

Pavement Condition Information Systems Support Contract	
Local authority concerns about SCANNER results PCMG 12/09.	
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Approved by	

## Local authority concerns about SCANNER results (PCMG 12/09)

### Introduction

- 1) A number of local authorities have expressed concerns that the “revised” SCANNER Road Condition Indicator (RCI) used in UKPMS weighting sets WS223v 0202 (BV223) and WS224av 0202 (BV224a) has led to very much reduced BVPI values in 2008 compared with 2007.
- 2) Following Suffolk and West Midlands raising the issue at the CSS/TAG Highway Management Group meeting in August 2008, TRL investigated the results in some detail, and a workshop was held in Birmingham on 30th March 2009 to discuss them. Annex A describes the concerns and the results of investigations so far in more detail.
- 3) The issue was reported and discussed at the CSS/TAG Highway Management Group meeting on 23<sup>rd</sup> April 2009. Annex B is the paper discussed at the meeting.
- 4) This paper identifies the issues for discussion.

### Issues for discussion and decision

How do we ensure that the SCANNER RCI reflects the real need for maintenance treatment, including edge condition (which is an important aspect of the need for maintenance on smaller rural classified roads) and surface deterioration (which is an important aspect of the need for surface treatment on many local roads)?

Are English local authorities comfortable with reporting ONLY the “red” length identified by the revised SCANNER RCI, given that the values are typically much smaller than those that were previously reported using Deflectograph and UKPMS CVI surveys, and using the original SCANNER RCI? (Figure 4 shows that most English local authorities fall in a band between 1% and 12%).

Or do they wish to consider adopting the SCOTS approach of reporting BOTH the “red” and the “amber” lengths?

## Reporting carriageway condition performance indicators

- 5) The revised SCANNER RCI eliminates “double counting” between the two measures of ride quality, to meet concerns from many urban local authorities that lengths of road in good condition were being misrepresented as “red” simply because of side road junctions. It does not include SCANNER wheel track crack intensity, because this proved to be a subset of whole carriageway crack intensity, and was therefore also “double counting” cracking in some places.
- 6) Consequently the revised RCI generally does identify less carriageway as being in the “red” condition than the original RCI. A paper by Stephen Child and Gordon Prangnell in Surveyor magazine in October 2007 explained this in some detail.
- 7) However West Midlands authorities are concerned that their road networks are being reported as being in much better condition than they believe is true. Apart from questions of data quality (which are being investigated separately) this raises two issues:
  - a) Does the current SCANNER RCI reflect all the main aspects of carriageway condition that drive the need for maintenance?
  - b) Does reporting only the “red” length (the length likely to be in need of maintenance soon) adequately reflect the condition of local road networks, or should the “amber” length also be reported (the length likely to be in need of investigation soon) also be reported?
- 8) The original TTS scoping study report identified the need for three stages in developing a “defects index”. The first stage was carried out, leading to the original SCANNER RCI, based on a limited sample of principal roads. The second stage was also carried, leading to the revised SCANNER RCI, based on a much larger sample of A, B, C and some unclassified roads. However the third stage, to incorporate the new SCANNER parameters, has not been carried out.
- 9) There is therefore a need to commission a third stage of investigation and development, to incorporate the new parameters (edge condition, surface deterioration, and improved methods of reporting ride quality and rut depth) which would lead to an “extended” SCANNER RCI, able to identify more of the aspects of road condition that drive the need for maintenance. This would, of itself, lead to a greater length of the network being identified as being in need of investigation or treatment.
- 10) However, there is a separate question about whether it is better to report only the “red” length (as in England) or the “red and the “amber” length (as in Scotland) and this could also be investigated as part of the development of the “extended” SCANNER RCI.

Andrew Gallagher

29<sup>th</sup> May 2009

## Annex A

# Local Authority concerns about SCANNER results

## Introduction

- 1) Local authority representatives raised concerns about BVPI results based on SCANNER surveys reported using the “revised” SCANNER Road Condition Indicator (RCI) weighting sets at the CSS / TAG Highway Management Group meeting on 28<sup>th</sup> August 2008.

## Suffolk

“Impact of Rules and Parameters Changes for 2007/8 Scanner based BVPI Results

“New rules and parameters were introduced for 2007/8. These were widely expected to result in lower figures for BVPI based indicators when applied to like data. Some authorities have seen very large reductions in values e.g. from 12% down to 2%.

“In Suffolk, the figure for A roads has shown only a marginal improvement (0.3%), and the Band C road figure apparently got worse from 11% to 13%. However this proved to be driven almost entirely by the contribution from the C Class roads. It is worth noting that the new rules and parameters give much greater weighting to rutting (max 100 out of 270 compared to 90 out of 370).

