ASSESSMENT REPORT
TYRE RECAPPING FACILITY AMPARA

Prepared for: Sri Lanka Transport Board

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Date of Visit: August 7, 2025

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1. Introduction

A multidisciplinary team comprising mechanical engineers, electrical engineers, and experienced tyre industry professionals visited the Ampara Tyre Recapping Facility to conduct a comprehensive assessment, with the objective of evaluating operations, identifying bottlenecks, and improving productivity, quality, and safety. The visit covered the entire process, from unloading worn-out tyres to delivering finished recapped products. Observations were made on machinery, materials, operators, maintenance practices, safety measures, and process flows, supplemented by detailed discussions with plant staff and operators.

The assessment criteria were developed by the NPP Australian Committee and subsequently adopted by Machine Mech Engineering to complete the required task.

The assessment identified multiple issues across machinery condition, material availability, material quality, operator skills, and process efficiency. Key concerns included underperforming equipment, uneven production flow, material stock gaps, inconsistencies in quality control, and the absence of personal protective equipment (PPE), posing safety risks. Infrastructure limitations in the store, compressed air systems, and ventilation were also noted. While the production line remains functional, corrective and preventive maintenance actions are required to maintain reliability, enhance output quality, and improve workplace safety.

A stepwise improvement plan is proposed. In the immediate phase, the facility aims to increase production from 16,000 to 21,000 tyres per year, while improving tyre quality by increasing mileage from 9,000–10,000 km to 15,000–16,000 km. In the subsequent expansion phase, the facility should integrate new machinery, upgrade infrastructure, and optimize plant layout to meet an increased target of 40,000 tyres per year. These measures are expected to enhance productivity, quality, safety, and long-term operational sustainability.

2. Current Facility Overview

2.1. General Description of the Facility

The Ampara Tyre Recapping Facility is currently operational, with all major machinery and equipment in running condition. The workforce consists of 14 personnel during the day shift, managing the full tyre recapping process, and 4 personnel during the night shift, focusing exclusively on the curing process in the chamber.

The facility has one curing chamber, capable of processing 11 tyres per cycle, with the number of curing cycles limited to 6 per day. One reason for this limitation is the insufficient number of curing tubes, which prevents preparation of the next batch until the previous batch is unloaded. This waiting time also results in energy wastage, as the chamber must be reheated to the required temperature for the next batch.

The plant currently produces approximately 66 tyres per day (around 1,200 tyres per month), which is below the plant's full capacity. Key factors limiting output include shift allocation, machine conditions, and process bottlenecks. Each stage of the process is equipped with one machine, meaning that a breakdown at any stage can halt the entire production line.

Corrective maintenance tasks including repairs to the pneumatic system and other critical equipment are necessary to maintain optimal performance and prevent unplanned downtime. Implementing a structured preventive maintenance program and selectively replacing worn-out machinery will enhance operational efficiency, ensure consistent product quality, and reduce production risks.

2.2. Plant Layout

The plant consists of two main buildings. The first building houses initial inspection, buffing, and a compressor room. Tyres are then transported via a small trolley to the second building, which contains cushion gum and tread application, the curing chamber, and finishing operations. Near the second building, a second compressor room and the cooling room are also located.

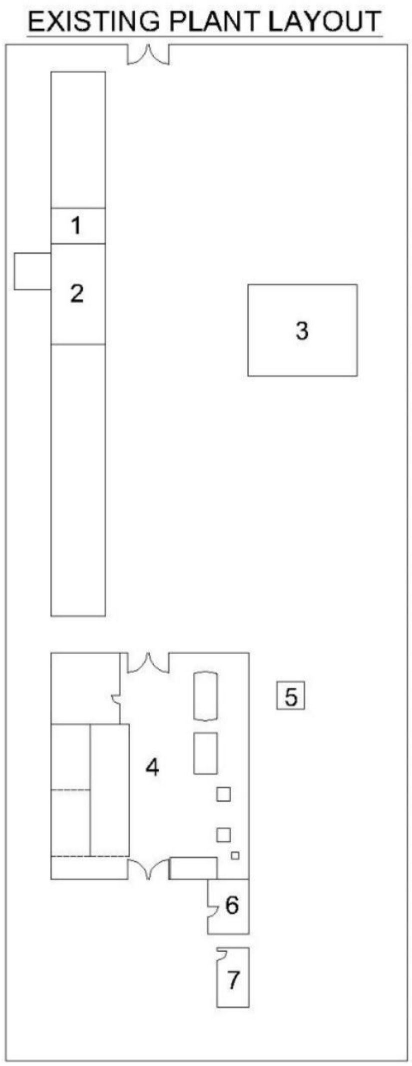

Figure 1:Existing plant layout

Table 1: Existing plant layout

No.	Building/Equipment
1	Compressor Room 1
2	Buffing Machine Area
3	Old Mold Store
4	Processing Area
5	Generator
6	Compressor Room 2
7	Cooling room
8	Work Table
9	Cushion Gum Mixing Machine
10	Tread Building Machine
11	Envelop Expander Machine
12	Monorail Machine
13	11–Tyre Curing Chamber
14	Office
15	Rubber Waste Storage
16	Recapped TyresStorage
17	Barrel Waste Storage

