

Terminal Design Services

From concept to reality:

Using emulation and simulation tools to optimize container terminal operations



Presenter



Christopher Saavedra

Senior Sales Manager, Automation
& Solutions Design, Kalmar

Agenda

1. Simulation & Emulation Differences
2. Emulation Benefits
3. Emulation Project Typical tasks
4. Emulation Typical KPIs
5. Summary and Q&A



Simulation & Emulation Main Differences

	The Scope	Performance and Accuracy	Real-Time Nature	Use Cases	Hardware Dependency
Simulation	It provides the basic behavior of a system but doesn't necessarily abide by the rules of the system being simulated.	Simulation models the essential features of a system but the precise behavior. It only approximates real system behavior.	Simulations do not necessarily operate in real-time. They run faster or slower than the actual time, depends on the processing power.	Simulation is typically used when testing the overall behavior of a system, usually in the early stages of design.	Simulations do not require the actual hardware to perform analysis. They can use software to mimic the behavior.
Emulation	Emulation mimics the exact behavior using the same internal dynamics as the system it's emulating.	Emulation, on the other hand, replicates the precise behavior and performance of the system it's emulating.	Emulations mimic the original device in real-time.	Emulation is used for fine tuning, debugging, and enhancing performance after the design is outlined.	Emulators often require hardware components to precisely mimic the system.

Simulation & Emulation Benefits

Simulation

Before Going Live

- Layout validation.
- Identifying the number of highways, distances to obstacles, etc.
- Identifying the number of charging stations
- Identifying the right fleet-size.



After Going Live

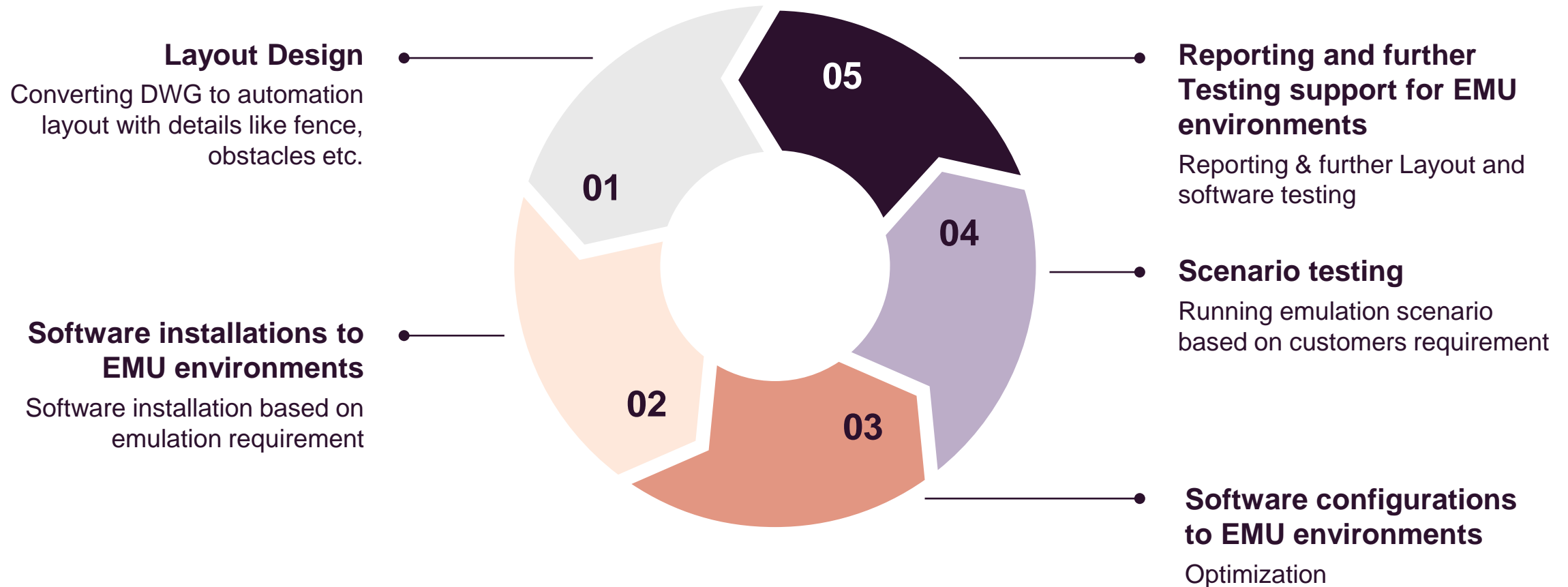
- Optimization and use case validations.