“A sample of the sites shown in the red band were inspected on site. Several were red by virtue of rutting, but none was observed. All of these were 4m width or less and it appears to be widely accepted, but not documented formally, that Scanner surveys on roads of this width can give rise to false rutting due to edge and verge influences. Excluding roads of this width gives a more credible result (overall BV224a) down from 11% to 9%, but this is still a small drop compared to many authorities. We are still examining results to see if there is any false rutting on roads in the 4m to 5m band.

“Given the wide difference between authorities in the effect of the new rule set, it would be interesting to know whether there is any logic or correlation with factors such as:

- Rurality ( C roads likely to be narrower and more rustic in profile)
- Perception of what the main problems are (networks with lots of cracking but little rutting may see the big reductions in BVPI outputs).
- Survey data provider
- UKPMS software provider

“Any emerging correlation with either of the last two would clearly be a cause for concern!”

## West Midlands

“There has been a significant drop in BVPI 223 and 224a results this year across the West Midlands as shown on the enclosed table but we have not carried out work to justify the drop. e.g. here at Solihull, BVPI 223 in 2006/7 was 12% and in 2007 /8 it is 2%. The work we have carried out only accounts for a drop of 1-2% and of course the condition of others, not picked up in 2006 /7, will have deteriorated.

As I understand, the rules for calculating the indicators have been adjusted from 2006 /7 to 2007 /8 and some West Midlands' Authorities have calculated the BVPI's with both sets of rules. This gives significantly differing figures using the 2 sets.

We appreciate that Scanner is being refined but our concern is that, at present, it is making our roads look a lot better than they probably are in reality and this could have an effect on funding. Could we add this to Item 9 please for discussion - I am happy for the table to be shared.”

Authority	2006/7 Results BVPI223	BVPI 223 2007/08 Data		2006/7 Results BVPI224a	BVPI224a 2007/08 Data	
		2006/7 Rules	2007/8 Rules		2006/7 Rules	2007/8 Rules
Birmingham	15.00%	10%	5.00%	14.00%	13%	5.00%
Coventry	9.00%			21.00%		
Dudley	16.00%		8.00%	17.00%		5.00%
Sandwell	10.00%		5.00%	15.00%		4.00%
Solihull	12.00%	4%	2.00%	13.00%	7%	3.00%
Walsall	11.00%		4.00%	12.00%		5.00%
Wolverhampton	10.00%	6%	2.00%	9.00%	6%	2.00%

Table 1 West Midlands authorities' BVPI results

## TRL investigations and findings

### Suffolk

- 2) The issues raised by Suffolk were referred to TRL to be investigated as part of the SCANNER accreditation, QA and audit contract. Working with Suffolk and the SCANNER survey contractor (in this case Jacobs) TRL identified two issues which have been rectified:
  - The algorithm for identifying rut depths from the transverse profile did not include a “cut off” on the offside (right) to eliminate any effects due to the edge of carriageway. (The algorithm does include a method of checking for features such as kerbs or verges on the nearside). Consequently, on some narrower roads, typically parts of the rural C-road network, the survey was reporting a rut depth which

was due to an offside edge feature. Jacobs have modified the algorithm to correct this, leading to less “false positive” errors of offside rut depth measurement.

- There was a difference between the lengths of “red” reported using different UKPMS systems. This was traced to a specific coding error in the Confirm system which, in some cases, counted a score of exactly 100 as “red” and in other cases as “amber”, when it should be “red”. Pitney Bowes has corrected this and written to inform all their customers of the potential error, and how to rectify it.
- 3) However the third issue, the difference between the results from using the “original” SCANNER RCI parameters, thresholds and weightings (which were specified for use in reporting BVPI in 2006 and 2007) and the “revised” SCANNER RCI parameters, thresholds and weightings (which were specified for use in reporting BVPI in 2008 and will be used to report NI in 2009) was anticipated and the implications are explored in more detail below.

#### West Midlands

- 4) The issues raised by the West Midlands were referred to TRL to be investigated as part of the SCANNER accreditation, QA and audit contract.
- 5) Whilst changes due to using the “revised” SCANNER RCI (the “2007/08 rules”), compared with the “original” SCANNER RCI (the “2006/07 rules”) were expected, the changes in the values calculated using the original SCANNER RCI (the 2006/07 rules) from the 2007/08 data compared with the 2006/07 data were not. Therefore TRL asked the West Midlands authorities to provide the relevant survey data from their principal road networks, so that changes in the reported values could be investigated in detail. In the event the investigation focussed on data from Solihull and Birmingham, which were the only authorities ready, willing and able to provide the information. The investigation concentrated on the principal (A) road network to reduce the quantity of data to be analysed.
- 6) In principle, only half of the principal road network is surveyed in each survey year. Therefore, to calculate the BVPI reported in 2007 (the 2006/07 results), data from 2005/6 and 2006/7 are used, whereas the same data from 2006/7 and new data from 2007/8 are used to calculate the BVPI reported in 2008 (the 2007/8 results). Therefore, any changes seen in the BVPI between 2006/7 and 2007/8 would be due to differences between the data collected in 2005/6 and in 2007/8.
- 7) Thus to undertake this investigation, SCANNER parameter values (those used to calculate the RCI) were obtained for each 10m length of both the Solihull and Birmingham networks for the surveys undertaken in 2005/6 and 2007/8, providing a dataset covering the same lengths of the (half) network for each year.
- 8) TRL carried out a detailed analysis, looking at the effect of each of the individual parameters that contribute to the RCI, and the effect of changes in the individual parameter values between the two years. This analysis was carried out on the data set as a whole, comparing the distribution of values, rather than comparing the values length by length along the roads.

