

PAVEMENT LIFE ASSESSMENT GUIDELINES

1. SCOPE

This guideline sets out the requirements for the assessment of life for the pavement design and construction of new and re-constructed flexible unbound and stabilised pavements with chipseal or thin asphalt surfacings. The various components of the pavement shall be as defined in the the Austroads (2012) *Guide to Pavement Technology – Part 2: Pavement Structural Design*.

To understand the requirements of this guide, it is recommended that a meeting between the Contractor, the Consultant, and the Transport Agency’s Highways and Network Operations Group (HNO), take place before the guidelines are implemented.

This document assumes that there are roughness, skid resistance and texture requirements for a minimum of 12 months after opening to traffic specified elsewhere in the contract documents.

The Contractor shall demonstrate the design of the pavement and materials used will meet or exceed the design life, through the assessment of four criteria:

1. Pavement Design.
2. Pavement Materials.
3. Pavement Layer Compaction.
4. Pavement Layer Stiffness.

2. COMPLIANCE ASSESSMENT

2.1 Pavement Design

Prior to construction starting the pavement design will be assessed. The pavement design(s) will only be accepted if the maximum allowable traffic volume computed using the procedures in Austroads (2012) *Pavement Structural Design guide* and the New Zealand Supplement to Austroads (Transit 2007) exceed the design traffic loading given in the Schedule to this Contract.

Key aspects that will be assessed in the design are:

1. Pavement layer stiffnesses assumed in the pavement design were lower or the same as presumptive values recommended in the Austroads (2012) *Pavement Structural Design guide*;
2. For stabilised pavement materials that are assumed to be pre-cracked (i.e. the tensile fatigue criterion is not considered) the vertical modulus is assumed in design to be less than 500 MPa (as per Section 8.2.4 in Austroads (2012));
3. For modified pavement materials the design should assume values of pavement layer stiffnesses including sub-layering as per an unbound granular material (see Section 6.3

in Austroads (2012), with an added limitation that the maximum allowable assumed vertical modulus is 750MPa;

The Contractor shall as per their Quality Plan, assess representative samples of the pavement cross-section to determine if the pavement materials and their depths used in construction are the same as materials assumed in the pavement design.

The assumed subgrade CBR for design shall also be confirmed on site.

As a minimum requirement, the Contractors Quality Plan shall include assessment of representative samples of pavement cross-sections in each lane at 20m intervals.

2.2 Pavement Materials

The Contractor shall as per their Quality Plan, assess representative samples of pavement materials to determine if the pavement materials used in construction are compliant with TNZ M/22 Guide or TNZ M/4.

As a minimum requirement the Contractors Quality Plan shall include assessment of representative samples of pavement materials (basecourse, upper and lower sub-base) that may be taken from the conveyor belt, bin, stockpile, truck, or from stabilised materials as mixed on site. Representative samples of the pavement materials shall be obtained in accordance with NZS 4407: 1991. Stored pavement materials shall be subdivided into lots so that pavement materials of visible difference are sampled and tested separately. The rate of obtaining samples from lots shall be as per the Contractors Quality Plan where the minimum testing rate shall be as per Table 1 below.

TABLE 1: MINIMUM SAMPLING RATE FOR PRODUCTION PROPERTY TESTS

LOT SIZE		NUMBER OF SAMPLES
FROM	TO	
1 m ³	400 m ³	2
400 m ³	1500 m ³	3
1500 m ³	4000 m ³	4

Where the lot size exceeds 4000 m³ additional testing shall be at a minimum rate of one sample for every 1000 m³.

2.3 Acceptance Criteria for Pavement Layer Compaction

Compaction testing of the pavement layers shall be carried out in lots. A lot is defined as a section where the pavement layer appears homogeneous and evenly compacted. The area of a lot shall not exceed 1000 m².

The degree of compaction for each lot shall be determined by testing as per the Contractors Quality Plan. A minimum of five selected areas shall be tested on top of the sub-base and base. The compaction requirements shall be met if the compacted dry densities and saturations measured immediately prior to sealing are greater than the targets specified in the

Contractors Quality Plan. The Contractor shall demonstrate in the Quality Plan how the target compacted dry densities for the sub-base and base were determined.

