

## 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 port<sup>2</sup> and number one transshipment hub.<sup>3</sup>

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 industry,4 starting by consolidating all container operations in a new, mega-capacity Tuas Mega Port on the island's west coast.



# with a 5G-powered brain PSA will leverage Singtel's ultra-reliable, low-latency 5G network to power the Tuas Mega

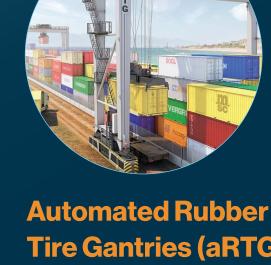
Port – the world's largest smart, fully automated port, once it goes fully online in 2040.5 Singtel, PSA and Ericsson recently concluded a trial of 5G-powered Automated Guided

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.



• Driverless vehicles transporting

of 10ms



**Tire Gantries (aRTGs)** 

with precision and minimal

manpower

Impact of

**5G trials** 

they are

What

- containers between quayside and container yard • 5G 3.5GHz midband frequency
- 50% reduction in latency compared to the previous 4G network

enabled minimum network latency

• 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
- 5G mmWave (26GHz/28GHz) frequencies) enabled 140 Mbps data uplink and an even lower network

Crane systems that stack containers

- latency • Surpassed baseline targets of >105 Mbps data uplink and <50ms network latency<sup>6</sup>
- Increased manpower efficiency: Operators can operate 6 aRTGs at one time, up from 3
  - operations can further drive efficiencies in Tuas Mega Port

Completely automated RTG

**Outcomes for** 

**Tuas Mega** 

**Port** 

**Tuas Mega Port: By the numbers** 

### 50% Reduced carbon emissions of AGVs, compared AGVs operating at Tuas

completion date

and unauthorised access.

maritime logistics.

2040

**Expected** 

to traditional diesel prime movers

**How 5G drives automation at Tuas** 

65 million TEUs Projected annual handling capacity - double

with the help of 5G

5G network slicing will provide the high speeds, high bandwidth, and ultra-low latency needed

networks tailored to the port's specific security needs, to help mitigate the risk of data breaches

for mission-critical applications around the Tuas Mega Port. It will also create secure private

Singapore's current demand<sup>7</sup>

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

Massive automation at scale **Remote-controlled precision** 5G's ability to support higher Cranes and AGVs will be operated from a central control numbers of AGVs will drive higher tower using ultra-low-latency 5G links. Operators can work container throughput across the from air-conditioned offices, instead of cramped crane Tuas Mega Port. booths at great heights.

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

Safer working conditions

delivering the intelligent connectivity required for increased security and more efficient port operations.

enabled trade future.

References

**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. **Driving maritime innovation through 5G** 

**Predictive maintenance** 

5G will support drone-based

surveillance and extended reality

applications to help detect faults

earlier, reducing costly downtime

Singapore's shipping industry looks set to maintain its global leadership position – thanks to 5G

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

**Supports over 2,000 AGVs for Enables real-time control of** high-throughput automation cranes and yard systems



# 5G+ for smarter, faster port operations

Learn more about Singtel 5G+

<sup>1</sup> Maritime & Port Authority of Singapore (MPA), Singapore is World's Top Maritime Centre for 12th Consecutive Year, 2025 <sup>2</sup> Seatrade Maritime News, Singapore ranked top maritime city, 2nd busiest container port, 2022

<sup>4</sup> Maritime & Port Authority of Singapore (MPA), Industry Transformation, 2025 <sup>5</sup> Straits Times, Tuas Port to be world's largest fully automated terminal when completed in 2040, 2019 <sup>6</sup> Infocomm Media Development Authority (IMDA), PSA makes waves in the future of maritime operations, 2022.

<sup>7</sup> Maritime & Port Authority of Singapore (MPA), Port of the Future, 2021.

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<sup>3</sup> Maritime Gateway, Singapore remains the world's busiest transshipment port, 2022