### Solihull

- 9) The difference in the BVPI mainly arises from the difference in the measurement of cracking between the survey years. The whole carriageway cracking measured in 2005/6 was, on average 0.56% higher than it was in 2007/8. Given that the lower threshold for whole carriageway cracking is 0.15%, this implies that the 2005/6 measurement of cracking intensity was more frequently contributing to the RCI on this network, whereas the 2007/8 measurement of cracking would contribute much less frequently.

### Birmingham

- 10) The difference in the BVPI appeared to be mainly due to the difference in the measurements of both cracking and ride quality (LPV) between the two years. In particular the overall intensity of wheel track cracking was 1% higher in 2005/6 than in 2007/8. Given that the lower threshold for wheel track cracking was 0.5%, this implies that the 2005/6 measurements of wheel track cracking were contributing to the RCI on this network, whereas the 2007/8 measurements would contribute much less. Similarly, 10m LPV measured in 2005/6 was, on average, 15.22mm<sup>2</sup> higher than it was in 2007/8. This was mainly caused by occasional high values (spikes) in the 10m LPV data from 2005/6.

### Survey issues

- 11) In 2005/06, the survey company (DCL) had problems with their crack detection software, that were not fully resolved until the end of the year. In essence, the company was able to collect images of the road that were sufficiently good for analysis, but the crack detection software was not able to identify cracks reliably. Because this was a “post-processing” issue, the company was accredited to gather data whilst the software was developed. Eventually the system was accredited, with certain settings of the parameters used to control the software, but the survey results delivered to customers used different settings, which produced much higher levels of cracking. This discrepancy was only detected at the end of the year, and DCL undertook to re-process the data, and to deliver reprocessed results to their customers.
- 12) The analysis by TRL was carried out on re-processed survey data, so problems caused by incorrectly reported levels of cracking should have been eliminated from the 2005/06 results.

### West Midlands workshop

- 13) The results of TRL’s analysis were discussed with the West Midlands authorities at a workshop on 30<sup>th</sup> March 2009. Birmingham had also carried out a detailed analysis of some specific aspects of the data on a selection of sites, particularly the ride quality (LPV) and the detection of cracks.

### Ride quality

- 14) Comparing the results of using the “original” SCANNER RCI on the 2008 BVPI results (2006/07 and 2007/08 survey data) with the “revised”

SCANNER RCI results, the scoring of ride quality (LPV) was much reduced (as was intended by the change in the method of reporting the SCANNER RCI).

#### Crack detection

- 15) Comparing downward facing images (from the crack detection system) with the reported levels of cracking intensity at a number of locations, it seemed that the system was consistently under-reporting the extent of cracking. However, there also seemed to be a number of issues with the quality of the images.

### Changes from original to revised SCANNER RCI

#### Ride quality

- 16) In the original RCI, both 3m LPV and 10m LPV contribute to the overall score, with a maximum of 80 points (3m LPV) and 60 points (10m LPV). However, where ride quality is poor, both tend to score together, so that ride quality could contribute a maximum of 140 points, giving an overall "red" score and contributing to the reported BVPI. Particularly in towns, side road junctions gave rise to "red" lengths which were due mainly to the surface geometry (where the crown of the side road runs out into the main road carriageway). Therefore, in the revised RCI the two are scored the same, but only the higher scoring value is counted towards the RCI, so that a ride quality defect, on its own, only reaches an amber score and does not contribute to the BVPI.

#### Crack intensity

- 17) In the original RCI, both whole carriageway cracking, and so-called wheel track cracking were included in the overall score, with whole carriageway cracking contributing a maximum of 50 points and wheel track cracking contributing a maximum of 40 points, to an overall maximum of 90 points. However, the wheel track cracking identified by SCANNER is only a crack (in any direction) which lies mainly within two wide bands either side of the centreline of survey. Therefore scores for wheel track cracking and whole carriageway cracking tend to overlap, leading to double counting. Therefore, in the revised RCI only whole carriageway cracking is counted, but with a slightly increased overall score (maximum 60 points). Thus the influence of cracking on the overall score is somewhat reduced.