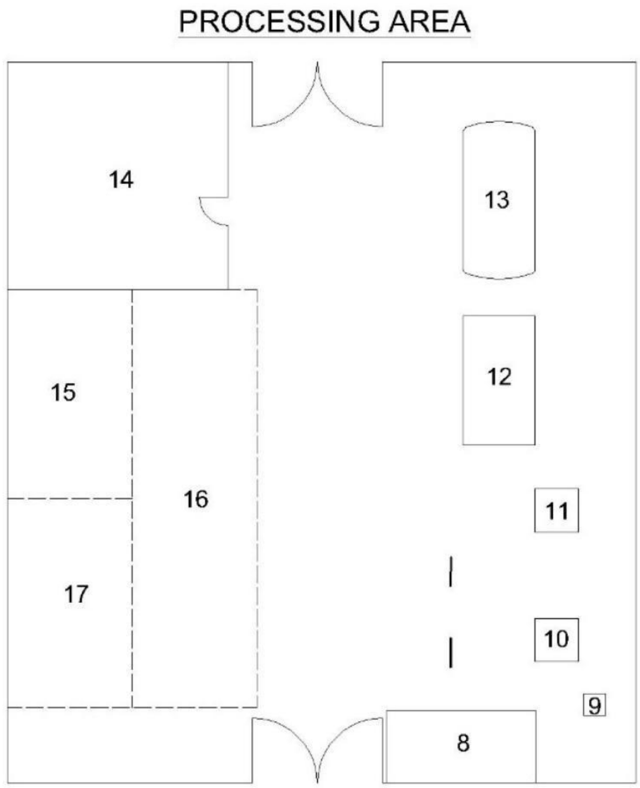

Figure 2: Processing Area

2.3. Process Flow

The tyre recapping process begins with unloading and initial inspection of worn tyres, followed by buffing to remove the damaged tread surface. Cushion gum and new tread rubber are then applied, after which tyres are placed in the curing chamber for vulcanization. Once cured, tyres undergo finishing operations, final inspection, and delivery. Each process stage relies on the smooth operation of a single machine, making reliability and preventive maintenance essential to avoid production interruptions.

