 lift, one of the doors will be blocked and therefore any data on the blocked doors will be impossible for the system (or any operator) to read. In this case the box ID will be read from TopView and other cameras, but seal presence cannot be confirmed during the lift. While these limitations are certainly an inconvenience in quayside automation, they are not enough to suppress the return on investment.

#### Conclusion

The VAG platform identifies everything that goes in or out of a terminal by road, rail or quay, digitises that information, and shares it with 3rd party systems such as the TOS to provide process automation and thus improve KPIs. In quayside operations, the VAG platform provides unique features such as TopView (spreader OCR), LaneView PTZ smart cameras that image every visible side during a lift, terminal tractor identification, and the Visy DNN which guarantees the best OCR read rates in the industry and even incorporates ADDS. While there are limitations to any quayside vision technology system, the ability of the technology to collect and share data faster and more accurately than a human make it a prudent investment for any operator seeking to improve their processes and provide their customers with enhanced service.

#### **STS Crane OCR for Baltic Hub**

Visy's partner, Autepra has signed a contract to supply crane OCR and quayside automation to the Baltic Hub terminal (DCT Gdansk) (member of PSA Group). Phase I of the project scope is design, delivery, implementation, integration with Navis TOS and 5 years support and maintenance of 14 STS cranes. With the planned Baltic Hub (DCT Gdansk) expansion, the system has the potential to be extended to new quays in the future. The system uses Visy's LaneView crane OCR solution with fixed PTZ cameras. The quayside automation is an extension of the gate and rail OCR automation that Visy and Autepra have already delivered. More on that project can be found at: https://youtu.be/iOJAcO2A2Ow

#### **About the Author**

John Lund has more than 15 years of experience helping marine and intermodal terminals achieve their operational objectives with technology. He has worked on a wide range of projects in Europe, Africa and the Americas involving OCR, RFID, DGPS, and other process automation tools. His career motivation is rooted in knowing that the systems he provides improve safety, efficiency, and profitability for his customers. John holds an MBA and law degree.



Visy crane gate system UI.

Visy LaneView camera.

