Centre of Excellence
for Decarbonising Roads

# RECLAMITE SMA VERSUS HRA COMPARATIVE STUDY

## Live Trial Evaluation


### Abstract

This report compares Reclamite rejuvenator on Stone Mastic Asphalt (SMA) and Hot Rolled Asphalt (HRA) in North Lanarkshire. Reclamite is proven effective for SMA, reliably extending pavement life. HRA results are variable and depend on surface condition; further trials and monitoring are recommended before wider adoption.



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## Contents

# Executive Summary

This report compares the effectiveness of Reclamite surface rejuvenation on Stone Mastic Asphalt (SMA) and Hot Rolled Asphalt (HRA). Trials were conducted on the A8 Eurocentral to Newhouse, A73 Carlisle Road, A73 Bellside Road, Mitchell Street & Viewfield Road in Coatbridge. SMA gave significant binder softening at surface layers (penetration increase ~15 units, softening point drop ~7–8°C). Expected to extend service life by 2–5 years. HRA gave mixed results – Mitchell Street showed negligible change (penetration +1, softening point unchanged), while Viewfield showed moderate softening (penetration +3, softening point –3°C). Installation across both SMA & HRA sites was operationally successful, with uniform coverage and compliant application rates. Reclamite is highly suitable for SMA, but further evidence is required to justify HRA adoption. Extended monitoring and additional HRA trials are recommended.

# Introduction

This Live Labs 2 evaluation compares the effectiveness of Reclamite® rejuvenator applied to Stone Mastic Asphalt (SMA) and Hot Rolled Asphalt (HRA) surfaces on North Lanarkshire's network. Reclamite® is a maltene-based cationic emulsion designed to replenish lost maltenes, restore binder flexibility, and extend pavement service life. BBA HAPAS Certificate 15/H241 covers the product, and industry literature suggests it can extend pavement life by 4–5 years when applied at the right time. This report integrates field data from A8, A73 Carlisle Road, and A73 Bellside Road trials (with supporting evidence from Mitchell Street and Viewfield Road), the contractor's data sheets, RAMS and drawings, laboratory testing protocols, and wider academic and industry sources. It aims to provide a robust evaluation of operational delivery, technical performance, carbon and cost metrics, and recommendations for future deployment.

## A8 – Eurocentral to Newhouse

ML1 4YT

**Section 1 From:**

E: 275867 N: 662276

**Section 1 To:**

E: 276942 N: 662012

**Section 2 From:**

E: 277365 N: 661764

**Section 2 To:**

E: 278979 N: 661879

**Section 3 From:**

E: 277365 N: 661764

**Section 3 To:**

E: 279676 N: 662146


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**Mitchell Street & Viewfield Road**