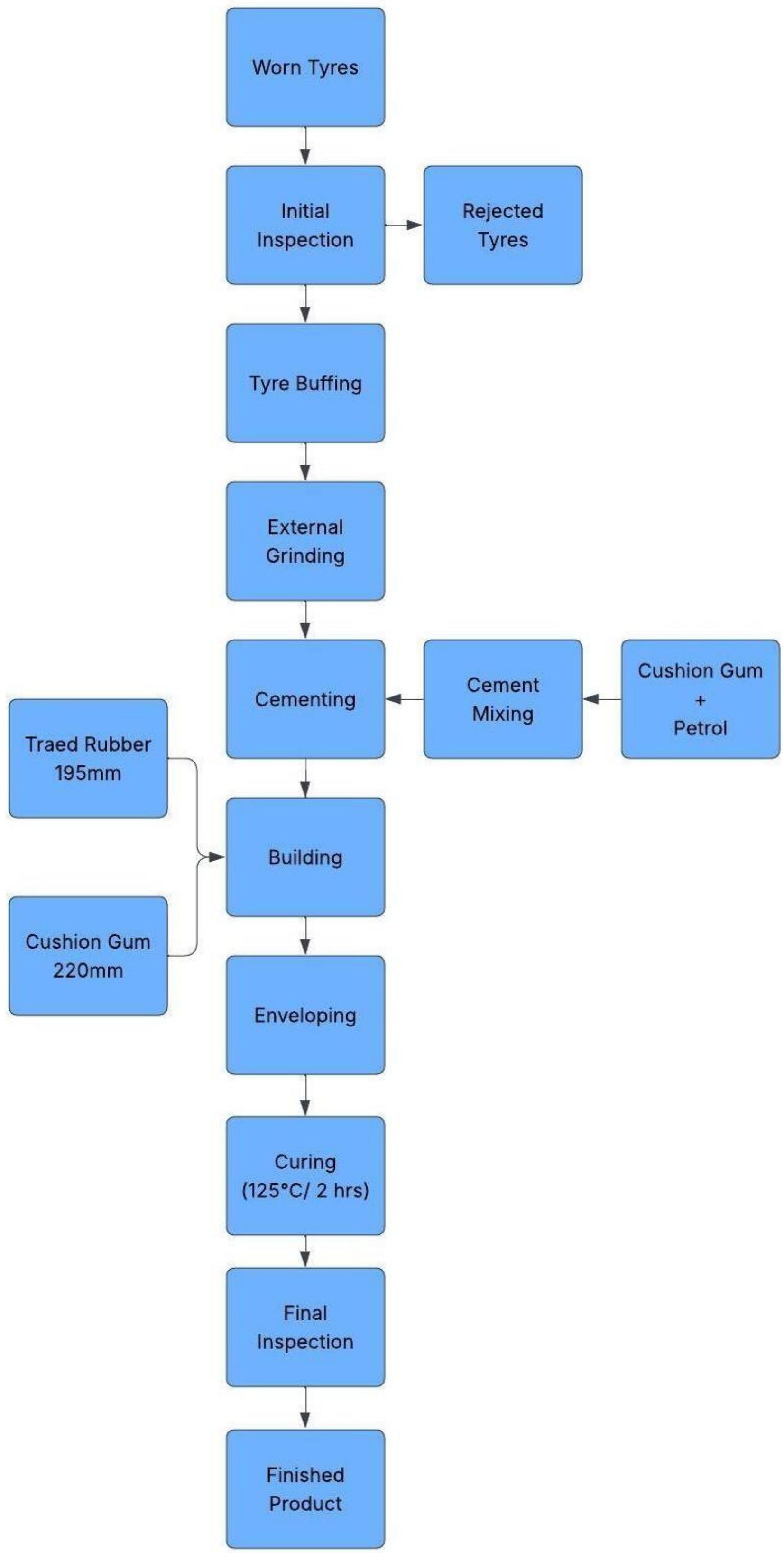

Figure 3: Process Flow of Tyre Recapping at Ampara Facility

3. Findings and Observations

There are gaps and issues at each stage of the production process, resulting in poor-quality tyres that fail to meet the minimum expected lifespan of 13,000 kilometers. Additionally, there is a lack of consistency in meeting daily production targets due to the absence of strong leadership and a standardized production process.

3.1. Tyre Inspection

The inspection machine area lacks sufficient fixed lighting and currently relies on a handheld light, which is inadequate for detecting small cuts, cracks, or embedded objects. Overhead and side-mounted lighting should be installed for consistent illumination.

Figure 4: Tyre inspection

- The standard practice of using a metal piece to check worn tires by sound is not followed, reducing the accuracy of identifying internal defects.
- The inspection machine has a pneumatic cylinder for tyre height adjustment to improve operator ergonomics, but it is not in use. The condition of the cylinder, pneumatic lines, and control valves should be inspected and repaired or replaced if necessary.

Figure 5: Initial Inspection Machine

3.2. Tyre Buffing Machine

No maintenance has been carried out on this machine since its installation. Management has not ensured the machine is operating correctly before commencing production.

Figure 6: Tyre buffing machine

- The tyre rotating motor is getting heated. Due to this issue, the machine cannot be operated for extended periods.

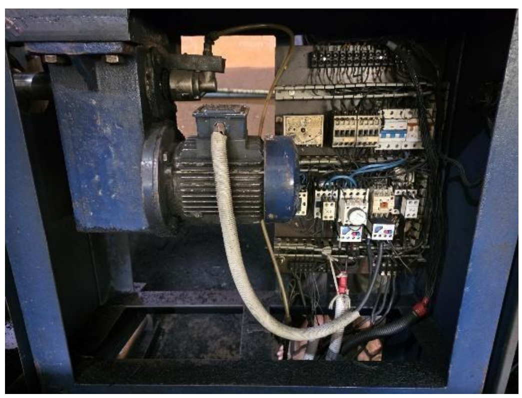

Figure 7: Tyre rotating motor

- The pneumatic tubes are leaking, and some required valves are missing. This results in insufficient air pressure during the buffing process, which can affect tyre quality. This issue should be fixed immediately.

Figure 8: Pneumatic line is leaking.

- The rim flap (rubber lining on the rim) is damaged, causing air leakage and compromising the ability to maintain proper air pressure in the tyre during buffing.

