LL-TEQ

LL30 Technical Manual

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LL30 Technical Manual — contents

01 Technical guide

LL-TEQ™ LL30 is a water-based polymeric binder intended for the structural rehabilitation of pavements and in-situ materials (RAP, granular materials), notably through cold in-place recycling. It is integrated into the reclaimed asphalt pavement (RAP) and the existing granular materials in order to rebuild a recycled asphalt pavement layer that is load-bearing, cohesive, and of low permeability.

General execution sequence

- Assessment and preparation of the existing pavement.
- Measurement of the material's OMC (optimum moisture content) at the start of the day, in order to establish the product's dilution parameters (water-to-LL30 proportions).
- Controlled application of the product at the established dilution, and adjustment of the moisture content close to the OMC.
- Milling, mixing, and integration to the target depth.
- Grading and shaping.
- Final compaction.
- After the integration, grading, and compaction of the LL30, allow the surface to harden (reference delay of approximately 2 h after final compaction) before applying the LL25. The sealer is placed using a heavy water truck driving over the surface: the surface must have hardened sufficiently to support the passage without being marked. The LL25 is then applied to the surface, after which the cure of the treated block continues until the return to traffic.

The process is carried out using standard road equipment, notably a water truck fitted with a spray bar, a cold recycler, a grader, and a wide double-drum compaction roller.

In the LL-TEQ™ system, the LL30 provides the structural integration and the LL25 provides the wearing course. The LL30 forms the structural block, and the

LL25 seals the surface and fills the residual voids left by the LL30 as it is incorporated into the structure, completing the uniformity of the whole.

02 Technical data sheet

Product name	LL30
Product type	Water-based polymeric binder
Primary function	Structural integration of in-situ materials through stabilization and cold in-place recycling
Primary use	Structural rehabilitation and improvement of pavements and in-situ materials (RAP, granular materials)
Compatible materials	RAP, granular materials, base aggregates, and other compatible structural materials
Application method	Controlled application and integration into the treated thickness using standard road equipment
Treatment depth	50 to 200 mm (2 to 8 inches), depending on the project
Target compaction	95% compaction and above (never below)
Cure	The cure of the treated block begins as soon as compaction is complete. After hardening for approximately 2 h, the LL25 is applied to the surface using the water truck, after which the cure continues until the required mechanical properties have developed prior to the return to traffic
Storage temperature	Above 5 °C and below 44 °C
Frost sensitivity	Frost-sensitive before installation
Sun exposure	Store away from direct sunlight
Shelf life	12 months unopened / 6 months after opening

02 Technical data sheet

Mixing requirement	No mixing or re-mixing required before use
Storage conditions	Store in the original or a compatible container, closed, protected from contamination, frost, excessive heat, and direct sunlight
Pre-use check	Visual inspection required before application
General restriction	Do not use a contaminated or visibly altered product without the manufacturer's approval

03 Compatible materials

Compatible materials for structural integration

LL30 is compatible with the following materials:

- Reclaimed asphalt pavement (RAP / asphalt millings).
- Granular materials (base, subbase, foundation).
- Natural soils (sandy, clayey, silty, gravelly, or mixed).
- Natural gravels.
- Recycled materials.
- Lateritic materials.
- Decomposed granite.
- Crushed limestone.

SOP formulation

LL30 is integrated into compatible materials, notably reclaimed asphalt pavement (RAP), granular materials, recycled materials, and natural soils, including their variants, depending on project conditions.

General statement

LL30 is used as a structural-integration binder in compatible materials, as part of a cold process using standard road methods.

04 Installation equipment

Structural integration – LL30

The LL30 structural-integration process is carried out using road equipment commonly employed in road and civil works.

Required equipment

- Water truck or tanker truck fitted with a pressurized spray bar for the controlled application of the liquid and adjustment of the moisture content.
- Cold recycler or stabilizer with injection capability for the milling, mixing, and integration of the product into the treated thickness.
- Grader for the final profiling and shaping.
- Compactor suited to the final densification of the treated layer, notably including a wide double-drum compactor.

Examples of equivalent equipment (for guidance only)

- Water truck: Freightliner M2 Water Truck or equivalent.
- Cold recycler: Wirtgen WR 240 / WR 250 or equivalent.
- Grader: Caterpillar 140M or equivalent.
- Compactor: BOMAG BW 211 tandem / double drum or equivalent.

Operational note

A wide double-drum compactor is preferred for compaction.

A roller fitted with tires or rear wheels can leave marks on the surface, whereas a double-drum compactor allows a more uniform finish, better compaction control, and a cleaner final appearance.

The makes and models above are provided for guidance only. Any equivalent equipment capable of achieving compliant application, integration, profiling, and compaction may be used.

05 Treatment depth

Structural-integration depth

The LL30 treatment depth corresponds to the thickness of the treated layer, whether the material is mixed in place or pre-mixed beforehand and then placed and compacted.

Reference operational depth

50 to 200 mm (2 to 8 inches), depending on the existing structure, the materials present, the project's structural objective, and the design adopted.

SOP formulation

LL30 is integrated into the thickness of the layer to be treated, either by mixing in place or by pre-mixing followed by placement and compaction. The reference treatment depth is 50 to 200 mm (2 to 8 inches), subject to assessment of the existing support, the composition of the in-situ materials, and the project's structural requirements. Any different depth must be validated according to the specific site conditions.