It is expected that the target dry densities should be obtained from either the maximum of: the dry density that was needed in order for the pavement material to meet the minimum strength/moduli of the design; and/or the requirements for compaction in TNZ B/2 Specification for the Construction of Unbound Granular Pavement Layers. The Engineer may request additional areas to be tested.

2.4 Pavement Stiffness

Within two weeks of surfacing the pavement the Contractor shall measure the pavement layer stiffnesses (moduli) achieved in the constructed pavement using a Falling Weight Deflectometer and the analysis procedure provided in the relevant Appendix in the Contract Scope.

The testing location shall be uniformly distributed in alternating left and right hand wheel paths of each lane with at least 40 deflection tests per 1000m² required for each lot. A Lot is defined as a section where the pavement is homogeneous, i.e. with the same pavement cross-section and a coefficient of variation (mean - standard deviation) of 0.25 or less. A Lot shall have an area of at least 1000 m².

Lots with modified or stabilised layers shall be deemed bound if the 95th Percentile Moduli (mean + 1.65 x standard deviation) value exceeds 3000MPa and unbound where it does not. The remaining life of the bound Lots shall be calculated from Section 2.6 below. The remaining life of the unbound Lots shall be calculated from Section 2.7 below.

2.5 Pavement Life - Bound Pavements

The remaining life of bound Lots shall be calculated from the Tensile Strain Criterion provided in Section 6.4.5.4 of the Austroads *Pavement Design Guide 2004*. The Lot will be deemed compliant if the 95th percentile value of the Lot exceeds the design requirements.

Non-Compliance with Pavement Life

In the event of non-compliance, where the pavement life assumed in the design was not achieved in construction, the engineer will either:

- Deduct the whole of life costs of the expected increased maintenance costs from the contracted sum; or
- Require the lot to be constructed again.

2.6 Pavement Life - Unbound Pavements

Recent research at the Canterbury Accelerated Pavement Testing Indoor Facility suggests that pavement life may be estimated from Falling Weight Deflectometer readings taken at the end of construction and a repeat set of readings taken a year after opening to traffic. The change in central deflection over what is known as the post compaction period (approximately one year) correlates well with pavement performance over a number of pavement materials and sub-grades. This requires a set of FWD readings to be taken at the end of construction and a repeat set a year after opening to traffic. The repeat set should be in approximately the same

location and the same Lots should be used. Care is needed to ensure that the tests are undertaken at the same moisture condition.

Compliance will be achieved if the calculated life meets the following requirement:

$$\text{Design Traffic Life (ESAs)} < 5,000,000 e^{(-0.023 * \Delta d_0)}$$

Where:

$$\Delta d_0 = \text{mean } (\delta d_0) - 1.65 \times \text{standard deviation } (\delta d_0)$$

$$\delta d_0 = (d_{0yr1} - d_{0yr0}) / d_{0yr0} * 100$$

$$d_{0yr1} = \text{Central Deflection at year 1}$$

$$d_{0yr0} = \text{Central Deflection at year 0}$$

Non-Compliance with Pavement Life

In the event of non-compliance, where the pavement life assumed in the design was not achieved in construction, the Contractor can demonstrate compliance by meeting the following rutting alternative.

The maximum rut depth at any point in the wheel paths measured by a wedge under a 2m straight edge, placed at right angles to the centreline, shall be less than 10mm. The rut depth measurements shall be made at 20m intervals in both wheel paths and at any intervening points that may exceed the given requirement.

In the event that compliance can be shown by the rutting alternative, the defects liability period will be extended one year and the pavement re-examined. The Lot will be deemed fully compliant on pavement life if the average rate of rutting from year 1 to year 2 predicts a rutting rate less than 20mm as defined by the formula below.

$$(R2 - R1) \times DL + R1 < 20$$

Where:

R1 = Average rut depth for the lot at the end of year 1

R2 = Average rut depth for the lot at the end of year 2

DL = Design Life in years