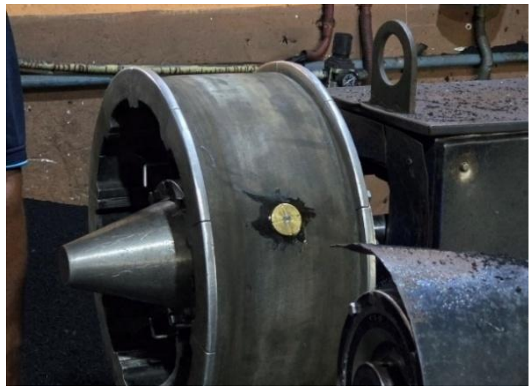

Figure 9: Rim flap damage

- The buffing cutter holding bed and tyre centre are not properly aligned. As this machine performs a critical function for tyre quality, unequal cutting on the tyre surface can occur. Therefore, the machine must be repaired or replaced.

Figure 10: Centre of the tyre and centre of the cutting bed are not aligned

3.3. Mixing Machine

The 25 L mixing machine for cushion gum is currently underutilized. Operators prepare thicker batches and manually add solvent outside the machine, resulting in inconsistent thickness and quality. It is recommended to prepare two proper batches using the 25 L mixer to meet daily requirements, ensuring consistent thickness and quality while eliminating manual solvent addition.

3.4. Tyre Tread Building

As with other machines, no maintenance has been carried out on this one. As a result, workers are attaching threads to the tyres without ensuring the machine is operating correctly, which leads to the production of defective tyres.

Figure 11: Thead Building Machine

- Tread is not bonding properly due to air leaks at the rim and air filter area. Tyres must be pressurized during tread building to ensure proper bonding between the casing and the tread liner.

Figure 12: Air leak at rim/air filter area

3.5. Tyre Curing Chamber

The single 11-tyre electric curing chamber was identified as a bottleneck in the production process. Currently, only 6 cycles per day are run, producing 66 tyres, despite continuous day-and-night operation. Several faults were observed, which limit the number of cycles and affect the final tyre quality.

Figure 13: 11 Tyre Electric curing chamber

- Heating coils are not properly connected, causing electrical sparks. This is a serious safety hazard and must be corrected immediately. Operators reported previous fire incidents due to these sparks.

Figure 14: Improperly connected coils causing electrical sparks

- The current temperature indicator is inaccurate. Tyres must be maintained at 125 °C for proper curing, but operators are relying on an estimated setpoint. The indicator should be replaced with a calibrated device to ensure correct curing.
- Insufficient curing tubes, envelopes, and hangers reduce efficiency. Only 17 tubes are available versus the required 22 (25 including standby), preventing preparation of the next batch while the current batch is curing.

- According to operators, the current tubes can only be used to cure approximately 30 tyres before replacement, which indicates poor quality. Normally, tubes should last around 100 cycles to ensure consistent quality and reduce downtime.

Figure 15; Enveloped tyre

- Compressed air flow is insufficient, affecting curing efficiency and increasing cycle time. Modifications are required to reduce cycle duration.
- No maintenance has been performed on the monorail system, and worn-out parts were observed, which could affect both operation and safety.

Figure 16: Worn-out parts observed due to lack of maintenance

3.6. Consumables and QA Process

We have identified a lack of communication between the procurement department and management at the tyre manufacturing facility, resulting in the incorrect selection of raw materials that do not meet the required quality standards. It has become common practice to proceed with whatever materials are provided by procurement, without any quality assurance checks.

- Current cushion gum is supplied at 220 mm, which is wider than the tread belt, causing higher cost and difficulty in final inspection. Future orders must supply 200 mm cushion gum to match the tread belt and avoid gaps or waste. No proper system currently exists for checking cushion gum quality.

Figure 17: Excess width of cushion gum causing gaps and difficulty in inspection.

- Proper tools for checking tread liner quality are not available. Poor-quality, contaminated, and under cured liners were observed, and operators are not consistently rejecting substandard material.

Figure 18: Air bubbles in tread liner

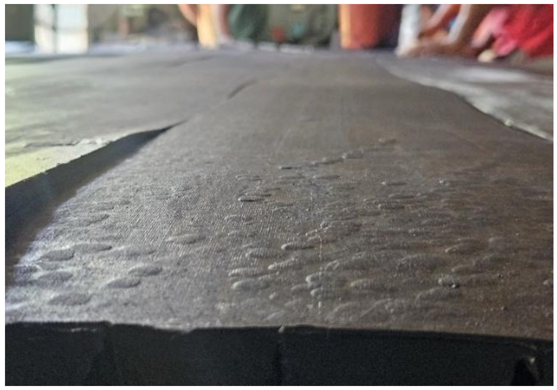

Figure 19: Tread liner surface with insufficient roughness

Figure 20: Tread liner with visible contamination affecting quality

- Only 195 mm tread liners are being used for 9.00-20 tyres, resulting in mismatched application and reduced tyre quality.
- No system is in place to monitor the mileage of recapped tyres from the depot. Availability of this data is important to analyse tread liner performance on a batch-wise basis.
- Tread Liner cutter is operating at an angle, producing cuts that are not at right angles, which affects the fit and quality of the tread liner.