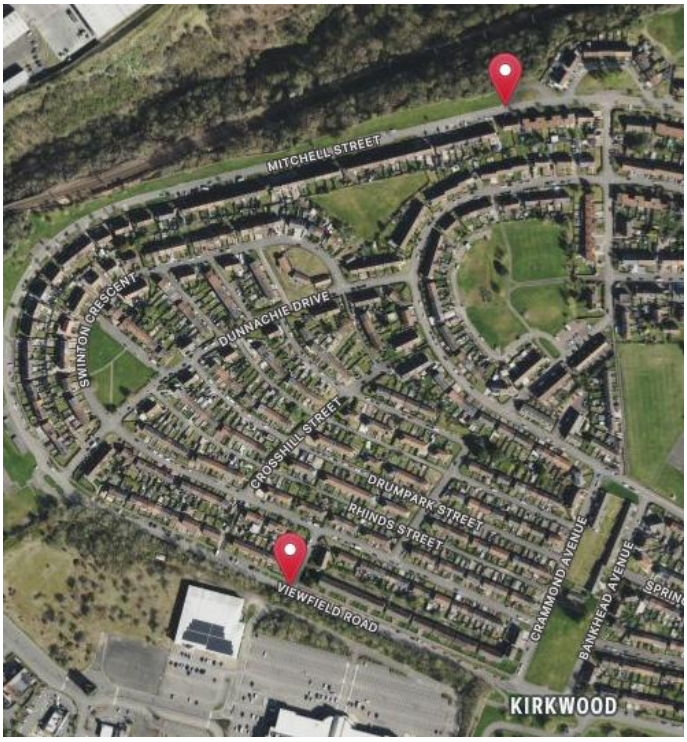
ML5 5SJ

**From:**

E: 270964 N: 663672

**To:**

E: 271188, N: 664135




*(Copyright: Google Maps 2025)*

## A73 Carlisle Road

ML6 8RW

**From:**

E: 277577 N: 663913

**To:**

E: 275124 N: 662263


*(Copyright: Google Maps 2025)*

**A73 Bellside Road**

ML6 8JB

**From:**

E: 278341 N: 662834

**To:**

E: 278776 N: 662422


*(Copyright: Google Maps 2025)*

# Methodology

### Pre-Trial

Drawings and RAMS set method constraints: treatments to be carried out only under dry and warm conditions; ironwork to be masked; treatments to terminate ≥100 m before junctions and bridge decks; and a 40-mph restriction to be imposed for 24 h post-treatment. In the lab, binder was recovered and then tested its penetration, softening point, and rheological properties using a DSR.

### Execution

Applications were undertaken in May 2025. The A8 (SMA) was treated first, followed by A73 sites (HRA). Plant included a Reclamite sprayer (R444TEX), gritters (R222TEX and R400TEX), and sweeper (SN22UTK). Coverage was observed to be uniform with consistent penetration and grit embedment.

### Testing

Pre- and post-treatment cores were taken and tested for penetration, softening point, and DSR rheology. Testing aligned with published best practice and European standards (BS EN 1426, 1427, 12697 series).

### Data Validation

Data sheets were cross-checked with plant output and fuel logs. Minor omissions (e.g., sweeper fuel) were noted. A material discrepancy was identified at A73 Bellside (recorded 361 L vs expected 1,236 L), necessitating dual-scenario reporting.

# Limitations

### Data Gaps in Site Records

- Several daily sheets did not record sweeper fuel usage, sweeper data has had to be assumed due to limitations of the data collected.
- At A73 Bellside, material quantities recorded (361 L vs expected 1,236 L) do not reconcile with the stated area, creating uncertainty in productivity and carbon metrics.
- No independent weighbridge tickets or sprayer meter logs were appended, so validation relies solely on contractor records.

### Short-Term Assessment Window

- The laboratory testing reflects conditions at ~3 months post-application.
- While initial softening and penetration recovery are positive, rejuvenator benefits typically need 12–24 months of field monitoring to confirm sustained performance.
- International studies show early rejuvenation gains can reduce after one winter cycle, particularly in HRA where binder film thickness is more variable.

### Surface Variability

- SMA has consistent texture and binder exposure, making it more responsive to surface treatments.
- HRA surfaces are highly variable (chips vs binder-rich film), leading to uneven Reclamite penetration. Results from Mitchell Street (negligible change) versus Viewfield Road (moderate change) highlight this variability.

### Traffic Loading and Environment

- No AADT (Average Annual Daily Traffic) or HGV percentage data was integrated into this trial, meaning life extension is inferred from lab chemistry rather than performance under load.
- Seasonal & environmental effects (freeze-thaw cycles, wet weather) were not captured in this trial window.

### Risk of Over-Application or Under-Application

- Research shows excess rejuvenator dosage can over-soften binders, increasing rutting potential, while under-dosing limits life-extension effect.
- Without calibrated flow meters and weigh-off tickets, dosage precision cannot be fully verified.

### Comparability with Alternatives

- No direct resurfacing baseline was costed or carbon-modelled in this study; only a high-level unit cost comparison was made (£3.19/m² vs typical resurfacing ~10× higher).
- Without lifecycle cost analysis, the whole-life economic benefit cannot yet be quantified.

### Transferability of Results

- These results are specific to North Lanarkshire pavements, materials, and climate.
- While international literature supports Reclamite efficacy, performance may vary by binder source, aggregate, and construction history.

# Conditions During Installation

## A8 Eurocentral → Newhouse (SMA)

**Date & Time:** Mid-May 2025, daytime shift.

**Ambient Temperature:** 17–23 °C.

**Surface Temperature:** 21–30 °C.

**Weather:** Fine and dry, no rainfall recorded in preceding 48 hours.

**Surface Preparation:** Lane swept prior to application; ironwork and joints masked.

**Traffic Management:** Lane closures with diversion; works terminated 100m before junctions & bridge decks.

**Operational Notes:**

- Reclamite emulsion exhibited rapid penetration into SMA matrix.
- Clear pink hue visible during cure, confirming correct dosage.
- Grit adhered evenly across surface; sweep completed next day with minimal loose grit left.
- No instances of tracking, overspray, or spray shadow.