#### Combined effect

- 18) The amber / green threshold was increased from 20 points to 40 points, which has the effect of reducing the overall length of "amber" – lengths where further investigation is recommended.
- 19) There were also a number of other smaller alterations to the scoring for rut depth and texture depth. The result of all the changes was to reduce BOTH the overall length of "red" – reported as the BVPI or the NI, and the overall length of "amber" – which is not reported, and increase the length of "green". Consequently most local authorities have seen a significant

reduction in their BVPI score and an apparent improvement in the overall condition of their road networks between 2007 and 2008.

- 20) The proposed changes were developed by the SCANNER RCI working group – chaired by Stephen Childs of Surrey CC, reported to the Road Performance Management Group – chaired by Gordon Prangnell of Hammersmith & Fulham, and approved by the UK Roads Board, before being adopted by the DfT for reporting the BVPI.

## Further investigations

- 21) At the West Midlands workshops, two issues were identified that need further investigation.

### Survey data

- 22) There are continuing concerns about the quality of the survey data being produced by Yotta DCL. As a result, in their role as SCANNER Auditor, TRL met Yotta on 29<sup>th</sup> April to discuss the concerns in general and specifically issues about the measurement of cracking intensity and ride quality. Yotta is making a number of improvements in their systems and processes to improve the quality of the data gathered, and the reliability and consistency of the results they report, and TRL is tightening up the accreditation and quality assurance procedures to ensure these improvements are delivered and maintained.

### Relevance of SCANNER measurements

- 23) There are continuing concerns that the SCANNER RCI identifies different lengths of roads as being in need of further investigation or maintenance, compared with visual survey methods. Therefore TRL proposed to carry out a joint investigation with Birmingham, under the PCIS support contract, to identify lengths of roads with CVI defects, and lengths of roads with SCANNER defects, and then compare the SCANNER and CVI defects on both sets of roads, to identify what aspects of road deterioration are not being captured in the current SCANNER RCI.
- 24) Work carried out by Worcestershire has already identified that edge condition is one of the main causes of difference, especially on smaller rural roads (the B and C roads, especially smaller C roads). However there are other differences and it is likely that they are due to aspects of surface condition and deterioration. It is possible that some of these could be measured and reported from the new measurements of surface texture and texture variability.

## Reporting to Highway Management Group

- 25) A summary report was provided at the CSS / TAG Highway Management Group (copy at Annex B) on 23rd April. Members of the group were very keen that the concerns about the SCANNER RCI be reported to the UK Roads Board and discussed there.
- 26) The results from the different surveys can be put into context. Figure 1 shows the reported values of performance indicators on principal roads from West Midlands authorities. (source Audit Commission). Between 2000

and 2004 local authorities reported either % length with residual life of zero (Deflectograph) or % length with structural condition index  $\geq 70$  (CVI). In 2005 they reported % length using the TTS defects, in 2006 and 2007 % length  $\geq 100$  (original SCANNER RCI) and in 2008 % length  $\geq 100$  (revised SCANNER RCI).

- 27) Figure 2 compares the difference between the values reported in 2007 (with the original SCANNER RCI) and in 2008 (with the revised SCANNER RCI) for all English local authorities. Symbols coloured red show where the survey contractor differed between the two years. This shows that Solihull experienced a change that was apparently greater than that of many comparable authorities, but that the changes in most of the other West Midlands authorities were consistent with changes experienced by other local authorities.
- 28) Figure 3 compares the BVPI results reported in 2007 using the original SCANNER RCI, from all local authorities, according to the percentage length of principal urban roads. The West Midlands authorities are shown in blue, and labelled. County councils are denoted by circles; London boroughs by squares, unitary authorities by triangles and metropolitan authorities by diamonds. Figure 4 shows the same results, but from only the metropolitan authorities.
- 29) Figure 5 compares the BVPI results reported in 2008 using the revised SCANNER RCI, from all local authorities, according to the percentage length of principal urban roads. The West Midlands authorities are shown in blue, and labelled. County councils are denoted by circles; London boroughs by squares, unitary authorities by triangles and metropolitan authorities by diamonds. Figure 6 shows the same results, but from only the metropolitan authorities.