3.7. Management Practices

This is a key concern regarding the facility. Issues such as production downtime, product rejects, and the correct operation of plant and equipment are not being addressed. Workers operate the production line without oversight, indicating a significant lack of leadership within the facility. In principle, SLTB should adhere to best management practices, regardless of production capacity. From our perspective, tyre recapping is not a complex process, and the poor performance of the plant is primarily due to ineffective management. On one occasion, it was observed that half of the workforce attended a funeral, resulting in a daily output of only 20 tyres. This reflects a complete absence of structured management practices, which is a major contributor to low production efficiency and poor tyre quality.

3.8. Worker Safety

During the plant visit, it was observed that PPE usage was very limited. Most operators relied only on oven gloves during curing operations, while other essential protective equipment such as safety gloves, safety shoes, and goggles were neither provided nor used. In the buffing section, noise levels were considerably high, yet hearing protection was not available. Additionally, work areas were not clearly marked with safety zones and caution signs, further increasing the risk of accidents.

Figure 21: Operators working without safety shoes

Furthermore, workers were found to be operating in casual clothing without proper overalls or uniforms, exposing them to a higher risk of injury. Some of the most hazardous tasks were observed during tyre pressurization. Operators are currently pressurizing tyres while loading them into the curing chamber, before the door is closed, which exposes them to serious safety risks. Proper procedure requires pressurization only after the chamber door is fully closed, but this is not being followed. Although workers were aware of the associated risks, they continued these practices for convenience and to reduce waiting time, thereby compromising overallsafety.

3.9. Maintenance Practices

During the plant visit, it was observed that preventive and corrective maintenance practices are not being adequately implemented. Machinery is frequently operated under unreliable conditions, with temporary fixes used to keep equipment running. This approach increases the risk of breakdowns, reduces operational efficiency, and contributes to the production of substandard tyres.

No spare parts stock is maintained, and there are no dedicated mechanical or electrical technicians available in the plant. As a result, maintenance is delayed or performed by operators, which can compromise both machine performance and safety.

Figure 22: Airline leaks not prepared properly

Figure 23: compressor bottom valve needs to replace

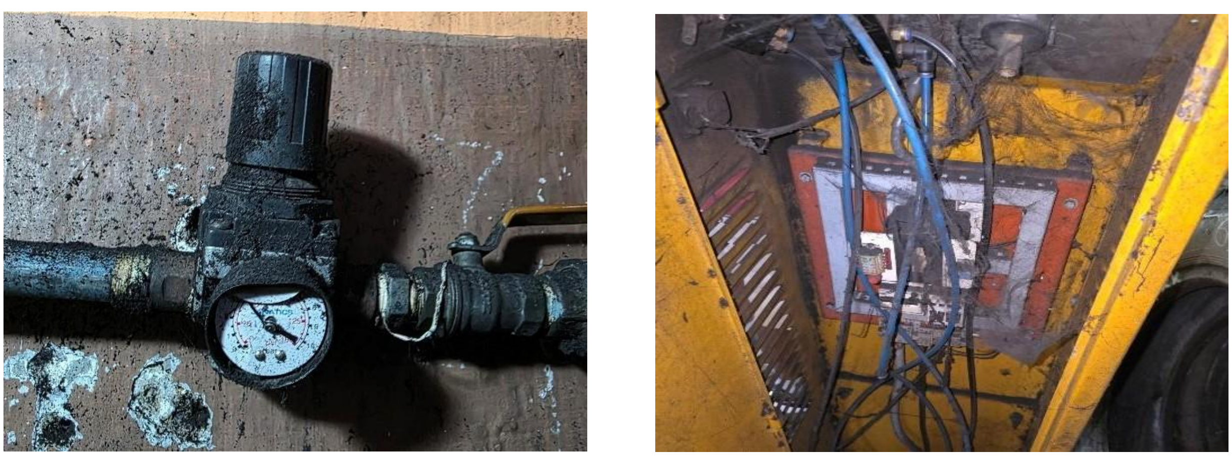

Figure 24: Maintenance not followed

3.10. Facility Condition

The factory building is structurally sound. However, the production line is not properly established to support smooth and continuous operation throughout each stage of the tyre treatment process. Compressed air is not centrally distributed, leading to inefficiencies.
The electrical services installation is outdated and requires a complete rewiring of the distribution system to mitigate potential fire hazards. The production flow is poorly organized, with excessive leftover and unwanted materials scattered throughout the facility.

