

UK Pavement Management System



SCANNER Road Condition Indicator

Description of Processing aimed at Users

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Document Information

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Document History

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1.01	Draft	RAC/CCS	23/08/05	1 st draft
1.02	Updated	RAC	12/07/06	Updated to reflect the latest version of the RCI guidelines (070v0104)

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Introduction

This document describes the SCANNER Road Condition Indicator (RCI) that has been developed within UKPMS. The primary aim of the RCI is to enable SCANNER data to be processed to produce BVPIs 223 and 224a for 2005/06 onwards. However an important secondary aim is to use this approach to process TTS data collected prior to April 2005. This backwards comparability will allow for some comparisons to be made between the new Condition Indicator results and the old-style TTS BVPI 96. Note that, as explained below, this will only be possible where the older data has been collected using coincident subsections. The main features of the RCI are set out in the following section.

Features of the RCI

Data Selection

Users are able to select data for processing. The intention is that the baseline functionality for data selection is the same as that required for the Automatic Pass. In particular the UKPMS system allows data to be selected based on:

Section criteria

Users are able to select one or more sections to be processed, via either the section label or the section attributes.

Survey criteria

Users are able to select one or more surveys as for the Automatic Pass, and it is suggested that this is by survey number. At this stage the baseline requirement is that only TTS/SCANNER data will be processed to produce a Road Condition Indicator. Although there are no plans to do so, it is possible that the Condition Indicator approach may in due course be used with other types of data too. Developers are advised that in this eventuality there will be a requirement to be able to select surveys by survey type.

Dates

Users are able to specify a 'from' date and a 'to' date, to select data (sections within survey) which have an end date lying on or between these dates.

As for the existing Automatic Pass, of the selected data, only the most recent for each Section/Feature/XSP is used.

Processing

SCANNER data collected for 2006/07 onwards should not contain any data with non-coincident subsections. The UKPMS system should validate the data prior to calculating the SCANNER Road Condition Indicator and produce an appropriate error message if such data is found. In these circumstances the RCI calculation is invalid. This validation may be carried out by the UKPMS system at any point in the process up to the calculation of the RCI, but the preferred option is that the data is validated when it is first loaded, and that if non-coincident subsection data is found the entire file is rejected.



It is recognised that data already loaded (2004/05 and 2005/06) may contain data with non-coincident subsections. Developers will have made ad-hoc arrangements for dealing with this data for the 2005/06 BVPI, and such arrangements should continue if this data is processed in the future. The two most likely courses of action open to Developers are:

- a. Continue to check the data prior to the RCI calculation and report an error if any of the data to be used by the RCI lies on non-coincident subsections. If such data is found then the RCI calculation is invalid.
- b. 'Correct' the historical data so that the database contains no data lying on non-coincident subsections.

Note that the validation described above is important to ensure that the Road Condition Indicator is the same whether the algorithm is built into the Automatic Pass or handled separately. Provided all defects use the same subsections the Automatic Pass chopping logic will have no impact on the results.

The calculation of the Road Condition Indicator is via three main processing steps:

1. Weight the SCANNER values

At this stage each SCANNER value is given a score in the range 0 to 100. The scores are obtained from weighting curves for each defect and these weighting curves have the following characteristics:

- The score is 0 for any value better than a threshold
- The score is 100 for any value worse than another threshold
- The score for values between these two extreme thresholds varies in a non-linear way. This function is expressed as a series of (X,Y) coordinates and uses linear interpolation (as for the current Method1 defect rating).
- The weighting curves for each defect may vary by the following section attributes:
 - i. Road hierarchy
 - ii. Speed limit
 - iii. Urban or rural
 - iv. Road type
 - v. DoT classificationThe code 'Any' is used for an attribute which can take any value

- The score is multiplied by additional factors (of between 0 and 1) to represent the reliability of the measurement and the relative importance of the defect. These factors also depend on the following section attributes:
 - i. Road hierarchy
 - ii. Speed limit
 - iii. Urban or rural
 - iv. Road type
 - v. DoT classificationAgain, 'Any' is used to indicate that any value is acceptable for that attribute.

