Quayside Digitalisation:
How Visy Systems See, Validate, and Act

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AI Vision and Data-Driven Operations for Brownfield Sites

Brownfield container terminals are under increasing pressure to modernise their operations and match the productivity of fully automated facilities. While upgrading an existing terminal presents clear challenges, transformation is both achievable and commercially viable. One of the most effective ways operators can improve performance and strengthen competitive advantage is by adopting a holistic approach to operational optimisation, particularly at the quayside.

In modern container terminals, ship-to-shore (STS) crane speed alone is no longer the defining performance metric. While traditional KPIs such as Gross Moves Per Hour (GMPH) remain relevant, competitive differentiation increasingly depends on how efficiently and predictably containers move between the quay and the yard, and how accurately physical execution aligns with planning in the Terminal Operating System (TOS). This broader view of quayside performance encompasses metrics such as internal truck turnaround times, yard productivity, and rehandle rates, all of which can be significantly improved through digitalisation.

Ultimately, efficiency between the quay and the yard is achieved by eliminating unnecessary work and

"Efficiency between the quay and the yard is achieved by eliminating unnecessary work and reducing uncertainty at handover points."

reducing uncertainty at handover points between STS cranes, internal transport, and yard operations. Visy addresses these challenges through AI-based vision technology and a software platform that transforms every container move into a verified, data-rich event aligned with the TOS plan. These solutions, including AI-powered crane Optical Character Recognition (OCR), dedicated pinning stations, and remote wharf management tools, demonstrate how digitalisation strengthens quayside KPIs while enhancing a terminal's profitability and market position.

Using Quayside Data Collection to Improve KPIs

At the core of Visy's quayside offering is an AI-based OCR engine that processes images captured by pan-tilt-zoom cameras mounted on crane structures such as portal beams and sill beams. These cameras capture images of the container end or door and long sides, in flight, during loading and discharge operations. In addition, cameras can be mounted directly on the spreader as part of Visy's proprietary TopView Spreader OCR application.

By capturing container identification and event data as soon as the twistlocks engage, TopView transforms the spreader into a smart device, making it the first

point of operational truth. Combined, the frame-mounted cameras and TopView system capture images of five sides of each container during single lifts and four sides during twin lifts.

The Visy OCR engine automatically detects and classifies a wide range of attributes critical to quay-yard coordination, including:

- Container ID and ISO codes
- Door orientation
- Seal presence
- IMO hazardous labels
- Unconventional lifts such as hatch covers, out-of-gauge cargo, and lashing gear boxes
- Internal terminal tractor number detection
- Automatic Damage Detection System (ADDS)

Through automated data collection, container attributes and lift types are confirmed immediately, eliminating the need for manual checks on the quay or vessel. For planning teams, this means all moves are digitised and verified before the container leaves the crane's operational sphere. For clerks, camera-based verification enables remote working in safe conditions, away from heavy equipment. Across the quayside, data is shared in real time to remove waste from operational processes and support consistent KPI standards.

From Detection to Decision: Real-Time Load and Discharge Validation

Data capture delivers the greatest value when it supports real-time operational decision-making. The Visy Crane Gate platform provides a quayside operations management layer by automatically converting OCR event data into structured, bi-directional communication with the TOS. As no terminal operation is free from exceptions, real-time data exchange between Visy Crane Gate and third-party systems enables operators to make fast, informed decisions.

During container handling, Visy Crane Gate:

- Generates real-time load and discharge events with container IDs and associated data
- Links cargo information with terminal tractor assignments
- Updates and validates execution against the TOS for move confirmation and upstream planning

Conversely, Visy Crane Gate creates exception-handling events when it detects:

- A mismatch between container ID and the vessel bay plan
- An incorrect terminal tractor positioned under the STS crane

- An unreadable container ID or asset damage exceeding acceptable limits
- Discrepancies between load lists and OCR data, including IMO placards, seal presence, door direction, and weight

These exceptions are immediately visible to remote operators, who can resolve issues without dangerous or time-consuming physical intervention on the quay. On-the-fly plan changes are simplified because all stakeholders operate from a single, digitised source of truth.

