

UK Pavement Management System



TTS Treatment Rules

A Summary of TTS Treatment Rules in UKPMS

UKPMS Document No 112

February 2007



Document Information

Title (Sub Title)	TTS Treatment Rules A summary of TTS Treatment Rules in UKPMS
Product Number	112
Author	Ro Cartwright
Description	This document summarises the treatment rules for TTS data in UKPMS for Rule Set RP6.02 onwards.

Document History

Version No	Status	Author	Date	Changes from Previous Version
1.01	Draft	RAC	01/02/07	1 st draft
1.02	Issue	RAC	02/02/07	Status set to 'Issue'

UKPMS Support Office
Chris Britton Consultancy
#4 Howard Buildings
69 - 71 Burpham Lane
Guildford
Surrey
GU4 7NB

www.ukpms.com

Email: support@ukpms.com
Phone: +44 (0)1483 405027
Fax: +44 (0)1483 452264



Introduction

This paper summarises the treatment rules for TTS data initially introduced via the interim Rule Set RP6.02 and then subsequently incorporated into the formal Rule Set RP7.01.

Throughout this document the term 'TTS' is used to indicate that the treatment rules are confined to the range of measured parameters collected by TTS and were based on an analysis of treatments for the principal road network. The measured parameters considered were therefore:

- Rutting (nearside & offside)
- Whole carriageway cracking intensity
- Wheel track cracking intensity (nearside & offside)
- Texture (nearside)
- Longitudinal Profile Variance (3m, 10m and 30m)

These measured parameters have also been collected as part of the SCANNER surveys from April 2005 onwards, and so the treatment rules developed will be used until superseded by further revised rules to encompass the additional measured parameters available from a SCANNER survey. Likewise, although originally developed for principal roads, the rules are applied to all parts of the network, but once an understanding has built up to differentiate treatments on different parts of the network this can be reflected in revised treatment rules.

Background

The treatment rules are based on work carried out in March 2006 in conjunction with a panel of engineers, and ratified by the UKPMS Steering Group, which led to changes to how indicative treatments are calculated from TTS data.

The aims of the changes were to rebalance the treatment rules to generate the right treatment proportions and to assign the right treatment to the right location. This resulted in changes to the rules triggering strengthen and resurfacing treatments but no change to rule for surface improvement treatment.

The work built on feedback received on the previous¹ approach to the treatment rules. The key points from this feedback were:

- Concerns about the measured values used to trigger a Strengthen treatment
- Concerns that the proportion of Resurface treatment suggested was much lower than engineering experience would suggest
- Concerns about the lack of agreement between parts of the network suggested for treatment by UKPMS and the parts of the network triggering the BV96 thresholds.

¹ RP6.01 and earlier



TTS Treatment Rules

First the general principles are listed, and these are then followed by the specific rules for each treatment.

General Principles

Treatment Groups

Three main treatment groups are used:

- Strengthen
- Resurface
- Surface improvement

The treatment rules below focus on each of these three treatments in turn. It is recognised that the interpretation of precisely what each treatment entails depends on many factors including the type of authority and more detailed information about the individual site. The intention is to try to obtain treatment rules which are broadly correct for a general case.

The treatment length is first tested against the rule for a strengthen treatment. Only if it does not meet the criteria for this treatment is it tested against the rule for a resurface treatment. Finally if the requirements for neither strengthen nor resurface are met, the treatment length is tested against the surface improvement rule.

Harmonisation of treatments with RCI and BVPIs

Harmonisation of treatments with the Road Condition Indicator and BVPIs is important (and both should reflect engineering judgement). Ideally 'red' parts of the network should always generate a treatment, 'amber' parts should generally generate a treatment (but with an acceptance that lower ambers may not), and 'green' parts should not generate a treatment.

The Road Condition Indicator is based on subsections of around 10m in length. While the treatments produced by UKPMS could be obtained on a subsection basis, the more normal practice is to produce treatments for longer lengths (either fixed 100m lengths or variable lengths of uniform condition). The thresholds used for the treatment rules are based on longer treatment lengths rather than on subsection treatments. This is in keeping with the Highway Agency thresholds which were developed for 100m average values.

Note that while this is the most appropriate way to obtain treatments which are useful from an engineering perspective, this underlying difference between UKPMS treatment selection and the Road Condition Indicator calculation (and hence the BVPIs) will lead to some lengths not requiring treatment despite having some 'amber' or 'red' subsections, and conversely some lengths requiring treatment despite having some 'green' subsections. It is not possible to obtain a complete harmonisation between the BVPI and treatments.