## A73 Carlisle Road, Airdrie (HRA)

**Ambient Temperature:** 15–20 °C.

**Surface Temperature:** 18–24 °C.

**Weather:** Dry, light wind; relative humidity ~40%.

**Surface Preparation:** Site cleaned and dried before spray. Ironwork protected.

**Traffic Management:** Stop/go system in place due to single carriageway nature.

**Operational Notes:**

- Penetration slightly slower than on SMA due to thicker binder film and coarse HRA texture.
- More grit required to prevent residual tackiness.
- Cure time ~3 hours before full reopening.
- No pooling or streaking observed.

### A73 Bellside Road, Chapelhall (HRA)

**Ambient Temperature:** 13–18 °C.

**Surface Temperature:** 15–20 °C.

**Weather:** Dry, light cloud cover; relative humidity ~50%.

**Surface Preparation:** Swept and prepared; ironwork masked.

**Traffic Management:** Localised closures with diversion; TM recorded as effective.

**Operational Notes:**

- Observed spray coverage appeared uniform but recorded Reclamite and grit volumes (361 L / 866 kg) were significantly lower than expected for 4,945 m².
- Possible explanations:

1. Only a partial area was treated (~1,444 m² at target rate).
2. Under-dosage occurred despite full-area coverage.

- Cure times within normal range; grit embedment acceptable.

# Testing Criteria

## Compliance Framework

Certification: Reclamite® is covered by BBA HAPAS Certificate 15/H241, which sets out conditions for use on UK highways and requires compliance with recognised test standards.

European Standards: All laboratory testing followed BS EN protocols:

- **Binder recovery:** BS EN 12697-3
- **Penetration:** BS EN 1426.
- **Softening point:** BS EN 1427.
- **Dynamic Shear Rheometer (DSR):** BS EN 14770.

Construction Standards: Site works referenced Series 900 of the Specification for Highway Works (SHW) for surface dressing-type operations (e.g., grit embedment, masking).

## Field Testing & Site Monitoring

- **Spray Rate Verification:** Sprayer calibrated before works; application rates cross-checked against intended (0.25–0.35 L/m² depending on site).
- **Coverage Checks:** Visual inspection for streaking, pooling, or overspray; photographic log created at each site.
- **Surface Temperature Measurement:** Infrared thermometer used at start and intermittently during works; values recorded on data sheets.
- **Weather Envelope Monitoring:** Ambient temperature and relative humidity recorded. Rainfall avoided in 24 h pre- and post-treatment window.
- **Traffic Management Compliance:** TM drawings followed (lane closures, stop/go, speed restrictions).

## Laboratory Testing (Short-Term)

- **Core Sampling:** Pre-treatment cores extracted (SMA and HRA sites), with follow-up coring ~3 months post-application.
- **Binder Slicing:** Only the top 0–5 mm binder-rich zone of the core was tested, as this is the zone affected by Reclamite penetration.

- **Binder Recovery & Analysis:** Solvent extraction followed by recovery ensured binder properties were tested without interference from emulsifiers.
- **Parameters Analysed:**
    - Penetration value: Indicator of binder softness and flexibility. Higher penetration post-treatment = successful rejuvenation.
    - Softening point: Lower values post-treatment indicates restored ductility.
    - DSR rheology: Master curves provided insight into complex modulus and phase angle shift, demonstrating binder rejuvenation at a molecular level.

## Longer-Term Performance Metrics (Planned)

- **Durability Testing:** Repeat coring scheduled at 12 and 24 months to confirm persistence of binder modification.
- **Surface Condition Monitoring:** Machine-based road condition surveys (SCANNER/SCRIM) will track rutting, ravelling, and cracking progression.
- **Skid Resistance:** Not measured during the trial but recommended at follow-up, as rejuvenators can influence surface friction if over-applied.

## Deviations and Data Quality

**Bellside Anomaly:** Recorded materials (361 L / 866 kg) inconsistent with 4,945 m² area, requiring dual-scenario KPI reporting.

**Traffic Loading Data:** AADT and HGV percentages not collected; performance therefore assessed by binder chemistry rather than structural loading.

