

UK Pavement Management System



Advice Note 7

UKPMS Inventory Data Collection

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Document Information

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1.0 Introduction

Inventory data is used by UKPMS during the processing of condition data. While not essential to the system, inventory data will affect the way condition data is processed by providing information on the area of the highway in which a defect has been recorded. This in turn can influence the selected treatments, ranking and estimated cost of repair. If no inventory data is available, default values for features are allocated. These values will be applied to all road sections of the same type (i.e. all single 2 lane carriageways will be assumed to have the same width of carriageways, footways etc.) as defined in the system Rules and Parameters.

It should be noted that the term Inventory in UKPMS currently refers to the length, width, surface and construction of highway features. As such it does not equate to the same term used in more comprehensive systems such as RMMS.

This document describes considerations and methodology of inventory data collection and while not exhaustive, provides guidelines and recommendations for data collection.

2.0 Overview of Survey

The survey is normally conducted on foot, although alternatives such as collection by video survey are also available. The survey measures the location of highway features by start and end chainage, measured from the section's start point. It is important that network characteristics, such as the zero chainage location of a section are clearly specified. Consideration needs to be given to methods of avoiding double counting of inventory assets ahead of data collection to ensure that inventory and defect data are collected consistently for all survey types.

Feature widths are also measured at the start and end chainages, where appropriate, and lateral position is recorded using cross sectional position (XSP) codes. Details of the XSP codes can be found in the Visual Survey Manual.

These attributes measure the physical extent of the feature, but additional properties are also recorded as specified in the UKPMS Rules and Parameters.

A feature is regarded as continuous along a section until one of its parameters changes (such as the end of a footway or change in width, a difference in construction, change of cross sectional position etc.).

Inventory data can be collected electronically or on paper. Electronic data collection is recommended as this minimises duplication of work and reduces the need for data validation which may be carried out by the data collection software. If undertaken as a paper exercise, a method of validating and transferring the data into UKPMS will be required.



The UKPMS Rules and Parameters list the inventory items and associated attributes which can be loaded into accredited UKPMS systems.

2.1 Data Collection Considerations

Inventory data is used in UKPMS in the following areas:

1. To refine pavement types using construction information
2. To calculate area of defects
3. In estimating costs of works
4. To map CVI defects collected at minimal XSP on sections using full XSP referencing.
5. To support DVI surveys (including BVPI 187)

The Inventory data collected should support other survey data held in the system to improve the quality of the processed results. The most important questions to be answered before conducting a survey are:

- Is the Network ready?
- What items/attributes are to be collected?
- What level of cross sectional position is to be used? (must be the same as defined by the network)
- Extent of Survey?

To help decide on the type and extent of data collection, some further information on these points is given below.

2.1.1 Is the Network ready?

A model of the network to be surveyed should be in place in advance of the data collection exercise. This is necessary for a number of reasons including

- Providing the network section references and direction to record data against
- To locate the start and end locations of data collection for surveys (see below)
- To be able to scope and price the work
- To ensure required survey parameters are defined
 - Section XSP Level
 - Footway hierarchy values
 - Nominated sections

Inventory collection/loading problems can occur if section start and end points for data collection at road junctions are not clearly defined. The larger the junction and further from a 90° turn the junction is, the more prominent this problem will become. Essentially two options of network modelling exist. Firstly data can be collected from the



notional node point (i.e. 0 chainage runs from the centre of the adjoining road). Alternatively, data collection begins from the white lining of the junction, although a GIS model may indicate the section as 'notionally' starting from the centre of the adjoining road.

Although both methods are valid, it is imperative that a single interpretation is applied across the network for all data collection. It is recommended that the second approach is adopted as this will minimise the exposure to traffic during walked surveys, makes determination of the start point of a section easier for driven/machine surveys, and ensures that the recorded section length matches the carriageway length.

If instigating this recommendation, users should be aware that differences between section 'digitised' (i.e. GIS) and site 'measured' lengths can on occasion be significant and this can affect the quality of data location when displayed in GIS.

Users should also be aware that the default loading tolerance for inventory data is 5% (section length) or 20m, whichever is the greater. Because of this, care must be taken in setting up the network to avoid extensive time being spent sorting out post-survey data fitting problems.

2.1.2 Items/attributes to be collected

If only carriageway information is required within the database, the collection of other items may be redundant and so may not be collected. It is possible to collect additional inventory at a later date and append this to existing data (see 2.1.4 below).