While Visy Crane Gate validates lift data and provides a comprehensive overview of quayside operations, the new Visy Wharf App supports crane operators directly by delivering clear audio and visual instructions for executing planned moves.

During crane operations, the Visy Wharf App:

- Displays the real-time move sequence
- Links each container ID to an accurate stowage position

- Validates execution against the TOS vessel bay plan and work order
- Delivers real-time updates from office coordinators

This immediate validation is critical during high-intensity vessel operations. When a physical move deviates from the planned bay, row, or tier, discrepancies are detected instantly and corrected before incorrect stowage occurs. Shipping lines and terminal operators benefit from digitised evidence of every move, validating both productivity and execution accuracy.

## TopView: A Rooftop Perspective That Enhances Visibility

By transforming the spreader into a smart device, TopView automatically identifies container IDs and references the TOS as soon as the twistlocks engage. The system also captures high-resolution images of the container roof before contact, providing evidence of pre-existing damage not caused by terminal operations.

In addition, TopView detects unconventional lifts such as out-of-gauge cargo and hatch covers, and automatically identifies twin-20 configurations, ensuring lifts are correctly processed without operator input. Because the spreader is the common denominator in all container moves, enabling it with AI-driven intelligence and TOS connectivity helps prevent lifting errors and costly rehandles.

During twin-lift discharge operations, each container is individually recognised, linked to its specific work order, and associated with the correct internal transport task. If an operator attempts to lift two 20-foot containers while the spreader remains in a 40-foot configuration, TopView alerts the operator before the industry-dreaded "twin-20" failed pick occurs.

For terminals, this delivers measurable operational value:

- Higher crane utilisation
- Reduced rehandle rates
- Improved yard resource planning
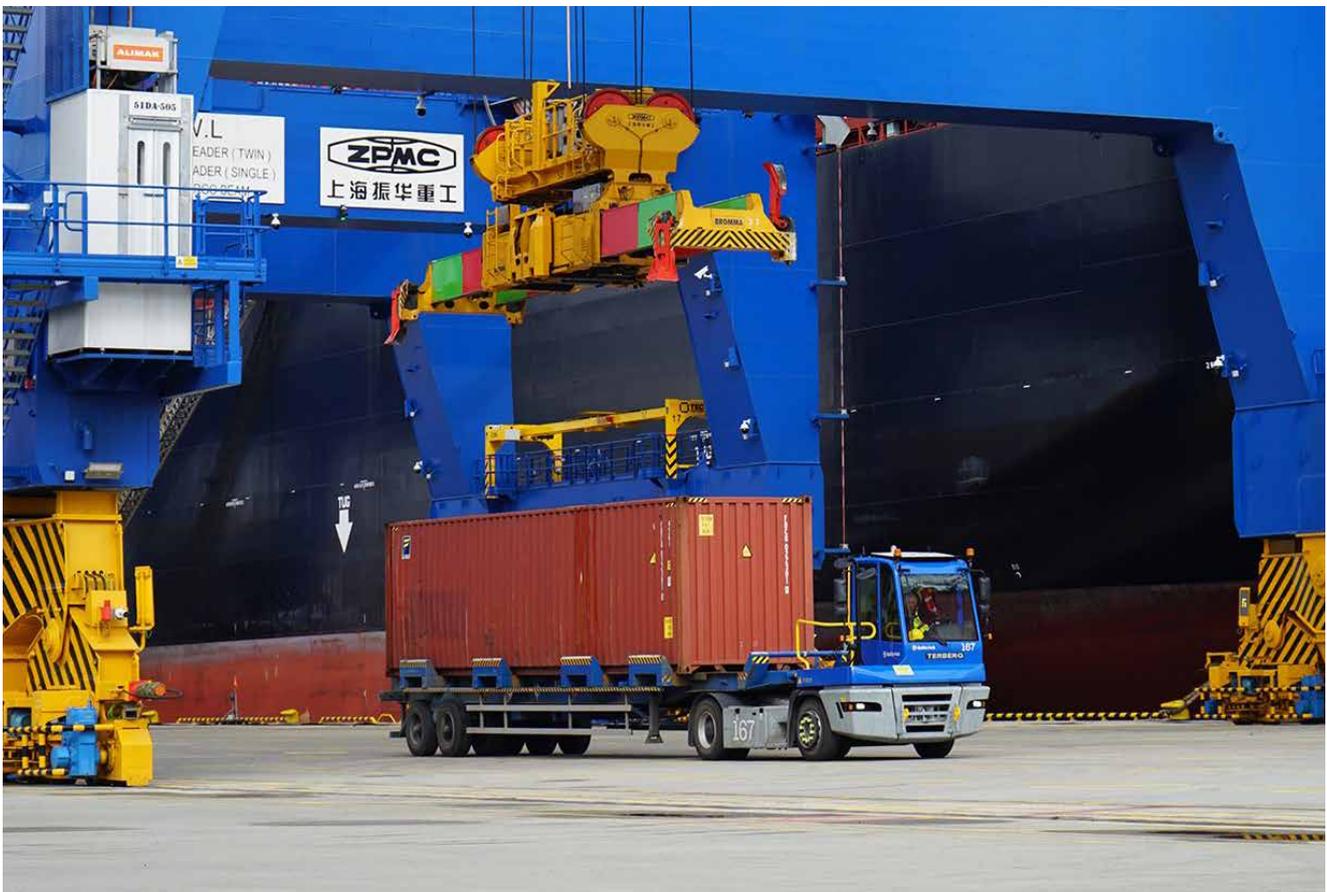
The result is not only faster and more accurate lifting, but smoother downstream execution and sustained KPIs based on "truth under the hook".