3.11. Fire Protection System

There is no evidence of maintenance for the fire detection system. The existing firefighting equipment has exceeded its service life and has not been replaced with new, certified units. This lack of replacement and modernization compromises the effectiveness of the fire safety system and exposes the plant to significant fire hazards.

In addition, rubber waste is being stored inside the building, occupying valuable production space and creating a fire hazard risk, while buffed tires are left outside without proper storage arrangements.

Figure 25: Improper storage of rubber waste within the processing area

4. Recommendations

Based on the assessment conducted, we propose both short-term and long-term recommendations aligned with the strategic objectives of the Sri Lanka Transport Board.

The short-term improvements aim to enhance operational efficiency and achieve the set targets using the existing plant and machinery.

The long-term goal is to expand production capacity by introducing an additional semi-automated production line, which will also support the future development of the facility.

4.1. Improvements to the Existing Plant (Target: 16,000 → 21,000 tyres/year)

This section addresses the issues identified during the assessment and provides recommendations to improve operational efficiency, ensure consistent product quality, extend tyre mileage, and strengthen safety measures within the current facility. Implementing the following recommendations will enable an increase in the number of daily curing cycles from 6 to 8, improving overall production capacity and efficiency.

4.1.1. Initial Inspection

- Install overhead and side-mounted lighting in the inspection area to ensure proper visibility for detecting tyre defects.
- Replace the finger-based method with the metal-piece method to accurately identify internal tyre defects by sound.The facility should implement this method immediately.

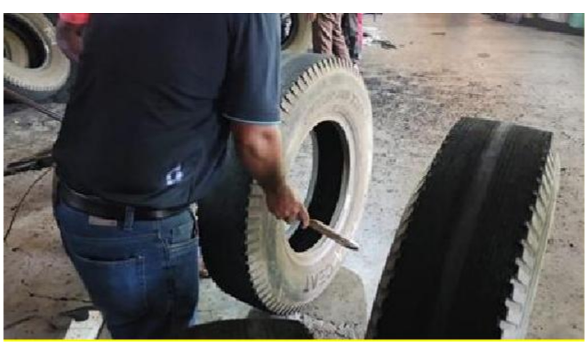

Figure 26: Checking worn out tires using a metal piece

- Inspect, repair, or replace the pneumatic cylinder, control valves, and pneumatic lines to restore the height adjustment functionality of the tyre inspection machine.

4.1.2. Tyre Buffing Machine

- Replace the cooling fan or check the power transmission of the tyre rotating motor to prevent overheating and enable extended operation.
- Repair pneumatic leaks and install missing valves to maintain proper air pressure during buffing.
- Replace the damaged rim flap to prevent air leakage and ensure correct tyre pressure.
- Realign and repair the buffing cutter holding bed to ensure uniform cutting and maintain tyre quality.

4.1.3. Mixing Machine

- Operate the 25 L mixing machine in two cycles per day (every 12 hours). Use an additional barrel to fully unload each batch before starting the next, ensuring consistent thickness and quality while eliminating manual solvent addition.

4.1.4. Tread Building Machine

- Repair and realign the tread liner cutter to ensure cuts are at correct angles, preserving liner fit and overall tyre quality.

4.1.5. Tyre Curing Chamber

- Reconnect and secure all heating coils properly to eliminate electrical sparks, mitigate fire hazards, and ensure all coils function correctly.
- Replace the inaccurate temperature indicator with a calibrated device to maintain consistent tyre curing at 125 °C.
- Increase the number of curing tubes, envelopes, and hangers to at least 25 each (including standby) to allow continuous batch preparation, reduce idle time, and minimize energy waste.
- Use high-quality curing tubes capable of at least 100 cycles to ensure reliability and consistent tyre quality, reducing the risk of defective products.
- Upgrade the compressed air supply line to provide adequate flow and pressure, reducing cycle duration and improving overall curing consistency.

4.1.6. Quality Assurance Process

Thread Liner

- Equip the facility with vernier calipers and hardness meters for accurate checks of tread liner quality.
- Operators should receive further training and be encouraged to reject low-quality raw materials.
- A test report must be given prior to purchase and a random sample checking system should be introduced for following parameters.

