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# UK Pavement Management System



## Technical Note 45

NI169 (2008/09) guidance notes for UKPMS Developers

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## Document Information

<i>Title (Sub Title)</i>	Technical Note 45 NI169 (2008/09) guidance notes for UKPMS Developers
<i>Authors</i>	Ro Cartwright
<i>Description</i>	This Technical Note provides guidance for UKPMS Developers to allow them to produce NI169 for 2008/09.

## Document History

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1.01	Draft	RAC	28/10/2008	1 <sup>st</sup> draft
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UKPMS Support Office  
TRL Ltd  
Crowthorne House  
Nine Mile Ride  
Wokingham  
Berkshire  
RG40 3GA

[www.ukpms.com](http://www.ukpms.com)

Email: [ukpms@trl.co.uk](mailto:ukpms@trl.co.uk)  
Phone: +44 (0)1344 770480

## Introduction

DfT National Indicators include NI169 to measure the Condition of Non-Principal Roads.

This technical document should be read in conjunction with the DfT advice document *Guidance for reporting NI168 and NI169 in 2009*<sup>1</sup>. The DfT document provides the NI guidance oriented towards local authorities, while this Technical Note is oriented towards developers/suppliers of UKPMS accredited systems.

This Technical Note provides guidance on the production of NI169 and consists of two parts:

Part 1 provides more detailed guidance on the calculation of NI169 and is aimed primarily at UKPMS system suppliers.

Part 2 summarises the requirements for all UKPMS-based National Indicators for 2008/09.

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<sup>1</sup>

## Part 1 - Calculation of the Indicator

Processing of the outputs from SCANNER to produce NI169 results will be undertaken using a UKPMS pavement management system accredited to produce NI169 for 2008/09, using Version RP8.01 of the UKPMS Rules and Parameters and version WSBCv02nn<sup>2</sup> of the Weighting Set.

The data from SCANNER surveys is supplied to UKPMS in HMDIF format as given in the SCANNER HMDIF Specification (available from the UKPMS website, [www.ukpms.com](http://www.ukpms.com)). This document also provides a full list of the current UKPMS defects collected by SCANNER surveys.

The National Indicator is based on the SCANNER Road Condition Indicator which calculates overall 'points' for each 10m sub-section based on a combination of the following UKPMS defects:

- Nearside Texture Depth
- Nearside Rut Depth
- Offside Rut Depth
- 3m Longitudinal Profile Variance
- 10m Longitudinal Profile Variance
- Whole Carriageway Cracking Intensity

10m sub-sections are characterised according to their overall points score as:

Red	Plan maintenance soon
Amber	Plan investigation soon
Green	Generally good condition

NI169 is calculated as the length of the network with a combined point score exceeding the 'Red' threshold divided by the surveyed length (i.e. the length where data has been recorded) expressed as a percentage. The figures for the B roads and C roads are calculated separately, and then combined to give NI169.

The surveyed length is taken to be that part of the network where data has actually been recorded. For the B roads since the requirement is for survey data in both directions, the percentage surveyed is based on the lane length, whereas for C roads, which are surveyed in one direction, the percentage surveyed is based on the network length.

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<sup>2</sup> The Weighting Set works in conjunction with the Rule Set and contains additional information required for the SCANNER Road Condition Indicator, which is used for NI169. For NI169 the Weighting Set is WSBCv02nn (the UKPMS website will provide guidance on the latest nn to be used and make the file available for downloading).

The following information should also be provided to support the NI:

UKPMS System & Version	
Version of Rules & Parameters Used	
Version of Weighting Set Used	
Copy of Valid SCANNER Accreditation Certificate	
Reasons for reduced survey coverage (if applicable)	
Other Comments	

The UKPMS System and Version must be checked against the 2008 Annual Health Check results on the UKPMS website to ensure that the version of the UKPMS system being used to produce the results is accredited to produce valid results for NI169 for 2008/09.

Technical Detail not included above

## Introduction

This note is intended for both System Developers and Users, and it should be borne in mind that some parts may not apply to all readers. A schedule showing the required content for reporting of NI169 (the “NI Report”) is attached. This standard report has been accepted by DfT if produced as output from a system that has successfully undergone Tranche 3 UKPMS testing and subsequent Annual Health Check testing of NI169 for 2008/09, and that has been configured to use version 8.01 of the UKPMS Rules and Parameters (updated as per the development schedule) and the latest version of the Weighting Set WSBCv02 (which is updated and published via the UKPMS website).