Emulation

- Test the system integration
- Start testing way in advance the machines are ready to be used.
- Continuous improvements are done before the machines are ready to be used.
- Use cases validation
- Personal training way in advance the machines are ready to be used.

- Test new versions before they are installed in production.
- Test configuration changes without affecting productivity in the real life.
- Optimization and use case validations

Emulation Projects typical tasks



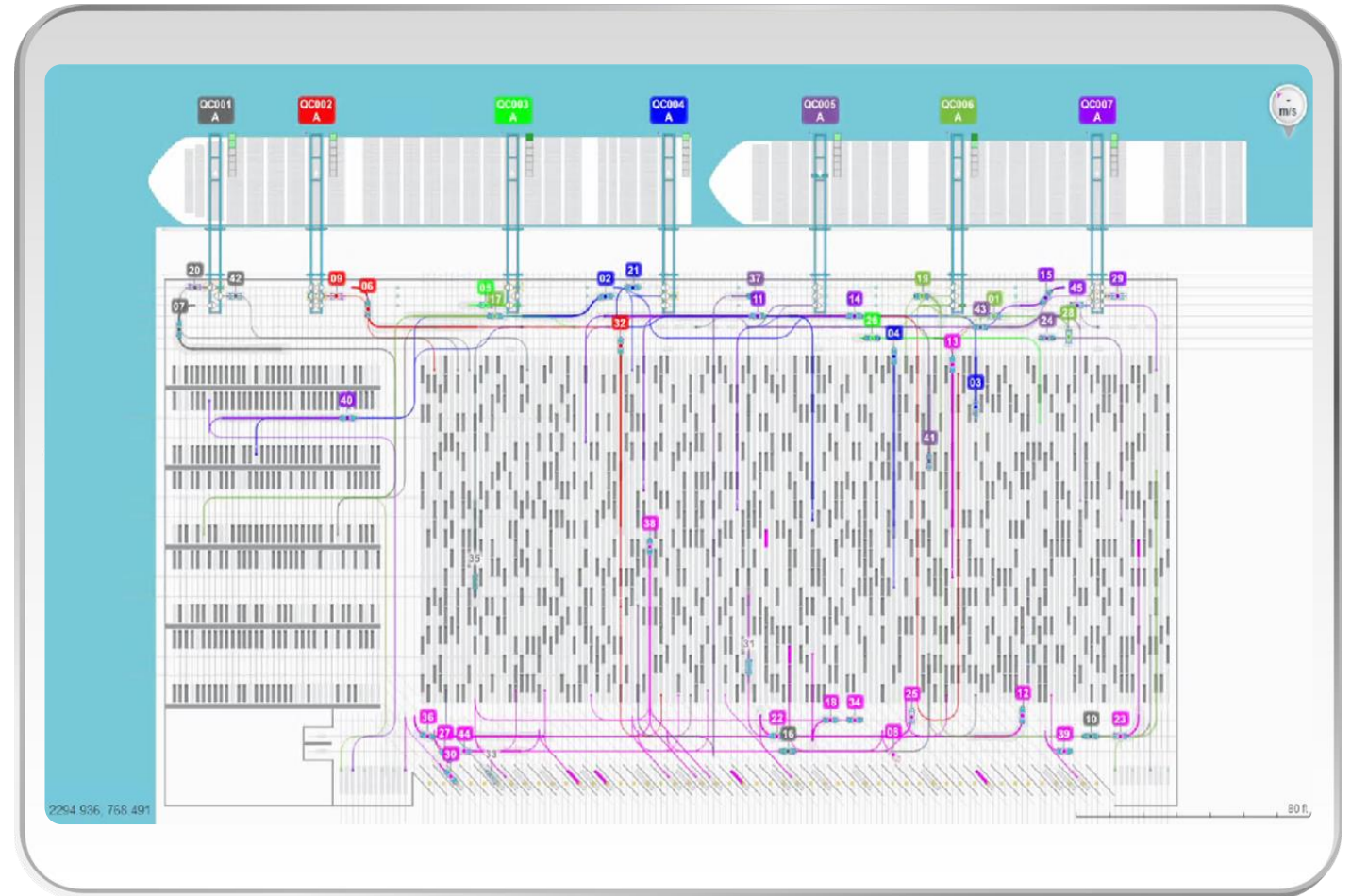
Disclaimer: The tasks timeframe may vary according to the emulation scope.