2. Combine weighted values for the subsection

At this stage a value will be obtained for each subsection using the following process:

- Assign the defects to families, and for each family take the highest scoring defect as the family value. Note that each defect belongs to only one family.



- Combine the family values to obtain a subsection value. The way in which the family values are combined will be specified for the weighting set and currently is one of the following:
 - i. Sum
 - ii. Maximum
 - iii. Average
 - iv. Weighted average

3. Produce summary results

The final stage is to provide summary results for the following groups of subsections:

- Whole network
- Splits using any combination of the following attributes:
 - Road hierarchy
 - Speed limit
 - Urban or rural
 - Road type
 - DoT classification
- Individual sections (i.e. section label split)

Developers are encouraged to extend this list to include geographical attributes which allow users to group by area, district etc.

Note that these groupings are all based on section attributes. Although there is no immediate requirement for non-section based groupings (e.g. pavement type) such groupings may be required in the future.

There are two different approaches to calculating the summary results, and the one to be used is determined by a setting in the weighting set:

- The first approach (known as the Bin approach) divides the subsections into bins and reports the length of subsections in each bin as a percentage of the total length of subsections in that group. The number of bins and the thresholds between the bins will be parameter-driven.
- The second approach (the Probability approach) calculates the summary result using a proportion of the subsection length. Typically, this notional length is based on the length of all the subsections above an upper threshold plus a proportion of those between the upper and lower thresholds; the proportion will be based on a linear function which interpolates between the lower threshold and the upper threshold. Each subsection between the thresholds will therefore contribute according to whereabouts it lies within the range.

Weighting Sets

The processing described above will be controlled by parameters known as Weighting Sets. The main principles of the Weighting Sets are as follows:

- There is a need to store and use several weighting sets. Some of these are current 'standard' weightings used for national results. Others may be old sets, used to help process new data using old weightings and hence compare new and old results. And



others will be local sets which users have set up and customised to suit their own requirements.

- Users will be able to view and report the weighting set values.
- Users are able to select a weighting set for a particular run of the Road Condition Indicator.
- Each weighting set is designated as either 'Master' or 'Local'. Master weighting sets can be added or deleted but cannot be edited. Local weighting sets can be added, deleted or edited. Any weighting set may be copied to produce a new weighting set, which will always be a 'Local' set.
- There are integrity considerations for processed data when a weighting set is deleted or edited and it is suggested that a weighting set cannot be edited or deleted if there is any processed data associated with it.
- We expect that there may be a need to be able to load new Master weighting sets frequently, and quickly. To achieve this, the Master weighting sets will be available via the UKPMS web site and downloaded by users when required (but not necessarily automatically). The UKPMS system will be required to include an Import function to load a weighting set. We do not expect loading and using a new weighting set to require Developer involvement.
- Weighting Sets are published in MS Access, CSV and Excel format.
- The Weighting Set version control is separate from the Rule Set version control, but there is a control table linking the two. This specifies which Rule Sets are compatible with each Weighting Set. This control table is separate from both the Rule Sets and the Weighting Sets, so that it can be updated whenever a new Weighting Set is made available, or whenever a new Rule Set is made available. Local Weighting Sets will always be based logically on an 'ancestor' Master Weighting Set, and will use that for Rule Set compatibility.

The initial Weighting Sets for use in the production of the BVPIs were produced under the auspices of the Defects Index Working Group, made up of members of the UKPMS Steering Group and the SCANNER Implementation Advisory Group.

Reporting

One of the main requirements of the SCANNER Road Condition Indicator is to produce BVPIs 223 and 224a and the requirements for these are given in UKPMS Technical Note 36 (for BV223 2005/06) and Technical Note 37 (BV224a 2005/06).