Hardness	Shore A	60-68
Specific gravity	g/cm3	1.110-1.140
Abrasion loss	cm3	<100

- A sample of texture (the roughness of the bonding surface) must be shown prior to purchase and a random sample checking system should be introduced against that same sample.
- Width of the sample must be according to the order form. i.e. 195mm, 190mm, 170mm, 165mm

Cushion Gum

- A system should be implemented to measure width and thickness at the factory and verify tensile properties of random samples from each lot.
- A rheological test should conduct at 125^{0}C and the report must be given prior to purchase and a random sample checking system should be introduced for following parameters.

tS2	Minutes	>5
tc90	Minutes	<90

- Establish a quality verification system for cushion gum at delivery, including measurement of width and thickness, and provide operators with training to identify low-quality gum manually using hand-applied force (tensile testing).
- The thickness and the width should be as follows;

Thickness	mm	1.05-1.25
Width	mm	195-205

- Implement a mileage tracking system for recapped tyres at the depot. The collected data should be regularly analyzed to evaluate tread liner performance on a batch-wise basis, enabling informed decisions for quality improvement and supplier assessment.
- Conduct operator training to ensure consistent rejection of contaminated, under-cured, or insufficiently rough tread liners.

4.1.7. Procurement of Consumables

- It is important to develop new specifications for raw materials before entering the market again. As part of these specifications, it is recommended to consider multiple options for tread liners based on estimated mileage, due to the poor performance of the current tread liner.An analysis can then be conducted to determine whether investing in a more durable option would be cost-effective by extending the mileage of pre-capped tyres.

4.1.8. Worker Safety

- Implement strict tyre pressurization procedures, ensuring tyres are pressurized only after the curing chamber door is fully closed to eliminate potential hazards.
- Conduct a safety training session for all operators to reinforce proper practices, hazard awareness, and adherence to standard operating procedures.
- Provide and enforce the use of comprehensive personal protective equipment (PPE), including dust masks, safety gloves, heat-resistant gloves, safety shoes, goggles, ear protection, and overalls, to minimize the risk of injury.
- Clearly mark work areas with safety zones, caution signs, and hazard warnings to guide safe operations and reduce accidental exposure to risks.
- Ensure the facility is equipped with a well-maintained first aid box for immediate response to any incidents.

4.1.9. Maintenance Practices

- Establish a structured preventive maintenance program to ensure all machinery is serviced regularly, minimizing unexpected breakdowns and improving operational efficiency. Engage external SLTB technicians as needed.
- Implement proper corrective maintenance procedures, avoiding temporary fixes and ensuring repairs follow manufacturer specifications.
- Maintain an adequate inventory of critical spare parts and provide the necessary tools for all major equipment to reduce downtime during repairs.

- Assign and train dedicated mechanical and electrical technicians from the existing operators to perform corrective maintenance safely and effectively, with training conducted at another recapping plant that has sufficient resources for comprehensive instruction.

4.1.10. Fire Protection System

- Replace all existing fire cylinders and fire protection equipment with new, certified units, ensuring proper coverage until a service agreement with a reputable company is established.
- Conduct training for all operators and staff on the correct use of fire safety equipment and emergency response procedures.
- Relocate rubber waste currently stored in the main processing building for sale or safe storage, maintaining a clean and hazard-free work environment.

4.1.11. Overall Management

- This is a key initiative that must be addressed immediately, without further delay, by appointing a Factory Engineer to take responsibility for the overall operation.
- By doing so, the Factory Engineer/Manager will be able to improve current operations and address workforce attitudes over the next six months, which will significantly support the planned factory expansion next year.
- A Factory Engineer or Manager with a background in mechanical engineering (preferably holding a BSc in Mechanical Engineering) should be appointed and provided with two weeks of training at a leading tyre recapping facility.
- A proper production line should be established to ensure that tires are not mixed up and remain in their designated places. Currently, there is a risk of tire mixing. Each stage should have a clear flow with defined responsibilities, such as one person for tire inspection, one person for tire buffing, and so on, to maintain order and efficiency.
- Each tire is assigned a serial number, which should be recorded in a log sheet. This sheet must be signed by every operator who handles the tire at each stage of the process. For example, after buffing, the buffing machine operator should sign the sheet, and the same applies to all subsequent operations. If a tire fails later, the log can be traced back to identify the stage and operator responsible for the error.

4.1.12. Budget Estimation for Improvements to Existing Plant

To support the recommendations outlined above, a preliminary budget has been prepared. This budget provides estimated costs for each proposed improvement. By implementing these measures, the facility will achieve its targeted increase in capacity, while ensuring safer operations and improved tyre quality.