Information Classification: General

Scenario for AutoStrad Application

Scenario KPIs:

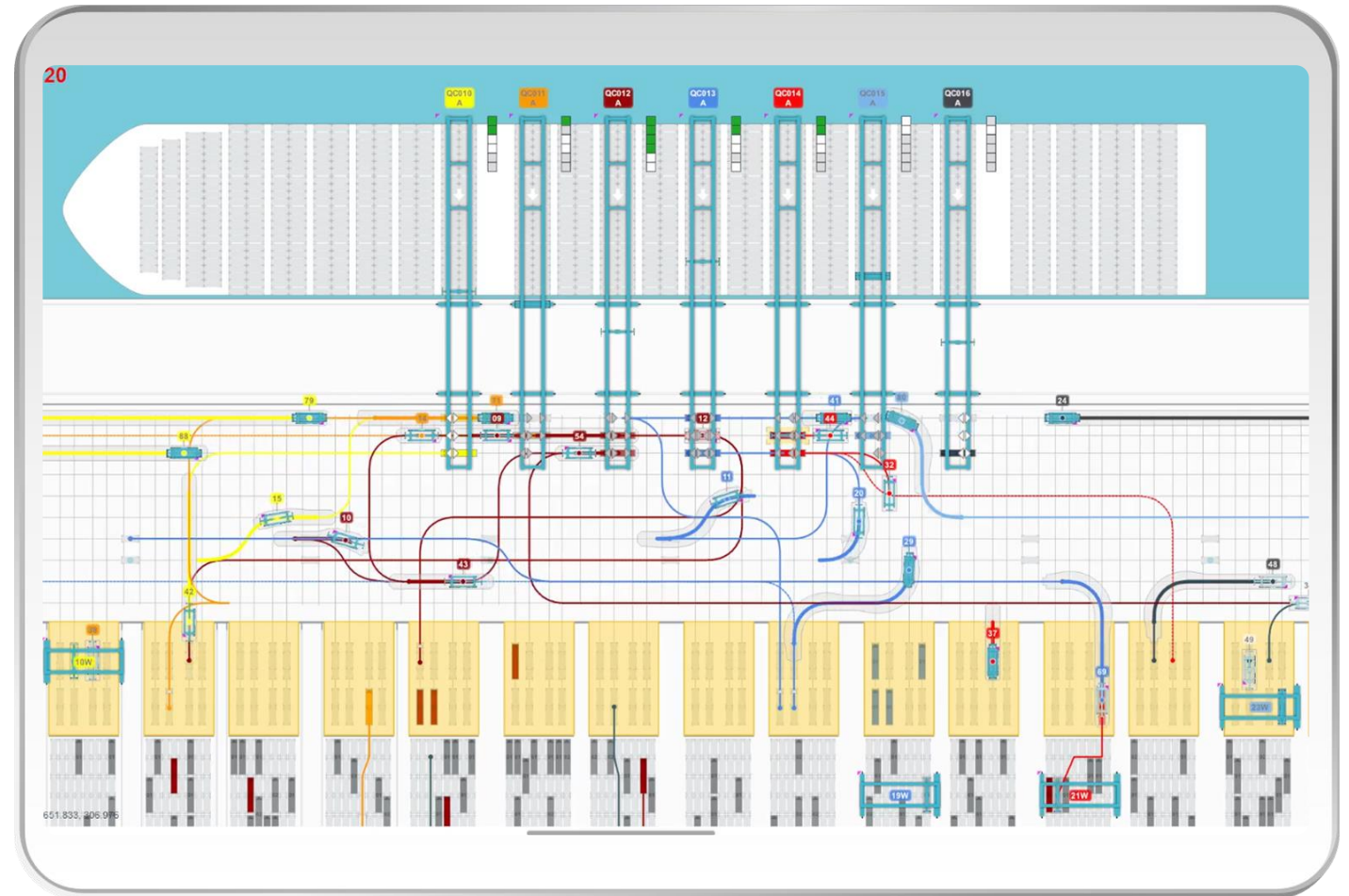
- ➔ QC Productivity
- ➔ AutoStrad Fleet-sizes
- ➔ Charging Stations locations
 - Battery SoC
- ➔ Landside Productivities
- ➔ Other Potential Findings
 - Bottlenecks
 - Utilization
 - Driving Distances