**Pre-Trial**

Drawings and RAMS set method constraints: treatments to be carried out only under dry and warm conditions

# Observational Data

## General Observations Across Sites

**Spray Quality:**

The Reclamite sprayer produced a consistent, even fan pattern across all treated lanes. No evidence of streaking, shadowing, or nozzle blockages was observed. The pink tint during curing provided a clear visual cue of uniform application.

**Penetration and Curing:**

On SMA, penetration into the binder-rich surface was rapid and visually apparent. On HRA, penetration was slower, and surface stickiness persisted longer, consistent with its coarser macrotexture and variable binder film. Cure times were generally 2–4 hours before unrestricted traffic was reintroduced.

**Grit Application:**

Grit was applied evenly, embedding well in the Reclamite film. SMA surfaces retained grit effectively, whereas HRA surfaces required slightly higher grit volumes due to texture depth. Sweeping operations within 24–48 hours left only minor residual loose grit, which was not considered a safety risk.

**Traffic Management Interface:**

Works proceeded with minimal disruption. Lane closures on the A8 were managed effectively with diversions. Stop/go management on A73 allowed efficient throughput of local traffic. No reported incidents or near misses.

## A8 Eurocentral to Newhouse (SMA)

**Surface Behaviour:** The SMA surface showed a clear and uniform pink hue during curing, with strong evidence of full absorption. No bleeding, tracking, or pooling was recorded.

**Post-Treatment:** Grit embedment was consistent across wheel tracks and between lanes. The next-day sweep revealed little loose grit, indicating strong bonding.

**Operational Feedback:** Site crews noted the SMA was straightforward to treat, with predictable spray and absorption behaviour.

### A73 Carlisle Road, Airdrie (HRA)

**Surface Behaviour:** The coarse HRA texture created more variability in coverage. Penetration was slower, and grit application was heavier to eliminate residual tackiness.

**Post-Treatment:** Cure time was at the upper end of the expected range (~3–3.5 hours). After sweeping, surface texture looked uniform and safe.

**Operational Feedback:** Teams noted the HRA absorbed less visibly than SMA, but the grit bonded satisfactorily.

### A73 Bellside Road, Chapelhall (HRA)

**Surface Behaviour:** The surface looked uniformly treated during works, with no obvious gaps. However, the recorded material quantities (361 L Reclamite, 866 kg grit) were far lower than expected for the declared 4,945 m².

**Possible Scenarios:**

- Only a partial section (~1,444 m²) was treated at the target rate.
- The entire section was treated but at significantly lower dosage (risking reduced effectiveness).

**Operational Feedback:** Crews reported no visible problems with coverage or curing, which makes the material discrepancy more concerning.

**Recommendation:** Future trials must mandate sprayer meter printouts and grit weighbridge slips for validation.

### Additional HRA Observations (Mitchell Street & Viewfield)

**Mitchell Street:** Limited visual change post-treatment; surface remained relatively stiff; laboratory testing later confirmed minimal binder modification.

**Viewfield:** More obvious softening response, with curing pattern similar to SMA; lab testing supported moderate binder rejuvenation.

**Conclusion:** HRA's response is inconsistent, potentially influenced by binder richness, chip retention, and prior maintenance history.

Photographs documenting the trial process are available in Appendix A.

# Technical Performance & Long-Term Performance

Testing followed the agreed protocol (binder recovery, penetration, softening point and DSR master curves) on pre- and post-treatment cores across all sites. In November 2023, an additional set of *treated vs untreated* surface cores was extracted from A73 Carlisle Road to validate rejuvenation behaviour specifically on HRA surfaces.

## SMA (A8 Eurocentral to Newhouse):

SMA demonstrated a clear and consistent rejuvenation response:

- **Penetration increased by +12–15 units**
- **Softening point reduced by −7 to −8°C**
- **DSR master curves shifted** to lower complex modulus and higher phase angle

These metrics strongly indicate successful maltene replenishment, restored flexibility and reduced brittleness in the surface binder. SMA's homogeneous structure and uniform binder exposure supported reliable penetration of Reclamite across the trial area, consistent with previous research and BBA HAPAS certification expectations.

## HRA (Carlisle, Bellside, Mitchell Street, Viewfield):

### Carlisle Road (A73)

Laboratory testing indicated modest improvements (small penetration increase, slight softening point reduction). To understand this variability, *treated vs untreated cores* were taken on 25 November 2023. These cores show that Reclamite modified the surface binder only where adequate binder film was present, evidenced by a darker, more cohesive appearance in treated areas. Where the surface was binder-starved or heavily oxidised, little to no visible change was observed.