TRL

29<sup>th</sup> May 2009

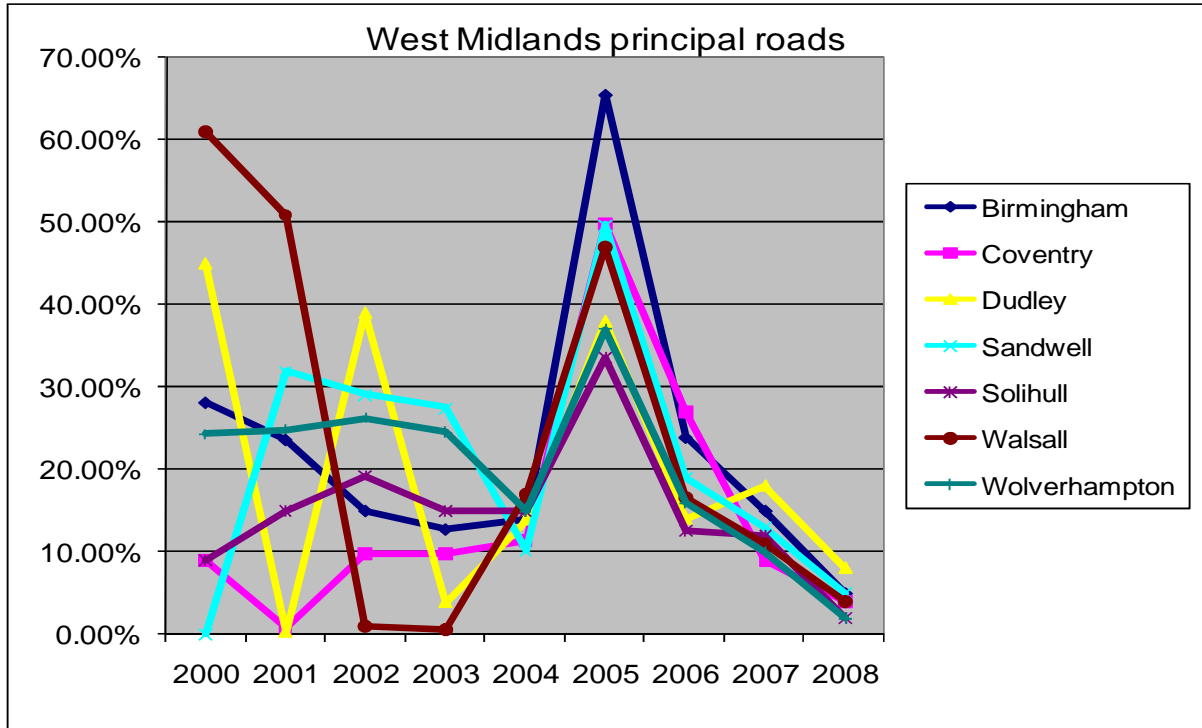


Figure 1 Performance indicators on West Midlands roads

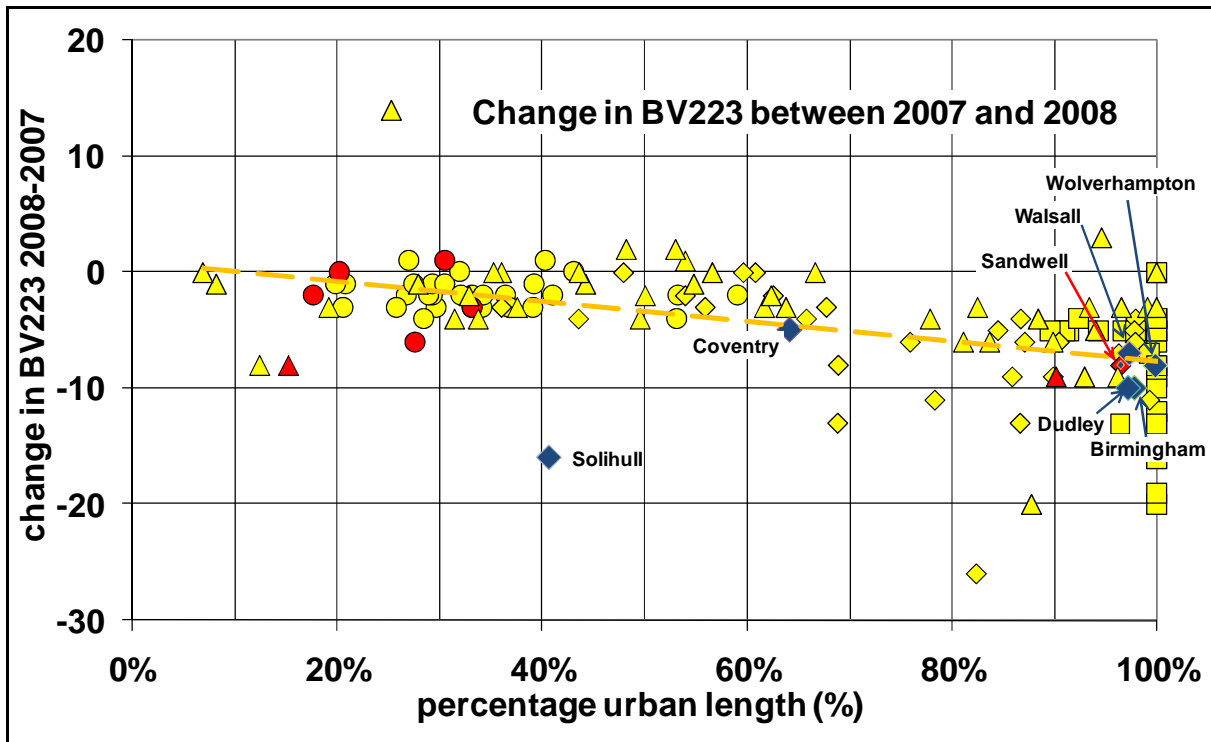


