ROAD PAVEMENTS FORUM

26 November 2025

Latest developments on Implementation of TRH24

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Overview

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- TRH24 Ratification
- Implementation status
- Formation of Industry Working Group
- Identified issues
- Future meetings and action items

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TRH24 Ratification – Notice ☝

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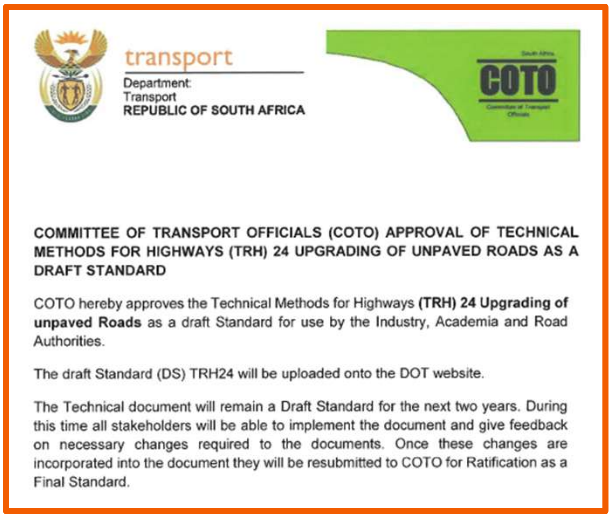
transport
Department:
Transport
REPUBLIC OF SOUTH AFRICA

COTO

COMMITTEE OF TRANSPORT OFFICIALS (COTO) APPROVAL OF TECHNICAL METHODS FOR HIGHWAYS (TRH) 24 UPGRADING OF UNPAVED ROADS AS A DRAFT STANDARD

COTO hereby approves the Technical Methods for Highways **(TRH) 24 Upgrading of unpaved Roads** as a draft Standard for use by the Industry, Academia and Road Authorities.

The draft Standard (DS) TRH24 will be uploaded onto the DOT website.

The Technical document will remain a Draft Standard for the next two years. During this time all stakeholders will be able to implement the document and give feedback on necessary changes required to the documents. Once these changes are incorporated into the document they will be resubmitted to COTO for Ratification as a Final Standard.

- COTO approved !! Acknowledge NDoT for their commitment and support.
- Draft Standard (DS) status means full legal standing
- Review period of 2-years for stakeholders to implement the manual and provide feedback on necessary changes
- After incorporating updates/changes the manual will be re-submitted to COTO for ratification
- Download from NDOT / SANRAL websites
- Provide comments on spreadsheet template and email to coto@nra.co.za

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SANRAL – IMPLIMENTATION OF TRH24 (>2022)

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- Pilot projects (7x): Upgrading from Gravel to Surfaced standards ≈ 163,1km
  - Limpopo x4 , KZN x2, Eastern Cape x1 (x6 at early stages of construction)
- Rehabilitation / Special Maintenance / Emergency Repair:
  - R504-3&4 (≈ 28,9+24km) & R555-3 (≈ 20km) – Full scale NME rehab (Construction completed)
  - N10-5 – Special Maint - Viable design solution, but not included in postulated tender (≈ 60km) (design)
  - N/Cape R369, R389, R48 routes – Special Maint - investigation and design (≈ 200 km route)
  - R26 Sections 6 – 9 (≈ 42 lane-km) (Construction completed)
  - Several other projects in design
- Road Surface Maintenance Actions
  - N14-3 (Ventersdorp) NME slurry trials - application with Spreader Box & Hand applied, 12mm NME Microsurfacing (overlay)
  - R510 (Thabazimbi) – NME texture slurry (Construction completed)
  - RRM N3 Durban to Pietermaritzburg – NME treated RAP for emergency repairs (Construction completed)
  - RRM N/Cape R369, R389, R48 routes – NME Slurry (hand), NME Microsurfacing, NME Base (existing G5) alternatives to asphalt patching (base & surfacing) (investigation and design)
- New Construction (seals)
  - R43 (Houw Hoek, W/Cape) – NME 20 Cape seal (trials only)
- Gravel road maintenance & Upgrade to surfaced standards
  - R380 Santoy (N/Cape) = 118,5km (investigation and design)