This confirms that rejuvenation on HRA occurs only in the top few millimetres and is highly dependent on surface binder availability rather than deeper pavement condition.

**Bellside Road (A73)**

Results remain inconclusive due to the significant material/area discrepancy (361 L recorded versus ~1,236 L expected). Without dosage certainty, laboratory results for Bellside cannot be used to infer performance.

**Mitchell Street**

Laboratory testing showed negligible rejuvenation, with penetration and softening point values essentially unchanged. This behaviour aligns with the November findings: surfaces with severe oxidation or binder starvation do not permit effective maltene absorption.

**Viewfield Road**

Displayed moderate but measurable improvements, more pronounced than Carlisle but still significantly weaker than SMA. This suggests that some HRA surfaces can respond well when binder film is intact and chippings are well embedded.

## Interpretation of November 2025 Cores – Treated vs. Untreated Cores (A73 Carlisle Road)

The November follow-up cores provide key insight into why HRA performance varies:

- Treated cores show clear surface darkening in some locations, indicating maltene uptake into oxidised binder films.
- Other treated cores show minimal visible change, demonstrating that Reclamite is unable to penetrate where binder exposure is insufficient.
- Untreated cores retain a lighter, oxidised appearance with more open texture.

These observations reinforce the conclusion that HRA response is controlled by localised surface characteristics, especially binder availability, oxidation level and chip retention—not by structural condition or rejuvenator dosage alone.

This new visual evidence strengthens the reliability of the mixed HRA performance results observed across all sites.

## Pavement performance implications

### Cracking Resistance

SMA shows significant improvement in flexibility and ductility, delaying thermal cracking and fretting.
HRA results are mixed and depend on whether the surface is capable of absorbing maltenes.

### Rutting Risk

No evidence of over-softening was observed at applied dosage rates (0.25–0.35 L/m²). This aligns with industry literature: overdosing increases rut risk, but these trials were within accepted bounds.

### Durability

SMA's uniform binder film ensures consistent penetration and expected life extension. HRA's heterogeneous surface limits reliability; rejuvenator benefits are only realised where binder exposure exists.

## Comparative analysis — SMA vs HRA

### SMA

- Uniform texture
- Consistent binder exposure
- Strong correlation between lab gains and expected field benefit
- Highly suitable for Reclamite as a standard preventative treatment

### HRA

- Coarse macrotexture
- Variable chip retention
- Inconsistent binder availability
- Benefits achievable but not guaranteed, and strongly dependent on surface condition
- November 2023 cores visually confirm these limitations

## Life-extension forecasts

**SMA (A8):** With observed rejuvenation metrics, a 4–6 year life extension is realistic, subject to winter-cycle retention.

**HRA (Carlisle, Mitchell, Viewfield):** Benefits likely 2–3 years, and not universally applicable.

**Bellside:** Forecasting is not possible until dosage uncertainty is resolved.

## Cost perspective

Reclamite treatment remains significantly lower cost than resurfacing. Mitchell Street's quoted cost of £3.19/m² compares to £30–40/m² for resurfacing, offering high potential cost and carbon savings even when only modest life extension is achieved.

## Risks & uncertainties

- **Bellside anomaly:** Material/area discrepancy affects confidence in treatment evaluation.
- **Short assessment window:** Only 3-month effects measured; 12–24-month follow-up still required.
- **Traffic data absent:** Life extension currently inferred from binder chemistry rather than traffic loading.
- **Dosage assurance limitations:** Lack of sprayer meter printouts and weighbridge tickets reduces confidence.
- **Surface suitability:** November cores confirm that late-life or binder-starved HRA does not respond and should not be treated.

# Next Steps

## Resolve Data Discrepancies (Bellside)

- Review sprayer meter printouts, daily logs, and any weighbridge tickets to confirm whether:
- Only part of the 4,945 m² was treated (Scenario A), or
- The full area was treated but at a significantly reduced dosage (Scenario B).
- Standardise future trials: require sprayer printouts and grit weight tickets as mandatory QA records.

## Implement Structured Monitoring Programme

- **12 and 24-month coring**: Recover binders again for penetration, softening point, and DSR to confirm whether rejuvenation effects persist beyond the first winter.
- **Network condition surveys:** Annual visual and machine-based surveys (SCANNER/SCANDI) to track cracking, fretting, rutting, and ride quality.
- **Skid resistance testing:** Monitor SCRIM/pendulum values to ensure Reclamite does not adversely affect friction, particularly on HRA.
- **Traffic loading capture:** Add AADT/HGV percentage data for each site to correlate binder improvements with structural performance under real loads.