Strengthen

The rule is that any of the following combinations trigger a strengthen treatment:

1. Left wheel track rut $\geq 20\text{mm}$ and $3\text{m LPV} \geq 10\text{mm}^2$
2. Right wheel track rut $\geq 20\text{mm}$ and $3\text{m LPV} \geq 10\text{mm}^2$
3. Left wheel track rut $\geq 20\text{mm}$ and whole CW cracking intensity $\geq 4\%$
4. Right wheel track rut $\geq 20\text{mm}$ and whole CW cracking intensity $\geq 4\%$
5. Left wheel track rut $\geq 20\text{mm}$ and left WT cracking intensity $\geq 4\%$
6. Right wheel track rut $\geq 20\text{mm}$ and right WT cracking intensity $\geq 4\%$
7. $3\text{m LPV} \geq 10\text{mm}^2$ and whole CW cracking intensity $\geq 4\%$
8. $3\text{m LPV} \geq 10\text{mm}^2$ and left WT cracking intensity $\geq 4\%$
9. $3\text{m LPV} \geq 10\text{mm}^2$ and right WT cracking intensity $\geq 4\%$

Notes:

- An alternative way of expressing this is that strengthening requires any two of rutting, 3m LPV and cracking/WT cracking to be present at sufficient levels in the same subsection.
- The combination of rutting with WT cracking must be in same wheel track.
- The threshold of 20mm for rutting is the Category 4 level used by the Highway Agency (IAN 42/02 and 42/05) and corresponds to that used by Scotland for the red threshold.
- The levels required for 3m LPV are tied to the Category 4 level of the Highway Agency IAN 42/02 for urban dual carriageways and rural single carriageways. This is also the same as the red threshold used by Scotland for A and B roads. The more recent Highway Agency IAN 42/05 provides new thresholds for an 'enhanced' LPV which is not yet used for TTS/SCANNER surveys.
- The thresholds recommended for cracking (both whole carriageway and wheel track) were based solely on engineering judgement. IAN 42/02 uses a whole carriageway cracking threshold of 2% for bituminous surfaces. However, IAN 42/05 replaces this by guidance levels to separate out low, moderate and high levels of cracking. The guidance level for high levels of cracking is 1.5% for HRA and 0.5% for other bituminous surfaces. No guidance levels are provided for wheel track cracking in either IAN 42/02 or 42/05.

Resurface

The rule is that any of the following combinations trigger a resurfacing treatment:

1. Left wheel track rut $\geq 15\text{mm}$
2. Right wheel track rut $\geq 15\text{mm}$
3. $3\text{m LPV} \geq 10\text{mm}^2$
4. Whole CW cracking intensity $\geq 4\%$
5. Left wheel track rut $\geq 11\text{mm}$ and $3\text{m LPV} \geq 4\text{mm}^2$
6. Right wheel track rut $\geq 11\text{mm}$ and $3\text{m LPV} \geq 4\text{mm}^2$
7. Left wheel track rut $\geq 11\text{mm}$ and whole CW cracking intensity $\geq 1\%$
8. Right wheel track rut $\geq 11\text{mm}$ and whole CW cracking intensity $\geq 1\%$
9. Left wheel track rut $\geq 11\text{mm}$ and left WT cracking intensity $\geq 1\%$
10. Right wheel track rut $\geq 11\text{mm}$ and left WT cracking intensity $\geq 1\%$



11. Left wheel track rut $\geq 11\text{mm}$ and right WT cracking intensity $\geq 1\%$
12. Right wheel track rut $\geq 11\text{mm}$ and right WT cracking intensity $\geq 1\%$
13. 3m LPV $\geq 4\text{mm}^2$ and whole CW cracking intensity $\geq 1\%$
14. 3m LPV $\geq 4\text{mm}^2$ and left WT cracking intensity $\geq 1\%$
15. 3m LPV $\geq 4\text{mm}^2$ and right WT cracking intensity $\geq 1\%$

And a resurfacing/patch wheel track treatment is triggered by:

16. Left WT cracking intensity $\geq 4\%$
17. Right WT cracking intensity $\geq 4\%$

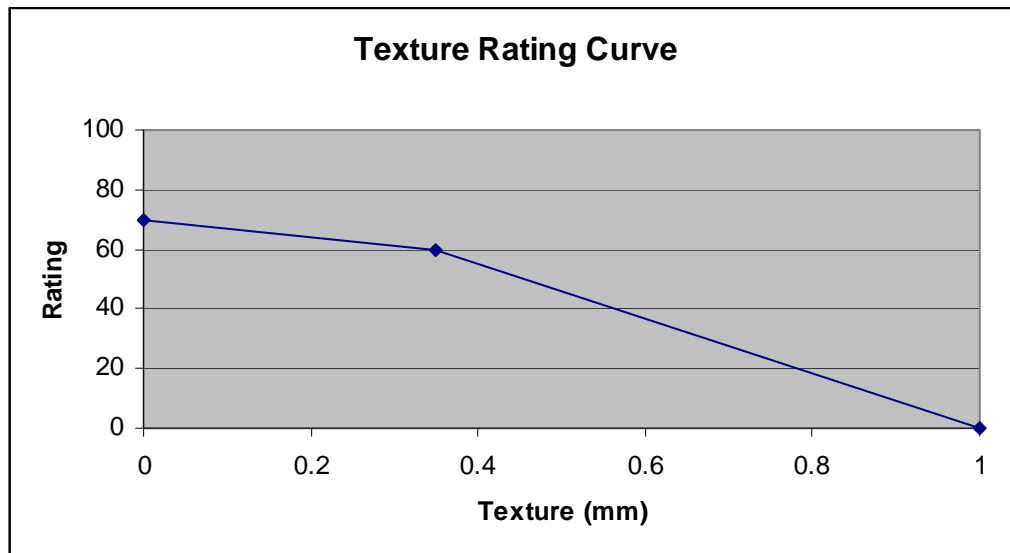
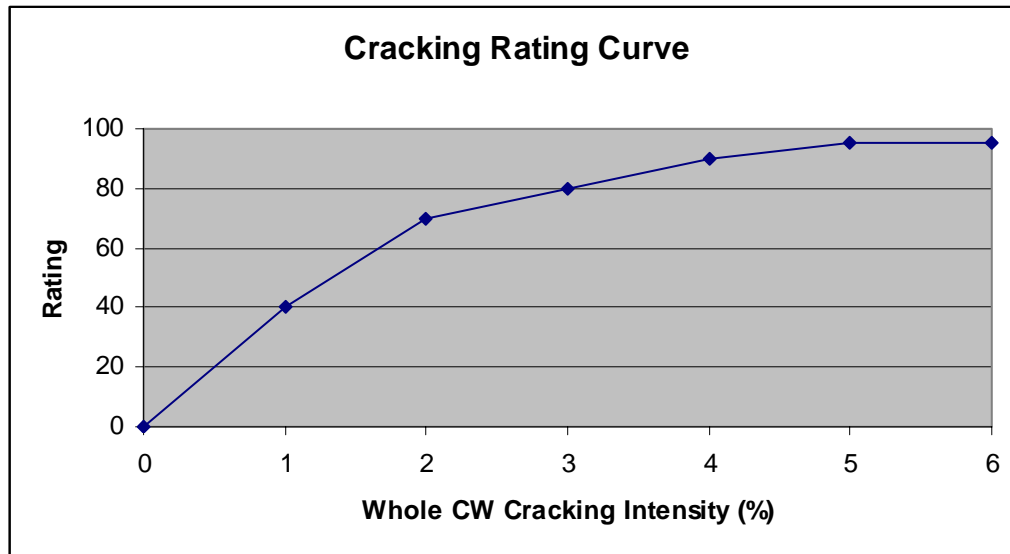
Notes:

- An alternative way of expressing this is that resurfacing requires either:
 - a. Rutting, 3m LPV or cracking to be present at sufficient levels in the same subsection.
 - b. Or, any two of rutting, 3m LPV and cracking/WT cracking to be present at sufficient levels in the same subsection.
- The rules intentionally include combinations of rutting with WT cracking which are not in the same wheel track.
- The threshold of 15mm for rutting in isolation (rules 1 & 2) was based on engineering judgement. The threshold of 11mm for rutting in combination with other measured parameters is the Category 3 level used by the Highway Agency (IAN 42/02 and 42/05) and corresponds to that used by Scotland for the amber threshold.
- The levels required for 3m LPV are tied to the Category 3 level of the Highway Agency IAN 42/02 for urban dual carriageways and rural single carriageways. This is also the same as the amber threshold used by Scotland for A and B roads. The more recent Highway Agency IAN 42/05 provides new thresholds for an 'enhanced' LPV which is not yet used for TTS/SCANNER surveys.
- The thresholds recommended for cracking (both whole carriageway and wheel track) were based primarily on engineering judgement. IAN 42/02 uses a whole carriageway cracking threshold of 0.5% for bituminous surfaces and, in view of the fact that the threshold for strengthening was double the IAN 42/02 Category 4 level, the group decided that for consistency the cracking threshold for resurfacing should be set to double the Category 3 level. Note that IAN 42/05 replaces the Category thresholds by guidance levels to separate out low, moderate and high levels of cracking. The guidance level for moderate levels of cracking is 0.45% for HRA and 0.15% for other bituminous surfaces. No guidance levels are provided for wheel track cracking in either IAN 42/02 or 42/05.

Surface Improvement

The treatment rule for surface improvement is expressed via a condition index for surface improvement: TTSSU. This condition index is calculated from the texture measurement and the whole CW cracking intensity.

First the texture and whole CW cracking intensity are rated using the curves illustrated below:



The rated measurements are then combined to provide the surface improvement condition index.

T⁺ISSU is the highest of:

- Whole CW cracking intensity
- Texture
- $0.55 (\text{Whole CW cracking intensity} + \text{Texture})$

The rule for triggering a surface improvement treatment is:

$$T^+ISSU \geq 50$$

Notes:

- This rule is unchanged from that used in RP6.01 and earlier. Since in due course many of the new SCANNER measured parameters will play a major role in



determining the need for surface improvement, the rule will be reconsidered at that stage.

- The texture measurement used in the above calculation is the SMTD average texture depth (LLTX)
- If the texture measurement is available in both wheel paths (i.e. LLTX & LRTX) or between the wheel paths (LCTX) then the highest of these measurements is used in the condition index calculation given above.