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TRH24 Layout

1	Introduction
2	Road Network Evaluation and Prioritisation (CEA-BASED)
3	Geometric Standards and Side Drainage
4	Cross Drainage Standards for LVRs
5	Pavement Structural Evaluations and Design:
6	Material Design Method using (MC-NME) Technologies
7	Selection and Design of Applicable Surfacings
8	Required Maintenance Actions
9	Method of Contract for Upgrading of Unpaved Roads

APPENDICES

APPENDIX A	Key Data and Sources for Economic Prioritisation
APPENDIX B	Guidelines for pre- and post-project assessments
APPENDIX C	Physical Environment
APPENDIX D	Laboratory DN Testing and Selection of a Moisture Regime
APPENDIX E	Project Specifications
APPENDIX F	Examples of MC-NME Stabilising Agents Tested in Practice
APPENDIX G	Surfacings for Low Volume Roads
APPENDIX H	Maintenance Concepts

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Rationale for forming the Industry Working Group

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The recent publication of the TRH24 (DS) resulted in the immediate application and implementation of the manual on new/upgrading contracts, maintenance contracts, and rehabilitation contracts.

The utilization of nano silanes and nano polymers to improve material properties, proved to be most challenging.

Matters that have been reported to date, include (but are not limited to):

- Localised premature failures on recently completed "nano" projects,
- Availability of site testing data & lessons learnt that can be used to improve TRH24,
- Call for testing protocols to be aligned
- Site specific problems and acceptance control
- Procurement challenges

It was decided to form an industry working group to create a neutral platform to address challenges

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Working Group Formation & Objectives

- Establish TRH24 WG
  - Key participants identified from industry and research institutions involved with current projects.
- Purpose of the Working Group
  - To identify problems, provide constructive inputs, develop improved standards, methods and procedures relating to the implementation of “nano-technology” in pavement engineering, as per TRH24.
  - To implement resolutions, resolve “bottlenecks”, create a knowledge-sharing environment.
  - Industry representation, therefore open-invitation.
  - THIS IS A WORKING GROUP

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TRH24 – “Nano” WG Kick-Off Meeting

- TRH 24 Implementation Industry Working Group (focusing on Nano-technology) = First Workshop (online) : 9 September 2025
- 50 attendees representing NDoT, SANRAL, consultants, contractors, suppliers, laboratories and academia.
- Summary of key discussion points:
  - **Technical Challenges and Lessons from Nanotechnology Implementation Projects:** Detailed case studies on recent projects, highlighting technical challenges, laboratory and field test results, and lessons learned regarding the use of nanotechnology in pavement layers.
  - **Open Floor Discussion: Testing Protocols, Material Behavior, and Specification Development:** Participants engaged in a technical discussion on testing protocols, the roles of different material components, and the need for improved specifications and performance verification methods for nanotechnology in pavements.

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Technical Challenges

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Construction challenges at some projects (R30, R504, R555, R26)

Excess moisture, curing time, poor joints, & early trafficking – Identified as primary causes of early deterioration and localized premature failures in stabilized layers.

Nano-stabilized layers can exhibit **significant strength gain over time**, sometimes exceeding design expectations

Low Tensile Strength

Binder ratio concerns – Incorrect ratios led to reduced tensile strength and compromised durability.

Impact on durability – Material performance declined significantly under moisture and load conditions.

Effective Retained Strength – Unable to meet criteria despite absolute values exceeding minimum values.

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Field Trials and Slurry Applications

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- Nano-modified emulsions in slurries, including micro-surfacing applications.
  - **After one year**, sections performed well with no significant stone loss or bleeding, except where construction errors occurred.
  - The trials demonstrated the importance of proper binder content and application techniques.

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Design & Acceptance Criteria

Current design gaps

- Current criteria fail to capture durability and moisture resistance adequately.
- Need for durability focus – Emphasized incorporating long-term performance indicators into design standards.

Performance-based approach

- Shift from prescriptive to outcome-based – Encouraged designs that prioritize actual performance over rigid specifications.
- Include risk assessment – Recommended evaluating risks like overdosing and mineral variability upfront.