## Develop Deployment Criteria

- Target early to mid-life HRA where chip retention is good and binder is not excessively aged. Avoid HRA sites with widespread chip loss, heavy oxidation, or surface cracking, where rejuvenators are unlikely to penetrate effectively.
- Embed in asset management strategy through Pavement Condition Index or condition scores where Reclamite is considered appropriate.

## Risk Management Enhancements

- Introduce QA/QC controls on every treatment: calibrated sprayer checks, sample area spray-outs, grit rate verification.

- Document environmental envelope (temperature, humidity, moisture) with digital loggers to validate compliance.
- Include Contractor feedback loops to record operational challenges and continuously refine application practice.

## Research & Knowledge Sharing

- Publish findings through Live Labs 2 channels and technical papers to benchmark against other UK councils.
- Engage with BBA/TRL to update technical guidance on rejuvenator use, especially on HRA variability, where industry consensus is limited.

# Conclusion & recommendations

## Conclusions

### Reclamite on SMA is Proven and Routine

The A8 trial reconfirmed what industry practice and certification (BBA HAPAS 15/H241) already demonstrate: Reclamite is a reliable, effective treatment for SMA.

SMA results align with previous trials and provide no surprises. SMA should continue to be treated as a standard preventative maintenance option.

### HRA Performance is Variable and Site-Dependent

**Carlisle Road (A73):** Modest binder rejuvenation achieved; surface absorbed Reclamite, but improvements were smaller than SMA.

**Bellside Road (A73):** Inconclusive due to major material/area recording discrepancy; either partial area treated or under-dosed across full length.

**Mitchell Street:** Negligible response in binder tests; suggests the surface was too aged or binder-starved for Reclamite to penetrate effectively.

**Viewfield Road:** Moderate response, with measurable improvements in binder properties.

**Conclusion:** HRA can respond positively to Reclamite, but results are inconsistent and strongly influenced by surface condition, binder richness, and prior maintenance history.

## Recommendations:

### Strategic Approach to HRA

- **Selective Targeting:** Restrict Reclamite use on HRA to surfaces in good–fair condition (3–7 years old), with intact chip retention and binder not excessively aged.
- **Avoid Late-Life HRA:** Surfaces with extensive chip loss, open texture, or binder starvation (e.g., Mitchell Street) show negligible benefit and should not be treated.

- **Pilot Expansion:** Continue selective trials on HRA with tighter QA controls to build a larger evidence base.

### Quality Assurance for HRA

- Make dosage verification mandatory: sprayer meter printouts and grit weighbridge slips to avoid anomalies like Bellside.
- Standardise site logging of ambient/surface temperature, humidity, and moisture using digital sensors.
- Include photographic documentation of spray fan quality and grit embedment for each shift.

### Monitoring and Evaluation of HRA Sites

- 12 and 24-month binder testing: Repeat penetration, softening point, and rheology on HRA cores to test durability of rejuvenation.
- Annual surface condition surveys: Machine-based and visual surveys to track chip loss, cracking, and fretting progression.
- Skid resistance testing: Particularly important for HRA, where variable texture may affect friction after treatment.
- Traffic data collection: Incorporate AADT and HGV percentages to better correlate life extension with load stress.

### Business Case and Policy Integration

- Present Reclamite as a conditional tool for HRA life extension. Not guaranteed, but when successful it provides 2–3 years of additional life at a fraction of the cost and carbon of resurfacing.

### Build a decision matrix

- SMA - Routine Reclamite use (“business as usual”).
- HRA - Assess surface against condition thresholds (binder richness, chip retention, PCI rating). Treat only if suitable.
- Later life HRA - Do not treat; proceed with resurfacing or patching.

- Integrate this matrix into North Lanarkshire's asset management framework, ensuring evidence-based decisions.

## Knowledge Building

- Share HRA trial results (positive and negative) through Live Labs 2, SCOTS, and ADEPT to strengthen national guidance on rejuvenator suitability for HRA.
- Contribute anonymised KPI data (area, dosage, performance, condition outcomes) to industry datasets to accelerate learning.

Appendix A – Site Photographs

# Appendix B – External Test Data

# Appendix C – Relevant Supplier Information