Pinning Stations: Controlled Handover Between Yard and Quay

At some terminals, the quayside digital ecosystem is complemented by dedicated pinning stations used during loading operations. Located at either end of the quay, these stations serve as controlled buffer points where containers are verified and pinned according to vessel requirements.

Using a handheld device with the new Visy Pinning App graphical interface, clerks confirm container IDs and terminal tractor numbers, identify the required pin type, and verify correct attachment. The terminal tractor then proceeds to the assigned crane, where servicing occurs once the unit is in sequence. This controlled handover significantly improves both safety and operational efficiency.

KPIs That Translate into Competitive Advantage

When AI-based vision technology, intuitive operator applications, and streamlined exception handling are fully integrated across quay-yard workflows, their impact is reflected in core operational KPIs, including:

- Net STS crane productivity
- Reduced vessel berth times
- Faster quay-to-yard cycle times
- Improved work order and inventory accuracy
- Lower rehandle rates
- Faster exception resolution
- Enhanced labour safety
- Overall operational efficiency

These improvements compound over time. Faster and more reliable quay-yard execution increases berth throughput and schedule reliability, enabling terminals to deliver a consistently higher standard of service, which is critical for winning and retaining shipping line business.

Data-Driven Control at the Heart of the Terminal

The future of quayside operations lies in adopting a holistic view of waterside performance that extends beyond crane productivity alone. AI-based vision technologies provide terminals with real-time operational control, improved KPI performance, and greater execution accuracy. Through continuous, digitised data collection and sharing, the performance of the entire wharf is elevated.

By combining vision-enabled automation with data-driven operational control, modern terminals are transforming the quay-yard interface into a powerful source of competitive advantage. In an industry defined by thin margins and high reliability demands, the ability to instantly see, validate, and act on every move is essential. Through the latest advances in AI and process modernisation technology, brownfield sites can now match productivity levels previously only associated with fully automated facilities.

About the author

John Lund brings over 20 years of experience helping marine and intermodal terminals achieve their operational goals through digitalisation and process modernisation. He has led numerous initiatives that enhance safety, efficiency, and profitability, guiding operators through every stage of digital transformation. Passionate about building a more dependable, sustainable, and resilient industry, John bridges advanced technology with real-world operational insights.

Originally from Boston, USA, and now based in Tampere, Finland, John holds an MBA and a law degree and is currently pursuing a master's degree focused on how digitalisation and process modernisation can reduce the industry's environmental footprint. Outside of work, he is a world champion rower and a member of Finland's Athletic Hall of Fame for the sport of wife carrying (eukonkanto).