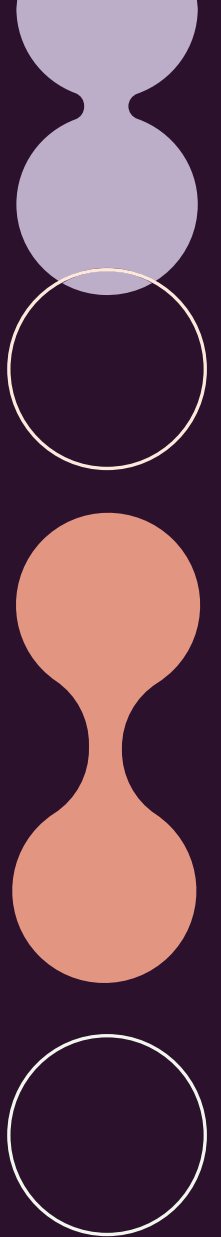
Scenario for AutoShuttle + ASCs Applications

Scenario KPIs:

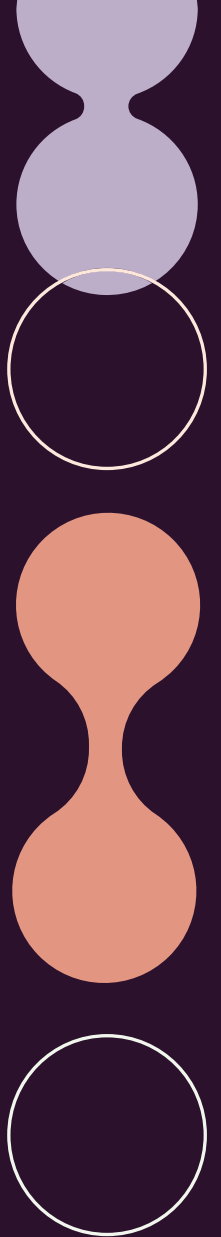
- ➔ QC and ASCs Productivity
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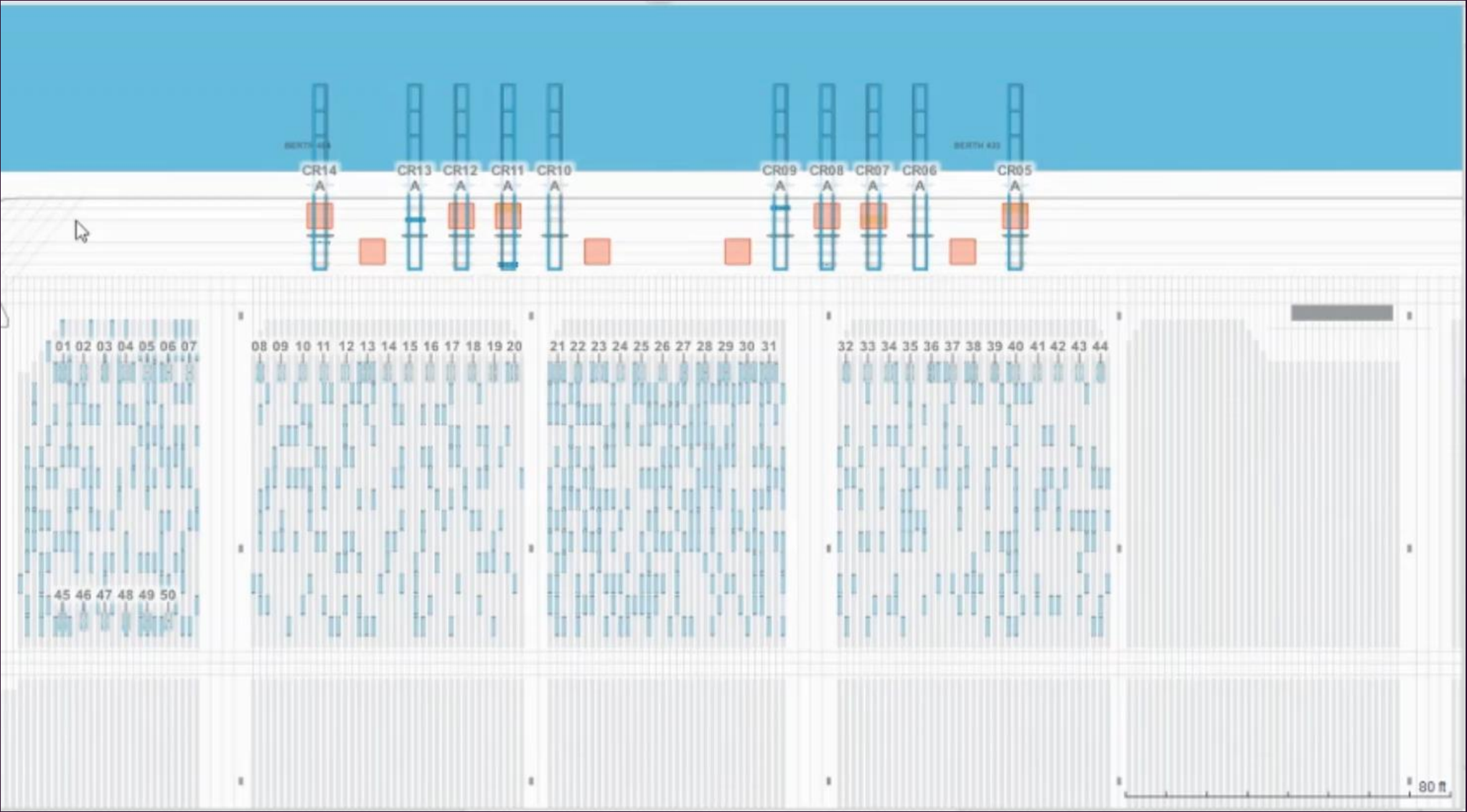
Simulation videos



