

MEDIA FACT SHEET FOR LAUNCH OF DEPOT 4.0 **ON 21 NOVEMBER 2025 AT BISHAN DEPOT**

ABOUT DEPOT 4.0

What is Depot 4.0?

Depot 4.0 transforms Bishan Depot - Singapore's oldest train depot – into a modern, world-class smart train maintenance facility through automation, digitalisation and advanced analytics.

Why introduce Depot 4.0 now?

Built in 1986, Bishan Depot was designed for the technology of its time. For over four decades, train depot design has remained largely unchanged, and overhaul processes continue to be labour-intensive and time-consuming.

Over the years, as the rail network expands and more trains are being added to support shorter intervals for better commuter journeys, it necessitates a demand for larger facilities and increased manpower for maintenance. In land-scarce Singapore, coupled with an ageing and shrinking workforce, a transformation driven by automation and digitalisation is essential.

As part of its 'Kaizen' efforts, SMRT Trains and STRIDES Technologies in partnership with CRRC Qingdao Sifang (CRRC Sifang), embarked on a two-year transformation journey since December 2023. This collaboration seeks to revamp Bishan Depot's rolling stock maintenance workshop, harnessing these advancements to optimise existing space, boost productivity, and enhance maintenance quality.

How will Depot 4.0 transform maintenance?

Without expanding or rebuilding the infrastructure, Depot 4.0 will deliver the following benefits:

- Doubles monthly overhaul output from two trains to four trains; Halves overhaul duration for a train from two weeks to one week.
- Boosts manpower efficiency by streamlining work processes and utilising advanced equipment, freeing up 30% of previously required manpower for reassignment to other tasks.
- All train overhaul works will now be carried out at Bishan Depot.
 - Frees up Tuas West Depot, the other train depot where overhauls used to be carried out, for preventive and corrective maintenance.
 - Reduces time for train parts to be transferred from one depot to another.
- Improves workplace ergonomics by reducing physically demanding and laborious tasks.
- Uplifts work quality through system integration and data-driven maintenance.
- Upskills maintenance staff to adopt advanced maintenance practices.
- Sets the benchmark for the design of future depots and the modernisation of existing ones.
- Enables aggregation of maintenance and condition-monitoring data into an intelligent platform that uses analytics to optimise maintenance and enhance reliability of rail operations.

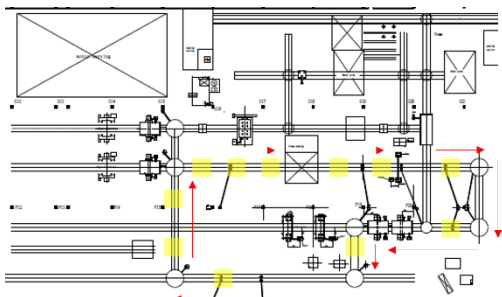
SELECTED KEY FEATURES OF DEPOT 4.0		
S/N	Equipment	Information
1	<u>ROLLING STOCK MAINTENANCE HUB</u>  <i>Photo of the Rolling Stock Maintenance Hub</i>	<u>Background:</u> Planning and monitoring overhaul readiness and progress require coordination across multiple departments and the consolidation of resource data scattered across various platforms—a process that was previously manual and time consuming. <u>What is it?</u> The Rolling Stock Maintenance Hub was established to bring maintenance planners together and synergise planning efforts. Maintenance Information Management System (MIMS) was also developed to streamline workflow planning, simplify resource monitoring, and recommend mitigations for perturbations such as unexpected defects or shortages of spare parts. <u>Features:</u> - Advanced Command and Control system that plans, tracks, monitors, and analyse maintenance activities. - Aids in recovery of unexpected situations by recommending mitigations. - Interfaces seamlessly with existing systems to draw wide range of data into a consolidated platform. <u>Key benefits:</u> - Single platform for maintenance planning, execution, and monitoring. - Decision support system facilitates recovery of unexpected situations to ensure overhaul is completed on time. - Streamlines coordination efforts by co-locating maintenance planners and providing them a unified view of the same data set.

2

RAIL GUIDED VEHICLES



Photo of a maintenance staff working on a bogie frame transported on a yellow Rail Guided Vehicle



Rail Guided Vehicles are marked by yellow boxes

Background:

Previously, heavy and bulky train components such as bogie frames were transported from one workstation to another by overhead cranes. However, overhead cranes are shared across workstations, creating bottlenecks as heavy items like bogie frames must queue for access, and each crane operation is both tedious and time-consuming.

What is it?

11 units of Rail Guided Vehicles (RGVs) have been introduced to autonomously transport bogie frames within the overhaul line. Each RGV can carry up to 5 tonnes of load.