Figure 2 Change in BV223 between 2007 and 2008

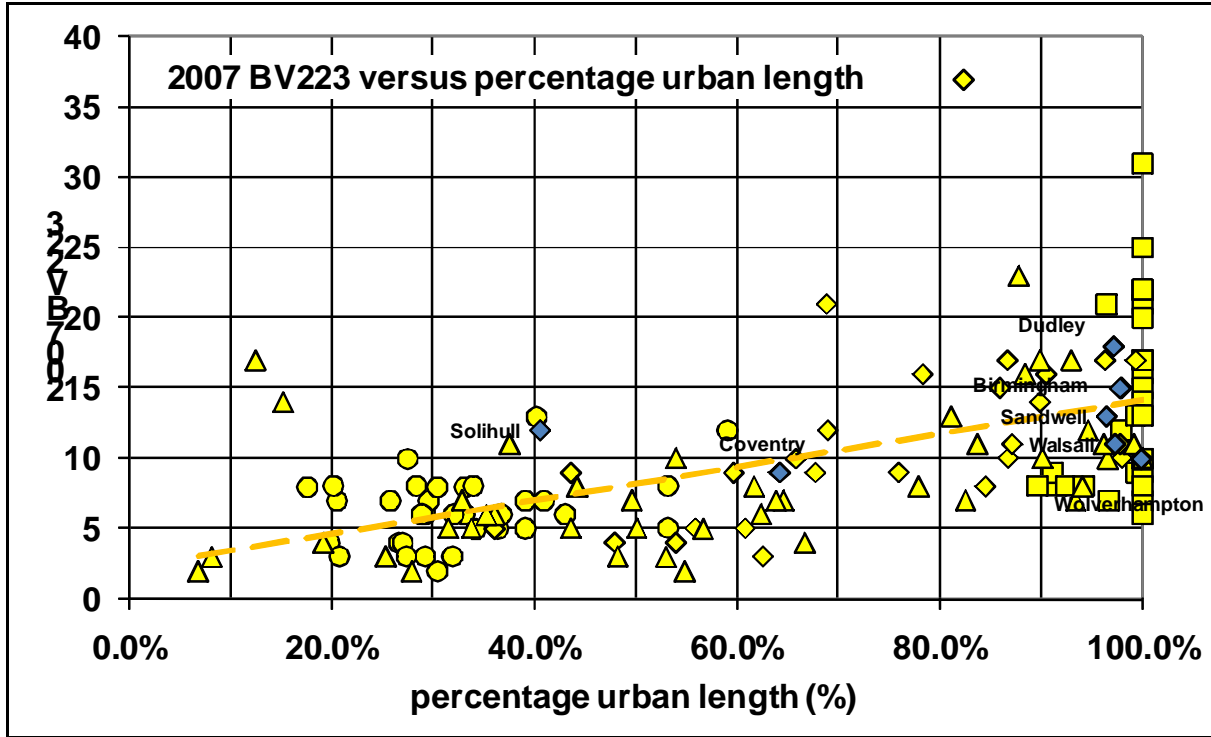


Figure 3 BV223 (2007) versus percentage urban length (all English local authorities)