Simulation videos



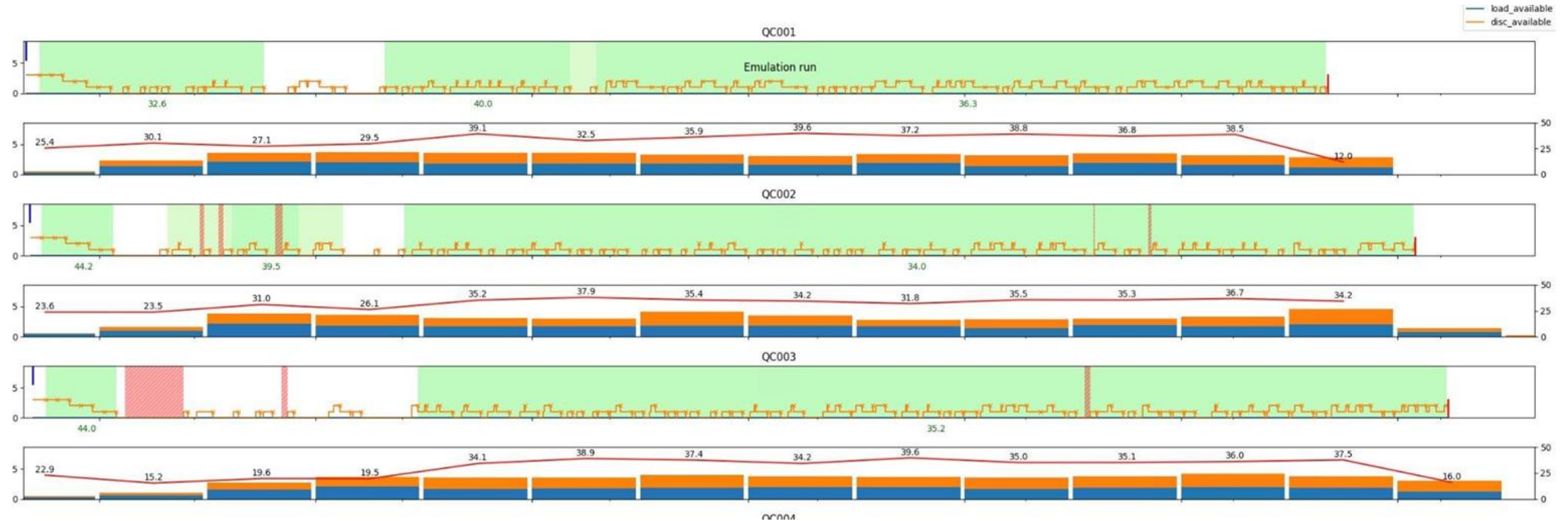
Emulation Videos



The KPIs & Results

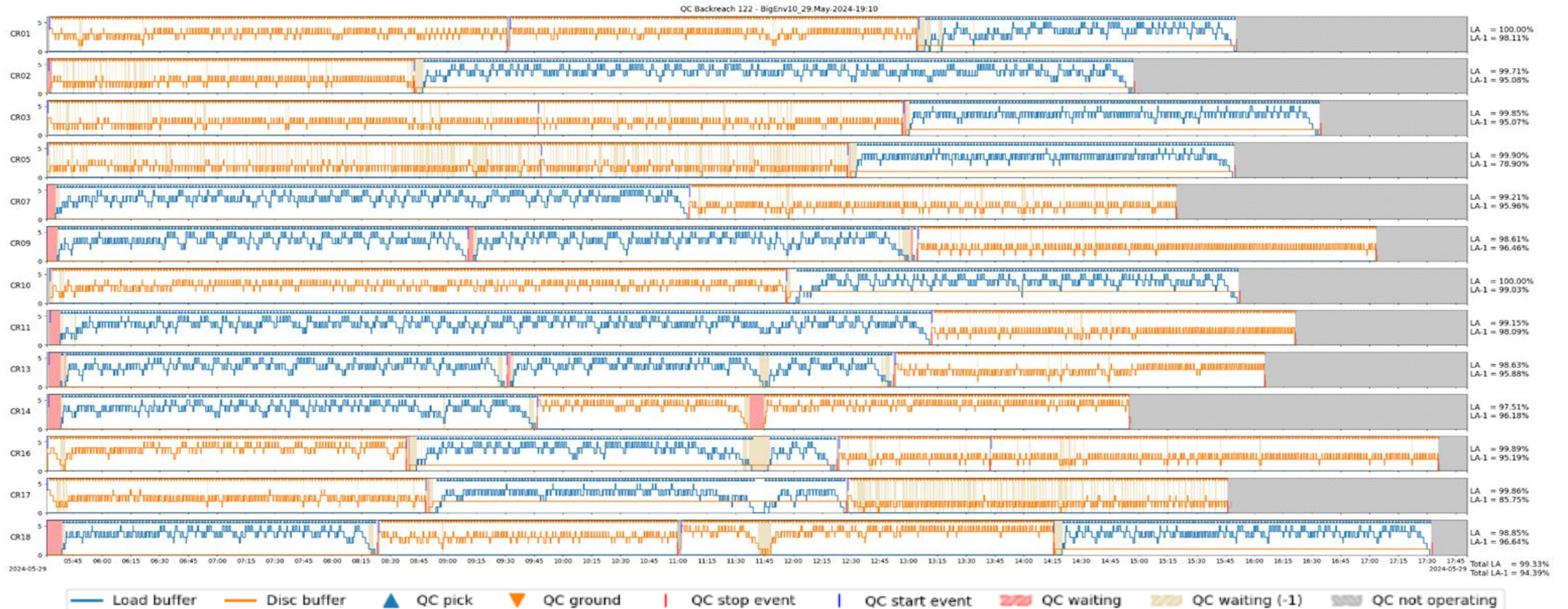
QC Productivity and Lane Utilization

Productivity



The KPIs & Results

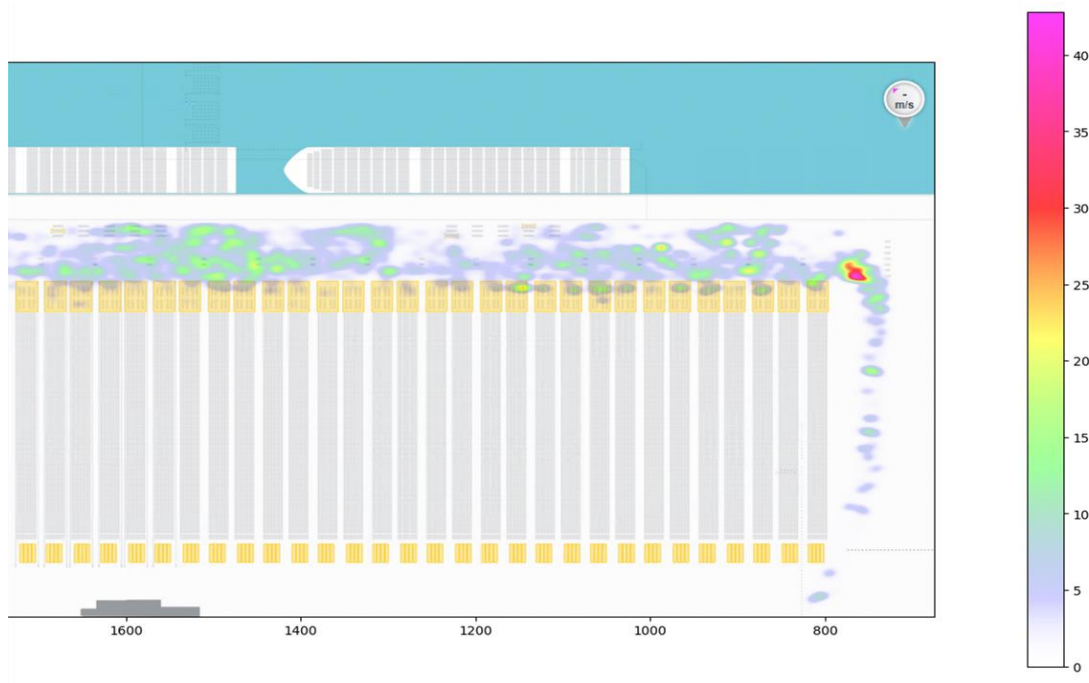
Back Reach Lane Utilization



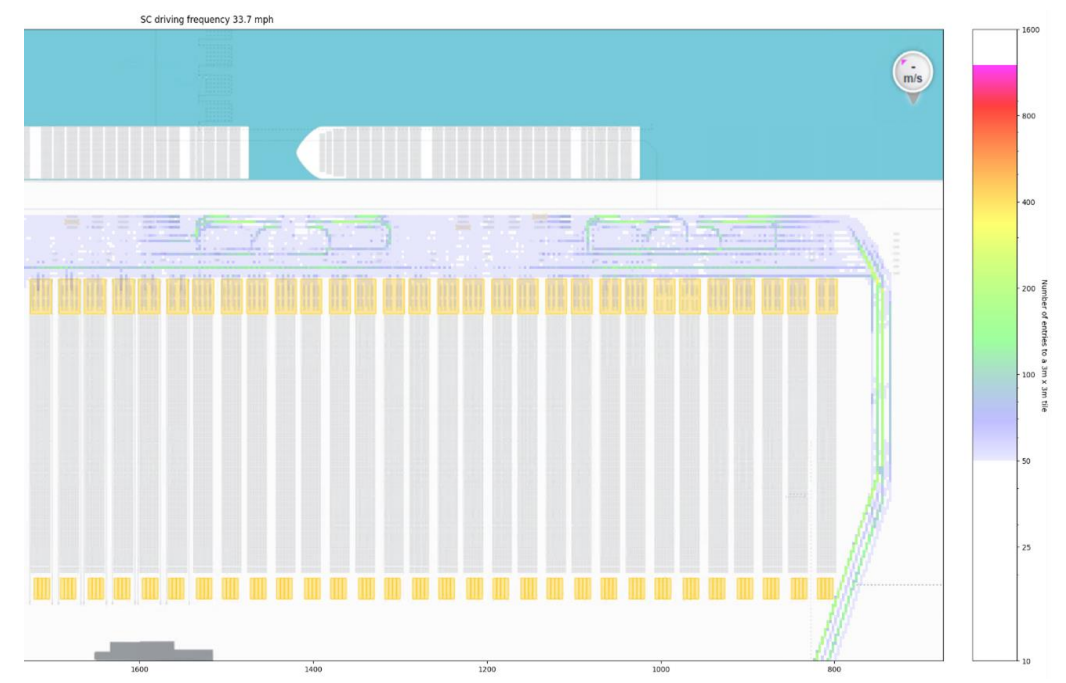
Back reach lanes
Utilization