## The NI Report

The NI169 report is produced by the SCANNER Road Condition Indicator for defect lengths as part of a UKPMS automatic pass. A subsection will trip the ‘red’ threshold (which is the only threshold reported by NI169) if the sum of the values of the contributing defects is  $\geq 100$ . NI169 is therefore the percentage length where the SCANNER Road Condition Indicator has a value of  $\geq 100$ .

Tables detailing thresholds and weightings for defects and their contribution to the overall Road Condition Indicator are published separately by DfT.

For 2008/09 authorities are required to calculate NI169 using the Revised Weighting Set (WSBCv02m<sup>3</sup>). This Weighting Set was also used in 2007/08 but prior to this the Original Weighting Set (WSBCv01m<sup>4</sup>) was used. However, the Original Weighting Set is still available and can be used to calculate a comparison figure to provide continuity with results from 2006/07 and earlier. Continuity can also be established by processing data for previous years using the Revised Weighting Set.

Note that the weighting factors used for NI169 apply different weightings to urban roads and rural roads. It is important to ensure that all roads surveyed by SCANNER for NI169 have been accurately designated as either Urban or Rural. Any section not defined as Urban or Rural will be processed using the weightings for rural roads and this may lead to an inaccurate NI figure.

## Confidence Limits

The NI169 report can provide 95% confidence limits on the NI value, if required. The following three values are required in order to calculate the 95% confidence limits:

- Maximum bias
- Minimum bias
- Random error

Once available these three values will be published by the DfT and entered interactively. If the values are not available then the report will produce ‘N/A’ for the confidence limits.

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<sup>3</sup> Previously known as WS224av02m

<sup>4</sup> Previously known as WS224av01m

## Content of the Report

### Notes:

1. Other than that the report should be presented in the three parts given below, the following is not intended to give guidance on the layout or format of the report merely to show what content should be included and how that content should be derived.
2. If the data is not provided on coincident subsections then the SCANNER RCI is not valid and it is not possible to produce the NI. [The RCI calculation is based on the premise that all data for a section within a particular survey is provided using the same subsection breakdown. So suppose Survey 123 on Section A345 using subsections 0-7, 7-17, 17-27 etc for rutting data (say). All other measured parameters for that survey on that section must use the same subsections. In the past there have been problems due to cracking data using a different set of subsections from the other measured parameters.]

### Part 1 – Run Details & Data Selected

This part of the report contains the details and identifiers for the run.

<i>Ref</i>	<i>Description</i>	<i>Example</i>
1.1	Authority	Oldshire CC
1.2	UKPMS System	Bloggs PMS
1.3	UKPMS System Version	2.45
1.4	Run Identifier	ABC01
1.5	Run Date	05/04/2009
1.6	Weighting Set Identifier	WSBCv0201
1.7	Rule Set Identifier	RP8.01
1.8	From Date	01/04/2007
1.9	To Date	31/03/2009
1.10	Combination method	Sum
1.11	Threshold type	Bin

Note that for those Developers who choose to implement the RCI as a type of Automatic Pass, the Run Identifier is simply the Automatic Pass identifier.

This is then followed by the criteria used to select the sections and surveys used in the run. For NI169, all sections with a DfT Classification Code of 4 or 5 should be selected. In addition it may be necessary for an authority to specify particular surveys if multiple SCANNER surveys have been carried out within the date range for NI169 and not all of these were intended for NI169. The report must give the type of criteria (e.g. survey number, or a specified section attribute) and the values included for that attribute.

<i>Ref</i>	<i>Description</i>	<i>Example</i>
1.12	Criteria Type	DfT Classification Code
1.13	Criteria Value	4

Note that currently the Road Condition Indicator algorithm and weighting sets only apply to SCANNER data. If, in the future, they are extended to other survey types then there will be a requirement to select the 'TTS' survey type for NI169.

The values used to derive the confidence limits are given next. If these have not been entered then 'N/A' should be displayed instead.