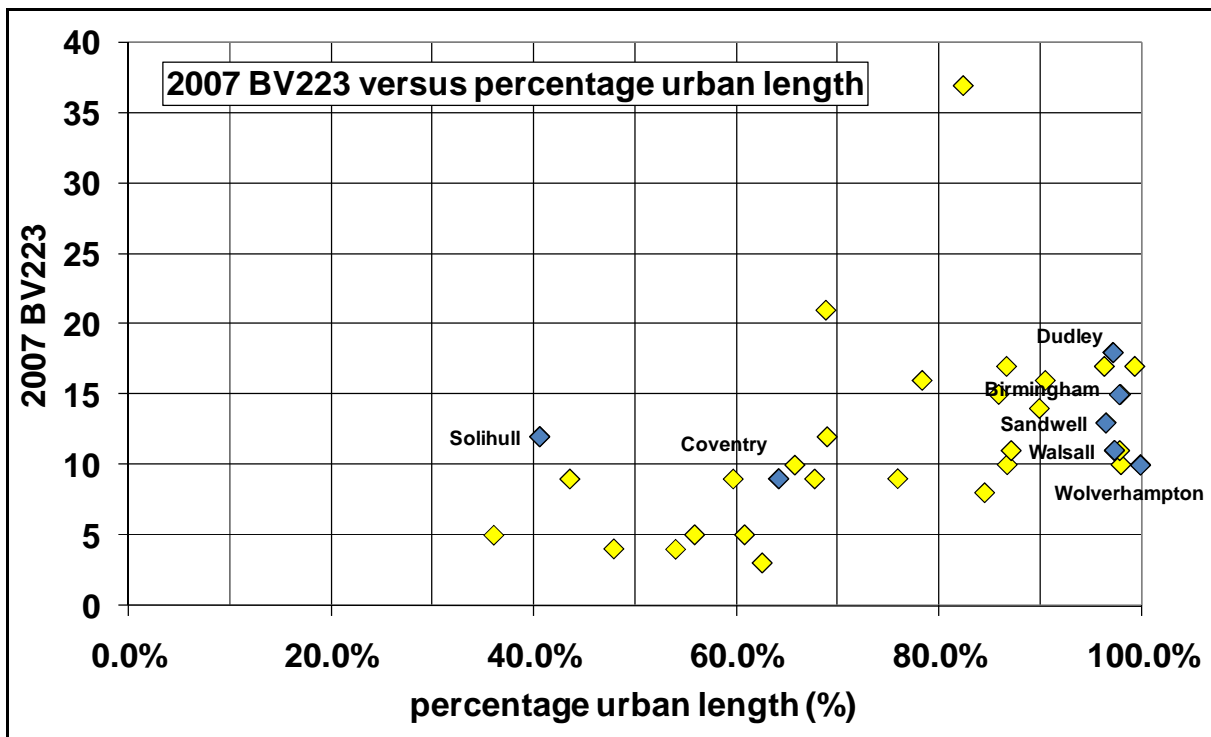


Figure 4 BV223 (2008) versus percentage urban length (metropolitan authorities only)

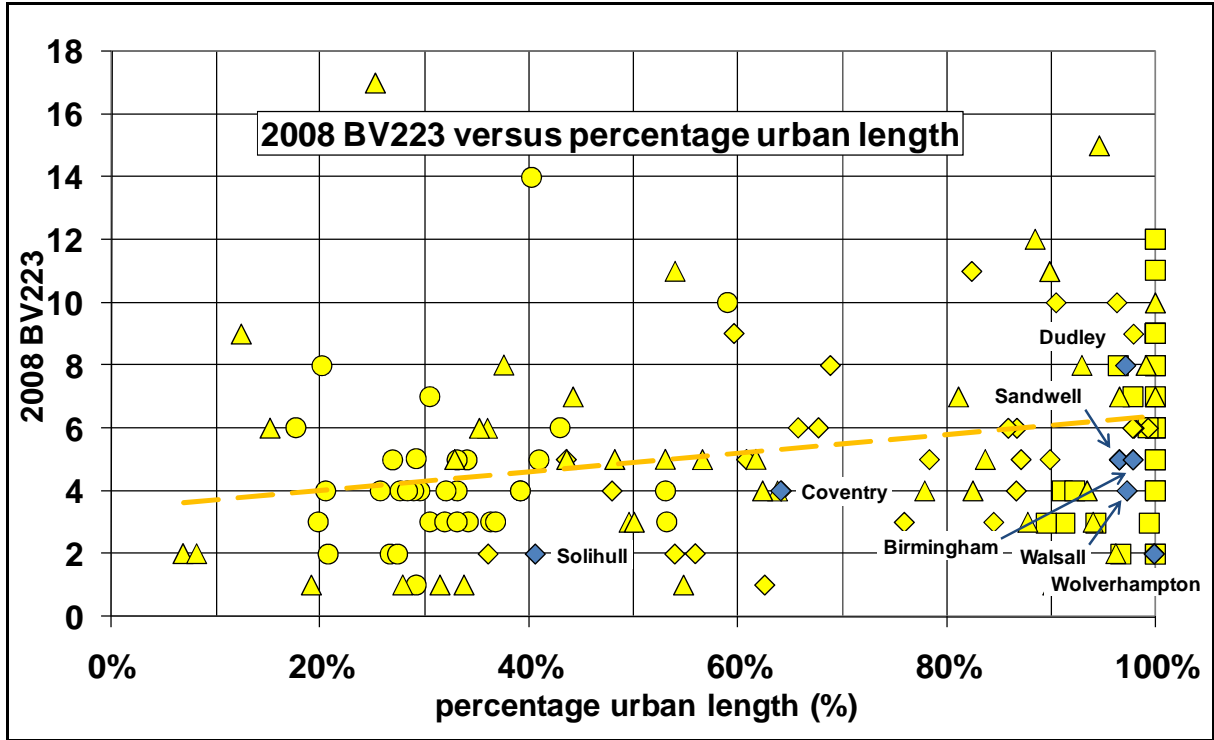


Figure 5 BV223 (2008) versus percentage urban length (all English local authorities)