Features:

- Autonomous travel with precise stopping at preset positions.
- Able to lift and lower bogie frame according to workflow requirements.
- Function simultaneously as a mobile workstation for performance of maintenance tasks.
- Waterproof design compatible with the bogie wash plant.
- Built-in proximity/obstacle detection to stop safely around people and objects.

Key benefits:

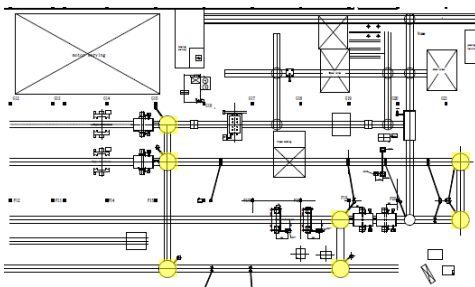
- Eliminates the use of overhead cranes to lift bogie frames from one workstation to another.
- Removes bogie frame idle time previously spent waiting for overhead crane availability.
- Improves ergonomics via height-adjustable RGV workstations, reducing strain and back-injury risks when staff perform bogie maintenance tasks.
- Enhances safety with controlled, sensor-assisted movements.

3

TURNTABLES



Photo of a Turntable



Turntables are marked by yellow circles

What is it?

Turntables are installed at key junctions of the overhaul line to rotate RGVs, enabling them to switch tracks and access multiple work paths without manual handling.

Features:

- Communicate directly with RGVs for seamless routing.
- Automatically rotate RGV to its desired direction once RGV moves onto the turntable.

Key benefits:

- Eliminates the need for staff to manually position the bogies onto the turntable or control direction changes.
- Maintains continuous workflow, reducing delays at line intersections.
- Combination of turntables and RGVs allows staff to specialise in performing a single task, as equipment is brought directly to them instead of requiring movement between workstations.

4

BOGIE DISASSEMBLY / ASSEMBLY EQUIPMENT

Before



Photo of staff lowering a bogie frame onto the wheelsets using overhead crane.

After



Photo of the Rail Guided Vehicle delivering a bogie frame to the Bogie Assembly Equipment.



Photo of the Bogie Assembly Equipment lowering a bogie frame onto the wheelsets.

Background:

Previously, separating the bogie frame from the wheelsets and reassembling it onto them were among several tasks that required overhead cranes. However, the limited number of cranes that could be installed in the depot workshop resulted in significant waiting times for resources. These tasks also demanded constant adjustments to align the wheelsets correctly with the bogie frame.

What is it?

The Bogie Disassembly and Assembly Equipment automate the process of separating and reassembling bogie frames and wheelsets. These systems communicate directly with RGVs, which deliver or collect bogie frames from the equipment. They also automatically position wheelsets at predefined locations to ensure precise and efficient operations.

Features:

- Able to communicate with RGVs to achieve a fully automated process.
- Able to position wheelsets automatically and precisely.

Key benefits:

- Previously, four staff were needed for the disassembly/assembly but with the new Bogie Disassembly and Assembly Equipment, only one staff is needed.
- Eliminates lifting operations to enhance safety and remove need for overhead crane.
- Cuts down time required to separate or assemble bogie frames and wheelsets.

5

Digital Torque Wrench



Photo of digital torque wrench

Background:

A torque wrench is a precision tool used to apply a specific amount of torque (tightening force) to fasteners such as bolts or nuts on train components like bogies and wheelsets.

Previously, maintenance teams relied on traditional torque wrenches, which use a mechanical scale or click mechanism to indicate when the set torque is reached. Torque values had to be recorded manually by staff, which was prone to human error.

What is it?

A digital torque wrench is an advanced tool that electronically measures and applies torque to fasteners. Unlike conventional mechanical wrenches, it uses sensors and a digital interface to provide real-time torque readings and alerts, ensuring components are tightened to exact specifications.

Features:

- Built-in sensors for precise torque detection.
- Digital display showing real-time torque values.
- Automatic data recording with integration into the Maintenance Information Management System (MIMS).
- Maintains torque accuracy within $\pm 3\%$.

Benefits:

- Delivers improved torque precision for safety-critical parts such as bogie assemblies.
- Eliminates human error by automating measurement and recording.
- Enhances traceability by capturing torque data for audits and compliance, supporting quality assurance.

6

AUTOMATED GUIDED VEHICLES



Photo of an Automated Guided Vehicle transporting train components or spares

Background:

Previously, smaller components such as traction motors and tread brake units were moved manually or by forklifts, creating inefficiencies. Parts often sat idle while waiting for forklift availability, slowing the overhaul process.

What is it?

Automated Guided Vehicles (AGVs) can transport up to 1 tonne of smaller equipment and spares to designated location.