General statement

The choice of treatment depth for LL30 must remain consistent with the existing structure, the nature of the in-situ materials, and the targeted performance objective.

06 Target compaction level

Structural integration

The target compaction level for LL30 is the level required to obtain a dense, homogeneous, and stable structural layer after placement of the treated material.

Reference compaction

- 95% compaction and above (never below).

SOP formulation

LL30 must be compacted to reach at least 95% compaction, never dropping below this threshold.

General statement

For LL30, compaction is an essential step in achieving the density, cohesion, and stability of the treated block.

07 Application weather conditions

Structural integration

Work with LL30 must be carried out under weather conditions that allow adequate mixing, effective compaction, and an undisturbed start of cure.

Required weather conditions

- Application under weather conditions compatible with normal milling, mixing, grading, and compaction operations.
- Unfrozen support at the time of treatment.
- Ambient temperature and support temperature above 5 °C at the time of application and during the execution operations.
- Absence of significant rain during application and compaction.
- Conditions allowing the required working moisture to be maintained until the end of compaction.
- Conditions favourable to the start of cure after shaping and compaction.

SOP formulation

LL30 must be applied under weather conditions compatible with the mixing, placement, and compaction operations, notably when the ambient temperature and that of the support are above 5 °C.

The support must not be frozen. Work must not be carried out under significant rain or in conditions preventing uniform mixing, achievement of the required working moisture, adequate compaction, or a satisfactory start of cure.

General statement

Work must be planned so as to avoid any weather condition liable to compromise the application, mixing, compaction, start of cure, or final stability of the treated layer. In the presence of unfavourable conditions, work must be postponed until conditions compatible with the process return.

08 Cure time

Structural integration

The cure of the treated block begins as soon as the compaction of the LL30 is complete. After sufficient hardening (reference delay of approximately 2 h), the LL25 is applied to the surface — the water truck then driving over a surface firm enough not to be marked — after which the cure continues. This cure allows the block to stabilize, begin to dry, and develop the necessary cohesion before its exposure to traffic.

Reference cure requirements

- The cure begins as soon as compaction is complete; the LL25 is applied after approximately 2 h of hardening, and the cure then continues.
- The treated block remains protected against any disturbance during the initial cure.
- Return to traffic only once sufficient stability has been reached for the intended service condition.

Restrictions during cure

- No traffic before the treated block has reached acceptable stability.
- No operation liable to deform, contaminate, or disturb the surface during the initial cure.
- No return to traffic and no subsequent step as long as rain or excessive-moisture conditions are liable to impair normal cure.
- No return to traffic if excess moisture, instability, or insufficient densification is still present.

SOP formulation

The treated block begins its cure as soon as compaction is complete. The LL25 must be applied only after sufficient hardening of the surface (reference delay of approximately 2 h after final compaction), so that it can support the passage of the application water truck without marking. The block must not be opened to traffic until sufficient stability has been reached for the intended service condition.

During the cure, the block must be protected against rain, surface disturbances, and any operation liable to impair its stability, geometry, or initial performance.

General statement

The cure time of the treated block depends on the condition of the support, the ambient temperature, the moisture, and the weather conditions.

No section must be opened to traffic until the LL-TEQ™ system (LL30 and LL25) has released enough moisture and air to reach its stability. A minimum delay of 12 hours before opening to traffic is required, to be adjusted according to moisture, temperature, and weather conditions.

09 Quality control

Structural integration

The quality control of LL30 aims to ensure the uniformity of the integration, conformity of the treated depth, achievement of the required compaction, and final stability of the treated block.

Quality-control checkpoints

- Verification of surface preparation before the start of work.
- Verification of the material's OMC before the start of work and establishment of the product's dilution parameters.
- Verification of the uniformity of the application and integration of the product during mixing.
- Verification of the treatment depth.
- Verification of the achievement of the required compaction level.
- Verification of the final profile and the homogeneity of the layer.
- Verification that the LL-TEQ™ system (LL30 and LL25) has reached sufficient stability before the return to traffic.

SOP formulation

The quality control of LL30 includes verification of the support preparation, the uniformity of the product integration, the treatment depth, the final compaction, and the profile of the treated block.

The treated block must present a homogeneous, stable appearance, consistent with the geometry as well as the structural requirements of the project.

10 Storage conditions

Storage conditions

LL30 must be stored in its original container or in a compatible container that is clean, properly labelled, and hermetically sealed.

The product must be stored at a temperature above 5 °C and below 44 °C, protected against frost and kept away from direct sunlight. LL30 is frost-sensitive before installation and must not be stored under conditions that could cause the product to freeze.

Its shelf life is 12 months when the container is unopened and 6 months after opening. No mixing or re-mixing is required before use, even after a prolonged storage period within the stated shelf life.

Before application, the product must be checked visually to confirm that it remains in a condition compatible with the intended use and that it has not been affected by frost or a freeze-thaw cycle.

Any product showing visible contamination or abnormal alteration must not be used without the prior approval of the manufacturer.

General statement – Storage

Products must be stored in a clean, controlled environment, under conditions that preserve their integrity and their suitability for application. They must be protected against direct sunlight, contamination, frost, and excessive heat. The shelf life is 12 months in an unopened container and 6 months after opening. No mixing or re-mixing is required before use, provided that the product has been stored under the specified conditions and remains within its shelf life.

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