<i>Ref</i>	<i>Symbol</i>	<i>Description</i>	<i>Example</i>
1.14	$\epsilon_{\min}$	Minimum bias (m)	-0.0834
1.15	$\epsilon_{\max}$	Maximum bias (m)	0.1043
1.16	s	Random error (m)	6.2311

### *Part 2 – Surveyed Network*

This part of the report gives the possible survey lane length together with the length which has actually been surveyed. Separate figures should be provided for the B Class roads (DfT Classification 4) and the C Class roads (DfT Classification 5). This is achieved in the Road Condition Indicator algorithm by splitting the selected network by DfT Classification. NI169 is calculated from all the B and C road network surveyed during 1<sup>st</sup> April 2007 to 31<sup>st</sup> March 2009.

<i>Ref</i>	<i>Symbol</i>	<i>Description</i>	<i>Example</i>
2.1		Selected network sections	218
2.2		Selected network length	165.438
2.3		Possible survey lane length	321.445
2.4		Actual survey lane length	316.650
2.5		Percentage of possible survey lane length surveyed in survey period	98.5%
2.6	N	Number of subsections surveyed	31697

The selected network sections figure is the number of sections in the selected network (i.e. with DfT classification 4 or with DfT classification 5).

The selected network length is the sum of the Section Length Number for the selected network.

The possible survey lane length is calculated as:

$\Sigma(\text{Section Length Number multiplied by Nearside Multiplier for the section Road Type}),$   
for the selected network.

The actual survey lane length is the sum of all subsection lengths with eligible data. (The definition of 'eligible' here is that the data satisfies the date criteria, plus any survey and section criteria).

The percentage (Ref 2.5) is calculated as actual survey lane length (Ref 2.4) divided by possible survey lane length (Ref 2.3) expressed as a percentage. For B roads this indicates if the authority has achieved the coverage requirements (as B roads are surveyed in both directions).

The number of subsections surveyed (Ref 2.6) is the number of subsections with eligible data.

The selected network length, possible survey lane length and actual survey lane length are given in km to 3dp, and the percentage is expressed to 1dp.

In addition to providing the above statistics a breakdown of the network on the basis of Rural/Urban/Undefined is also required for B Class roads and for C Class roads (separately).

<i>Ref</i>	<i>Description</i>	<i>Example</i>
2.7	Rural surveyed network	230.346
2.8	Urban surveyed network	118.143
2.9	Undefined surveyed network	1.640
2.10	Total surveyed network percentage	82.0%

The rural surveyed network is the sum of all rural subsection lengths with eligible data; similarly the urban surveyed network is the sum of the urban subsection lengths with eligible data. The undefined network length is the sum of all those subsections with eligible data but which are neither urban nor rural. Together the rural, urban and undefined figures should add to give the actual survey lane length (Ref 2.4).

The total surveyed network percentage is the actual survey lane length (Ref 2.4) expressed as a percentage of the selected network length (Ref 2.2). For C roads this indicates if the authority has achieved the survey requirements (as C roads are surveyed in one direction only). As B roads are surveyed in both directions this figure is normally greater than 100% for B roads.

The rural, urban and undefined surveyed networks are given in km to 3dp, and the percentage is expressed to 1dp.

### *Part 3 – NI Results*

This part of the report contains the NI169 result.

Since the NI169 weighting set uses a Bin type threshold, the length and percentage in each bin is given. This information is required for B roads and for C roads (separately).

<i>Ref</i>	<i>Description</i>	<i>Example</i>
3.1	Bin description	Red
3.2	Bin threshold	$\geq 100$
3.3	Length (km) in bin	15.516
3.4	Percentage in bin	4.9%

Note that the sum of the length in all bins should total to give the actual survey lane length (Ref 2.4) for that DfT Classification, and the sum of the percentages should be 100% (subject to rounding errors).

The length in the bin is required in km to 3dp, and the percentage in the bin is expressed to 1dp.

The final figures in the report give the NI169 figure and the confidence limits; this part of the report gives a combined figure including both the B and C roads in a single result.

<i>Ref</i>	<i>Description</i>	<i>Example</i>
3.5	NI169	10%
3.6	Lower 95% confidence limit	8.2%
3.7	Upper 95% confidence limit	11.4%

NI169 is obtained by taking a weighted average of the Red bin B Class and C Class figures, using the carriageway length (Ref 2.2) to provide the weighting.

For example suppose the statistics are as shown in the table below:

<i>DfT Class</i>	<i>Carriageway length</i>	<i>Surveyed lane length</i>	<i>NI length</i>
4	100km	95km	5km (=5.3%)
5	800km	80km	20km (=25%)

The NI169 figure is calculated as:

$$((5.3\% \times 100) + (25\% \times 800)) / (100 + 800) = 23\%$$

Using the reference notation this is:

$$((3.3_B \times 2.2_B / 2.4_B) + (3.3_C \times 2.2_C / 2.4_C)) / (2.2_B + 2.2_C)$$

NI169 is expressed to the nearest whole percentage.