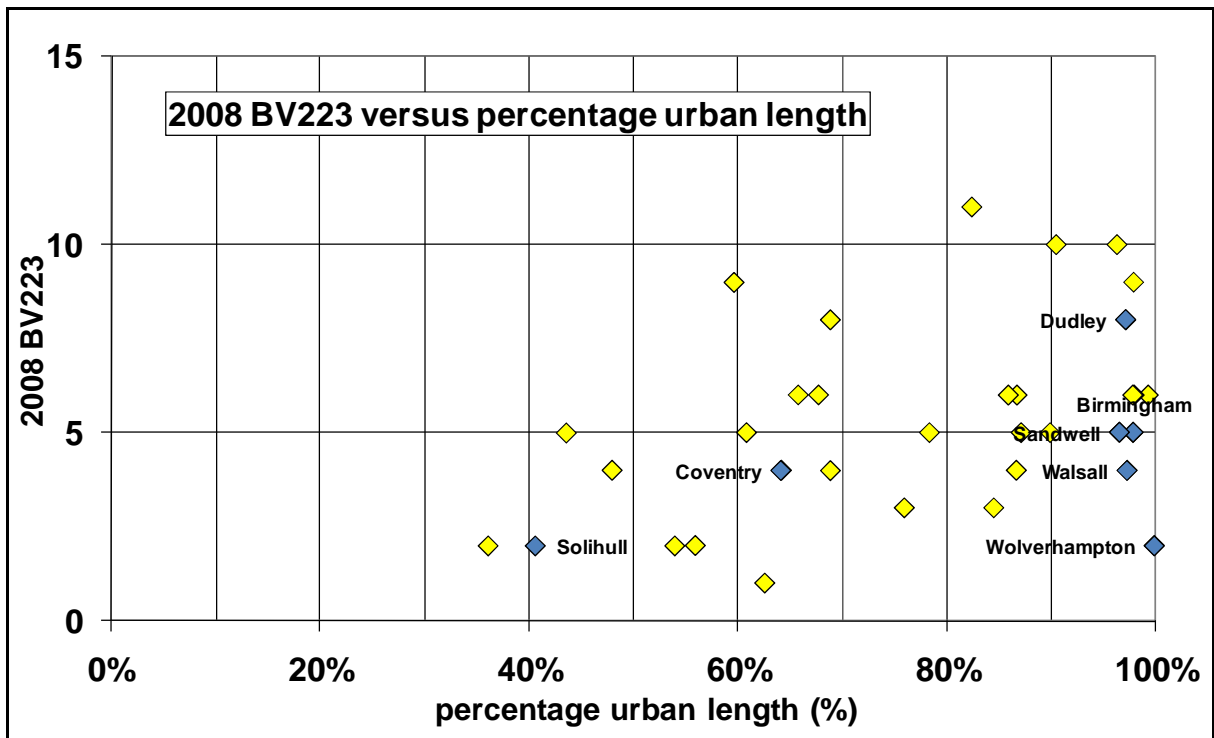


Figure 6 BV223 (2008) versus percentage urban length (metropolitan authorities only)

## Annex B

### Report to CSS / TAG Highway Management Group

#### SCANNER RCI BV223 and BV224a reporting in 2008

A number of local authorities have expressed concerns that the “revised” SCANNER Road Condition Indicator (RCI) used in UKPMS weighting sets WS223v 0202 (BV223) and WS224av 0202 (BV224a) has led to very much reduced BVPI values in 2008 compared with 2007.

Following the West Midlands raising this at the CSS/TAG Highway Management Group meeting in August 2008, TRL has investigated the results in some detail, and a workshop was held in Birmingham on 30<sup>th</sup> March 2009 to discuss the results.

The revised RCI eliminates “double counting” between the two measures of ride quality, to meet concerns from many urban local authorities that lengths of road in good condition were being misrepresented as “red” simply because of side road junctions. It does not include SCANNER wheel track crack intensity, because this proved to be a subset of whole carriageway crack intensity, and was therefore also “double counting” cracking in some places.

Consequently the revised RCI generally does identify less carriageway as being in the “red” condition than the original RCI. A paper by Stephen Child and Gordon Prangnell in Surveyor magazine in October 2007 explained this in some detail.

However the West Midlands authorities are concerned that their road networks are being reported as being in much better condition than they believe is true. There are two possible issues – either there is something wrong with the SCANNER measurements, or the SCANNER RCI is not finding defects that matter to highway maintenance engineers.

TRL’s investigation compared data from the 2005/06 survey with data from the 2007/08 survey from Solihull, and from Birmingham. Less cracking was identified in 2007/08 compared with 2005/06, and this has made a significant difference in the results (in addition to the difference due to the change in the method of calculation). Also there was more 10m longitudinal profile variance in the 2005/06 data from Birmingham, which also affected the results.

TRL will investigate the performance of the crack detection system with the survey contractor, as part of the SCANNER QA contract.

The investigation so far has identified a number of issues that require further investigation, and TRL has proposed a joint investigation with Birmingham to try to find out why the SCANNER RCI is producing less carriageway in the “red” category than West Midlands local highway authorities expected.

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Andrew Gallagher (TRL)

14<sup>th</sup> April 2009