The KPIs & Results

Idle Times & congestion



Driving Patterns & Traffic Flow Analysis



Heat Maps

The KPIs & Results

Battery Technology

High Energy Battery



Operation time without charging



Charging time

High Power Battery



Operation time without charging



Charging time

Charging Technology

CCS Charging

Comes as standard



FastCharge™

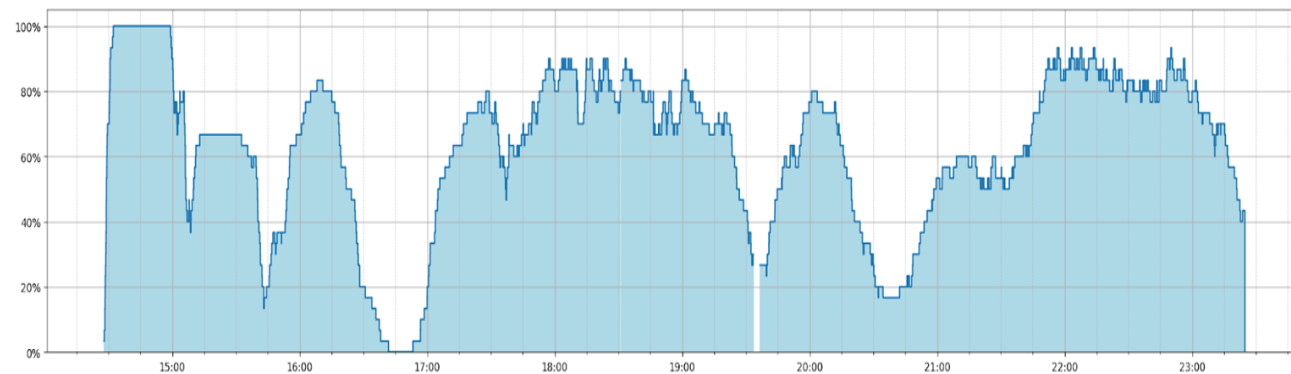
Optional



The Electric Fleet Battery SoC



The Charging Station Utilization

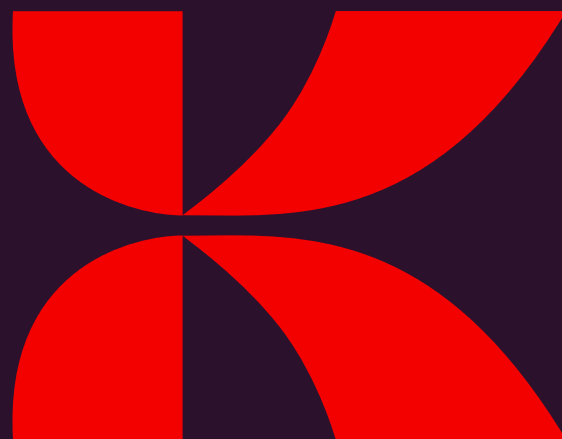


Summary

- ➔ Simulation and Emulation helps you test and optimize without risking disruption to actual operations.
- ➔ Simulation and Emulation tools are vital for you automation and decarbonisation journeys.
- ➔ Emulation tools eliminates the need for physical prototypes or extensive hardware setups during the testing phase, saving time and financial resources.
- ➔ Emulation tools precisely replicate the behaviour of the system under test, providing accurate insights into how the system will operate in the real world.



Q&A



Kalmar