

Smarter, faster port operations with 5G precision

Transforming port operations with 5G

In 2024, Singapore reinforced its position as a global maritime hub by handling a record 41.12 million twenty-foot equivalent units (TEUs).¹ Anchored by PSA International Pte Ltd (PSA), the world's largest container terminal operator, the city-state's logistics industry leverages its massive capacity and rapid vessel turnaround to cement its role as the world's second-busiest container port² and number one transshipment hub.³

However, growing transshipment volumes are approaching the limits of the country's existing port infrastructure. Singapore has responded with an ambitious vision for its sea transport port industry,⁴ starting by consolidating all container operations in a new, mega-capacity Tuas Mega Port on the island's west coast.

A hyperconnected terminal with a 5G-powered brain

PSA will leverage Singtel's ultra-reliable, low-latency 5G network to power the Tuas Mega Port – the world's largest smart, fully automated port, once it goes fully online in 2040.⁵

Singtel, PSA and Ericsson recently concluded a trial of 5G-powered Automated Guided Vehicles (AGVs) and gantry cranes at Pasir Panjang Port. The trial validated the power of 5G's low latency and high bandwidth to enable real-time, high-volume container movement at scale.



Automated Guided Vehicles (AGVs)



Automated Rubber Tire Gantries (aRTGs)

What they are

- Driverless vehicles transporting containers between quayside and container yard

Impact of 5G trials

- 5G 3.5GHz midband frequency enabled minimum network latency of 10ms
- 50% reduction in latency compared to the previous 4G network

Outcomes for Tuas Mega Port

- AGVs can operate within a much more confined space – improving yard optimisation at Tuas Mega Port
- Increased number of AGVs in operation, resulting in improved productivity – targeting 2,000 AGVs in Tuas Mega Port

- Crane systems that stack containers with precision and minimal manpower

- 5G mmWave (26GHz/28GHz frequencies) enabled 140 Mbps data uplink and an even lower network latency
- Surpassed baseline targets of >105 Mbps data uplink and <50ms network latency⁶

- Increased manpower efficiency: Operators can operate 6 aRTGs at one time, up from 3
- Completely automated RTG operations can further drive efficiencies in Tuas Mega Port

Tuas Mega Port: By the numbers

2040

Expected completion date

50%

Reduced carbon emissions of AGVs, compared to traditional diesel prime movers

2,000

AGVs operating at Tuas with the help of 5G

65 million TEUs

Projected annual handling capacity - double Singapore's current demand⁷

How 5G drives automation at Tuas

5G network slicing will provide the high speeds, high bandwidth, and ultra-low latency needed for mission-critical applications around the Tuas Mega Port. It will also create secure private networks tailored to the port's specific security needs, to help mitigate the risk of data breaches and unauthorised access.

By delivering high-throughput, high-density connectivity across thousands of devices and control points, 5G will lay the groundwork for scalable, precise, and secure port automation in the Tuas Mega Port. These capabilities will be critical to advancing Singapore's position in global maritime logistics.

Massive automation at scale

5G's ability to support higher numbers of AGVs will drive higher container throughput across the Tuas Mega Port.

Remote-controlled precision

Cranes and AGVs will be operated from a central control tower using ultra-low-latency 5G links. Operators can work from air-conditioned offices, instead of cramped crane booths at great heights.

Safer working conditions

5G-enabled remote operations minimise human presence on the quay, reducing the risk of accidents.

Secure operations

Secure private networks will be tailored to the Mega Port's specific security needs, mitigating the risk of data breaches and unauthorised access.

Predictive maintenance

5G will support drone-based surveillance and extended reality applications to help detect faults earlier, reducing costly downtime

Driving maritime innovation through 5G

Singapore's shipping industry looks set to maintain its global leadership position – thanks to 5G delivering the intelligent connectivity required for increased security and more efficient port operations.

Through strategic collaboration with partners like Ericsson and Singtel, PSA will use 5G to drive the development of automated maritime systems, advancing Singapore's vision of a digitally enabled trade future.



Supports over 2,000 AGVs for high-throughput automation



Enables real-time control of cranes and yard systems



Powers secure, remote operations with ultra-low latency and slicing

5G+ for smarter, faster port operations

[Learn more about Singtel 5G+](#)

References

¹ Maritime & Port Authority of Singapore (MPA), Singapore is World's Top Maritime Centre for 12th Consecutive Year, 2025

² Seatrade Maritime News, Singapore ranked top maritime city, 2nd busiest container port, 2022

³ Maritime Gateway, Singapore remains the world's busiest transshipment port, 2022

⁴ Maritime & Port Authority of Singapore (MPA), Industry Transformation, 2025

⁵ Straits Times, Tuas Port to be world's largest fully automated terminal when completed in 2040, 2019

⁶ Infocomm Media Development Authority (IMDA), PSA makes waves in the future of maritime operations, 2022.

⁷ Maritime & Port Authority of Singapore (MPA), Port of the Future, 2021.