Features:

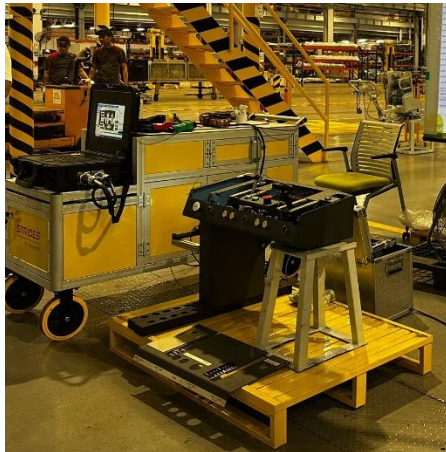
- Autonomous navigation
- On-board control panel for staff to input routing instructions.
- Built-in proximity/obstacle detection to stop safely around people and objects.

Key benefits:

- Eliminates forklifts and manual handling for smaller components, reducing item congestion.
- Removes idle queue time to access forklift.
- Improves ergonomics and reduces risks of physical strain, supporting a safer and maturing workforce.
- Enhances safety with controlled, sensor-assisted movements.

7

Master Controller Test Bench



Photos of Master Controller Test Bench

Background:

The master controller is a critical component of a train's propulsion and control system, located in the driving cab. It comprises the Master Controller Handle (MCH), Mode Selector, and Master Key Switch, and is responsible for managing traction, braking, and operational modes. Over time, these components require servicing and functional checks to ensure safe and reliable train operations.

Previously, testing the master controller involved using handheld instruments such as multimeters, meggering meters, and vernier calipers on individual parts. This inspection process was tedious and typically took an entire day to complete.

What is it?

The Master Controller Test Bench is a specialised testing setup used to verify the functionality and performance of the master controller after servicing or overhaul.

Features:

- Automates the testing process of master controller
- Enables off-train testing by simulating train operating conditions to validate master controller components.

Benefits:

- Cuts testing time by 50%, reducing the duration from one full day to half a day.
- Delivers more accurate and consistent results, ensuring safer and more reliable train control systems.

8

Relay Test Bench



Photo of Relay Test Bench

Background:

Relays are critical components in train control and safety systems, responsible for switching circuits and ensuring proper operation of functions such as traction, braking, and emergency loops. Over time, these relays require precise testing to confirm they meet operational and safety standards.

Previously, testing relays and contactors—including measuring voltages, timings, and resistances—was done manually and individually. Staff also had to record test results by hand, a process that was time-consuming and prone to human error.

What is it?

A Relay Test Bench is a specialised testing setup used to verify the performance and reliability of electrical relays and contactors after servicing or during preventive maintenance.

It measures key parameters such as pickup and release voltage, pickup and release time, as well as coil or contact resistance, all executed through a programmed test sequence.

Features:

- Automates the entire testing process for relays and contactors.
- Measures multiple key parameters in a single sequence.
- Displays results and generates comprehensive test reports.

Benefit:

- Reduces testing time and improving maintenance efficiency.
- Delivers more accurate results.
- Eliminates human error by automating data capture and reporting.

9

REMOTE-CONTROLLED LIFTING TABLE



Photo of a remote-controlled lifting table

Before

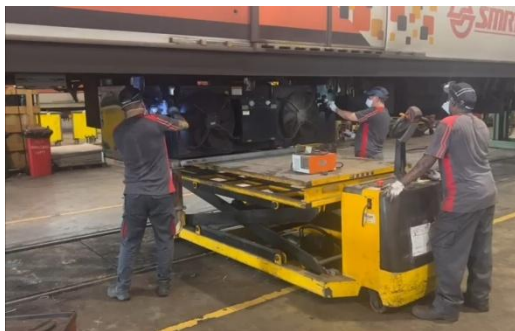


Photo of staff operating the existing lifting table to install parts underneath the train

After



Photo of staff operating the remote-controlled lifting table to install parts underneath the train

Background:

Previously, installing components beneath trains using existing lifting table to manoeuvre heavy equipment into position was slow and tedious. Staff had to repeatedly reposition components because the existing lifting table lacks lateral movement, making precise alignment challenging.

What is it?

Remote-controlled lifting tables now replace existing lifting table, allowing more controlled and accurate positioning of equipment under the train.

Features:

- 360° omnidirectional movement for the ease of finetuning equipment alignment during installation of components onto the train.
- Remote-controlled.

Key benefits:

- Eliminates the need to repeatedly re-position and staff no longer need to bend down multiple times, improving workplace health and ergonomics.
- Reduces handling time and task complexity.
- Provides stable, accurate placement of components under the train.

10

DRY ICE CLEANING MACHINE



Photo of staff using dry ice cleaning machine to remove dirt from a train component

What is it?

Dry ice cleaning machine replaced water-based method as a more effective way to clean train components.

Key benefits:

- Generates minimal by-products such as water wastage.
- Eliminates drying time for components, accelerating workflow.
- Removes slipping hazards from wet floors.