These cost estimates are indicative and may be subject to change.

No.	Item	Qty	Rate (LKR)	Amount(LKR)
1	**Inspection Area**			
	Install new wiring and luminaire to improve lux levels	1	5,000.00	5000.00
	Repair pneumatic cylinder and associated works	1	10,000.00	10000.00
	Find leaks on the pneumatic line and repair	1	10,000.00	10000.00
2	**Repairing buffing machine**			
	Fix pneumatic side			
	Check and correct operation of the cooling fan motor			
	Reinstate the machine alignment	1	25,000.00	25000.00
3	**Repairing thread building machine**			
	Replace moisture filter and automatic valve to check the correct operation	1	10,000.00	10000.00
	Replace Hardness meter	1	10,000.00	10000.00
	Replace Mixing bucket 25l	1	4,000.00	4000.00
4	**Curing chamber and associated works**			
	Perform chamber repair activities, including: Fixing electrical cable terminations to heating coils. Repairing or replacing temperature gauges. All work is to be carried out over the weekend to minimize operational disruption. Include any necessary electrical switching upgrades within the machine control board as part of the scope.	1	125,000.00	125000.00
	Extra curing tubes to ready the second set(need to run over 100 cycles)	8	35,000.00	280000.00
	Extra envelops to ready second set(need to run over 100 cycles)	8	20,000.00	160000.00
	Fabricate extra hangers to ready second set	10	3,000.00	30000.00
5	**Service all compressors and dryer**	1	40,000.00	40000.00
6	**Safety**			
	Safety shoes	14	8,500.00	119,000.00
	Eye protecting goggles	10	350.00	3,500.00
	Dust masks	10	350.00	3,500.00
	Heat resistance gloves	10	850.00	8,500.00
	Engage fire service contractor to renew all fire fighting and detection equipment's	Urgent	Urgent	Urgent
	Total			**843,500.00**

4.2. Factory Expansion – Target : 40,000 Tyres Annually

This long-term goal aligns with SLTB's strategy to increase in-house production of recapped tyres. SLTB plans to meet 30% of its tyre requirements through the Ampara production facility. To achieve this target, an additional production line will be added to the existing facility. This expansion will require the purchase of new machinery and improvements to the current infrastructure.
It is important to construct new amenities or upgrade existing ones including washrooms, rest areas, and administrative sections to provide better working conditions for staff.

The estimate below outlines the funding requirements for Stage 2 of the project.

NO	DESCRIPTION	RATE, USD	QTY	AMOUNT,USD
1	Tyre Buffing Machine assembled with pneumatic and electrical control	6750.00	1	6750.00
2	Thread Building Machine	4950.00	1	4950.00
3	12 tyre electrical curing chamber	19850.00	1	19850.00
4	Monorail for 12 tyre electrical chamber	3450.00	1	3450.00
5	Curing rims with flanges	185.00	12	2220.00
6	Inspection speader with tyre lifting attachment	2250.00	1	2250.00
7	Dust collector	950.00	1	950.00
8	Envelope expander vertical type with tyre lifting attachment	2950.00	1	2950.00
9	Shipping and Insurance cost	2800.00	1	2800.00
10	Electrical , compressed air and lighting upgrade (new distribution board and cabling)	10000.00	1	10000.00
11	Recruit a new factory/production engineer for 12 months	8000.00	1	8000.00
12	Machine Installation and amenities improvement	5000.00	1	5000.00
	Contingency	3500.00	1	3500.00
	TOTAL			**72670.00**

5.Conclusion

The assessment of the Ampara Tyre Re-Capping Facility has identified both strengths in its operational framework and several critical areas requiring immediate attention. While the plant is currently capable of meeting its production targets, deficiencies in equipment, processes, management and quality control are limiting efficiency, product reliability, and workplace safety.

By implementing the recommended **Stage 1 actions** which focus on repairing equipment, strengthening preventive maintenance, improving quality control, and enforcing safety measures the facility can rapidly increase daily output and extend tyre mileage. These improvements will result in immediate gains in productivity and product performance.

Stage 2 improvements, centred on infrastructure upgrades, machinery enhancements, and optimized layout, will position the plant to scale production sustainably and meet future demand with higher quality and reduced operational risks.

In summary, successful execution of Stage 1 will increase daily production to **66–80 high-quality tyres**. Adding another production line with semi-automated machinery will further boost output to **160 tyres per day**.

To achieve these objectives, **appointing an experienced factory or production engineer** is critically important. Their expertise will help streamline operations and elevate the facility to become a benchmark for operational excellence within SLTB's network of facilities.