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Design and Acceptance Criteria Questions

- Key questions raised about the timing of acceptance tests (e.g., 7-day vs. 28-day results),
- Potential for materials to become overly brittle due to continuous strength gain. The need for effective retained strength criteria and consideration of material behavior over time was emphasized.
- The issue of risk allocation among suppliers, consultants, and contractors.

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Interpretation of test results

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- Effective Retained Strength provides a more holistic assessment than absolute values for UCS and ITS,

RTS in relation to minimum $ITS_{wet(criteria)}$ = $RTS_{effective}$

= ((RTS x (ITS_{wet}/$ITS_{wet(criteria)}$)) (%)

- High UCS_{dry} and ITS_{dry} values could influence assessment

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Laboratory vs Field Performance

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Lab vs field performance

Moisture sensitivity differences – Lab results underestimated field moisture effects, causing unexpected failures.

Variability in strength – Observed inconsistencies between lab predicted strengths and actual field performance.

Adequacy of current performance criteria – Despite improvements to mix designs, effective retained tensile strengths remained below target.

Binder Adjustments

Impact on curing – Binder adjustments influenced curing time and overall structural integrity.

Effect on long-term performance – What is the effect of changes in mix design and material variability on pavement lifespan and maintenance needs.

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Lab Testing Protocols & Hydrophobicity

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Standardized protocols

Consistency across labs – Standard protocols reduce discrepancies and improve reliability of test results.

Reduce variability – Uniform methods ensure comparable outcomes across different testing facilities.

Hydrophobicity tests

Assess water resistance – Hydrophobicity tests help predict material behavior under wet conditions.

Correlate with field performance – Link lab hydrophobicity results to actual in-pavement durability.

Alternative tests to measure hydrophobicity and soil suction effects.

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Material Behavior

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Overdosing risks

- **Impact on strength** – Excess binder caused brittleness and reduced structural resilience.
- **Potential for cracking** – Overdosing increased shrinkage, leading to surface cracks under stress.

Mitigation strategies

- **Controlled dosing** – Implement strict monitoring to prevent excessive binder application.
- **Monitoring during mixing** – Real-time checks ensure proper material proportions and uniformity.
- Each project requires **tailored mix designs** and careful adjustment based on material variability.

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Mineralogy & XRD Testing

Importance of mineralogy

Influences binder reaction – Mineral composition affects chemical bonding and stabilization efficiency.

Affects durability – Reactive minerals can compromise long-term pavement performance.

XRD for material characterization

Identify reactive minerals – XRD testing detects minerals that may cause expansion or instability.

Reporting and Use of XRD Results: Standardized format for reporting

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Link with Research

Collaborative research

Engage universities – Academic partnerships foster innovation and advanced material research.

Industry partnerships – Collaboration ensures practical applicability and resource sharing.

Future priorities

Focus on sustainability – Future research should prioritize eco-friendly materials and processes.

Improve testing methods and protocols– Develop advanced protocols for accurate prediction of field performance.

Long-Term Pavement Performance (LTPP) program and expanded **accelerated pavement testing** for nano-stabilized materials

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Knowledge Base and Experience Sharing

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- Participants stressed the importance of **transparency and trust-building** through sharing knowledge, especially as new technologies are implemented.
- Past negative experiences must be prevented. **Sharing of experience** will ensure the successful adoption of nanotechnology and prevent the technology from being unfairly discredited due to isolated failures.
- **Documenting experiences** from early projects, e.g. Describe construction processes in detail, the sequence of applying the different additives, curing time and regime, when to apply prime, binder compatibility, early trafficking, specifications, etc.

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Working Group Structure and Collaboration

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Group continue **collective discussions** before splitting into task teams, to ensure diverse perspectives are considered and avoid fragmented solutions.

Future **face-to-face meetings** or regional hubs to facilitate deeper engagement.

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Action Items & Next Steps

Manual Updates

Incorporate WG feedback – Ensure all member inputs are reflected in the final manual.

Set timeline – Define clear deadlines for each phase of the manual update process.

Next WG meeting

22 January 2026 @ Engineering 4.0

Agenda to cover current, pending topics and new priorities.

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THANK YOU FOR YOUR ATTENTION

QUESTIONS?

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