The lower 95% confidence limit (Ref 3.6) is calculated using the minimum bias (Ref 1.14), the random error (Ref 1.16) and the number of subsections surveyed (Ref 2.6). The minimum length in the Red bin is the length in bin (Ref 3.3) plus:

$$\frac{N}{1000} \left( \varepsilon_{\min} - \frac{1.96s}{\sqrt{N}} \right) \quad \text{Note that } \varepsilon_{\min} \text{ is usually a negative number.}$$

This is calculated for B roads to give a lower limit for 3.3<sub>B</sub> and for C roads to give a lower limit for 3.3<sub>C</sub>. These new, lower numbers for Ref 3.3 are then used in the above weighting formula to give the lower 95% confidence limit for NI169.

The upper 95% confidence limit (Ref 3.7) is calculated using the maximum bias (Ref 1.15), the random error (Ref 1.16) and the number of subsections surveyed (Ref 2.6). The maximum length in the Red bin is the length in bin (Ref 3.3) plus:

$$\frac{N}{1000} \left( \varepsilon_{\max} + \frac{1.96s}{\sqrt{N}} \right)$$

This is calculated for B roads to give an upper limit for 3.3<sub>B</sub> and for C roads to give an upper limit for 3.3<sub>C</sub>. These new, upper numbers for Ref 3.3 are then used in the above weighting formula to give the upper 95% confidence limit for NI169.

The upper and lower confidence limits should be expressed to 1dp, and if no confidence statistics have been entered then they should be given as 'N/A'.

*Example of NI169 Report*

Run Details & Data Selected

Authority: Oldshire CC  
 UKPMS: Bloggs PMS v2.45  
 Run Identifier: ABC01  
 Run Date: 05/04/2009  
 Weighting Set ID: WSBCv0201  
 Rule Set ID: RP8.01  
 Dates: From 01/04/2007 to 31/03/2009  
 Combination method: Sum  
 Threshold type: Bin

Criteria:

DfT classification 4  
 DfT classification 5

Minimum bias: -0.0834 m  
 Maximum bias: 0.1043 m  
 Random error: 6.2311 m

Surveyed Network

DfT Classification:	4		5	
Selected network sections:	218		526	
Selected network length:	165.438 km		426.838 km	
Possible survey lane length:	321.445 km		846.193 km	
Actual survey lane length:	316.650 km	98.5%	350.129 km	41.4%
Number of subsections:	31697		35260	
Rural surveyed network:	260.123 km		230.346 km	
Urban surveyed network:	55.647 km		118.143 km	
Undefined surveyed network:	0.880 km		1.640 km	
Total surveyed network:	316.650 km	191.4%	350.129 km	82.0%

NI results

Green (<40)	218.488 km	69.0%	173.313 km	49.5%
Amber (>=40)	82.646 km	26.1%	136.545 km	39.0%
Red (>=100)	15.516 km	4.9%	40.271 km	11.5%

NI169 10%

Lower 95% confidence limit: 8.2%  
 Upper 95% confidence limit: 11.4%

## Part 2 UKPMS - National Indicator Summary for 2008/2009

### Carriageways

<i>NI:</i>	NI 168 (SCANNER)	NI 169 (SCANNER)
<i>Road Class:</i>	Principal Including principal motorways	Non-principal classified
<i>DfT class:</i>	3	4 & 5
<i>Amount:</i>	100% both directions (Minimum 90%)	DfT class 4: 100% both directions (Minimum 90%) DfT class 5: 100% one direction (Minimum 80%)
<i>Dates Surveys Carried Out:</i>	2 years 1 Apr 07 to 31 Mar 09	2 years 1 Apr 07 to 31 Mar 09
<i>Survey type:</i>	SCANNER	SCANNER
<i>Rule Set:</i>	RP8.01	RP8.01
<i>Weighting Set:</i>	WSPrinv02nn	WSBCv02nn

The Weighting Set works in conjunction with the Rule Set and contains additional information required for the SCANNER Road Condition Indicator, which is used for the national indicators. The UKPMS website will provide guidance on the latest nn to be used and make the file available for downloading