Users should remember that footway inventory is required for the production of BV187 (See UKPMS Advice Note 5)

2.1.3 Cross Sectional Position (XSP) Referencing

Inventory data can be collected using either Full or Minimum Cross section Position Referencing as described in the Visual Survey Manual. The level of referencing used is an attribute of network sections and cannot be defined by the data collection exercise. Because of this, the level of XSP referencing must match that defined by the section or it will not load into UKPMS.

2.1.4 Extent of Survey

Inventory data may be collected on one of more features on a section in any survey. For example, users may decide to collect only carriageway inventory initially and collect footway inventory at the same time as undertaking a DVI survey. This has the advantage of ensuring that the two different data types are collected consistently, minimising the potential of data loss during loading and processing.



When inventory data is collected and loaded/committed into UKPMS, the user will typically have some control over how the data will replace the existing records in the database. Users should refer to their system documentation to determine the updating/overwriting options available.

3.0 Inventory Item Parameters

All UKPMS Inventory items have the following attributes. Whether the information is collected will depend on the feature being collected. For example, Kerbs do not have a width measurement. Valid values for feature Hierarchy, Surface Types and Construction are given in the UKPMS Rules and Parameters.

Start Chainage	
End Chainage	
Start Width	– Not for Kerbs
End Width	– Not for Kerbs
Feature Hierarchy	– To be defined by the user, see 4.1.5 below.
Surface Type	– Defined as 'Material Type' for Kerbs
Construction	– Not for Kerbs

All chainage measurements are to the nearest metre.

It is not possible to know from observation what the construction of a feature is. For example a road may appear to be bituminous, but is bituminous overlaid concrete. Attribute data collected must be based on what is known rather than what could be assumed and as such should not be made the responsibility of the Surveyor.

3.0.1 Changes to Inventory Attributes

Whenever the surface, construction or feature hierarchy changes (material type for kerbs), the creation of a new inventory item is the only way to record the change. Alternatively, if all inventory data is collected as having an unknown surface type and construction, then only changes to hierarchy need to be recorded; this alternative means fewer records will exist within the database, and so fewer data conflicts.



4.0 Inventory Survey Procedure

4.1 Data collection considerations

Due to the huge variations in road and feature layout which can occur when measuring inventory, decisions on how to collect data consistently for all survey types will ensure that inventory and other survey data are collected to complement rather than conflict with each other. Alignment of inventory and condition data can have implications for data processing, especially in connection with DVI data so the sections below explain steps which can be taken to minimise data conflicts.

4.1.1 Start and end location of section

Inventory data can be collected in either the forward or reverse direction of the section (only possible limitations to this are given in 4.2.3 below). When collecting data in the reverse direction, cross sectional positions should be recorded as they are observed, recording the direction of the survey as reversed means that UKPMS will reverse the data and XSP codes automatically.

Definition of the start and end point of sections needs to be defined by the network model before any data collection is undertaken as described in 2.1.1 above. All data collection must be undertaken consistently to the network model or data conflicts between different surveys will be likely, leading to survey data either not being accepted into the database, or being lost during UKPMS processing.

4.1.2 Nominated Sections

Some network sections may both contain the same feature, such as the central reservation of a dual carriageway. To avoid data being either collected twice or not at all on these features, one of the two adjoining network sections can be assigned as the nominated section. This is a network attribute that indicates which section will have the shared features data assigned to it.

4.1.3 Width Measurements

The start and end width of all inventory items recorded with width measures (area items) must be taken as found on site. UKPMS calculates all areas as trapezoids, so there is not a limitation requiring start and end widths to be the same. By making measures of the start and end width of each feature as individual areas, it will also produce the best measure of the area as it exists on the ground. Also see 4.2.4 below for specific requirements of Roundabouts.



4.1.4 Feature Hierarchy

Carriageway, Footway and Cycletrack features have an associated hierarchy as defined in the Code of Practice for Maintenance Management. The carriageway hierarchy is defined for all carriageways as a network section attribute which must be defined. Footways can also have a default Hierarchy assigned as an attribute of section, but footways and cycletracks can have their own Hierarchy defined during Inventory data collection.

This ability is useful where the hierarchy of a non-carriageway item changes within the limit of a single network section. However, hierarchy attributes must be defined by the User in advance of any survey work as a surveyor will not be able to make an informed assessment of a site based only on the time available during the survey.

4.2 Double Counting Errors

Data collection needs to be consistent and represent features as they appear on the ground. It is important that where areas of two road sections overlap, the features common to both are recorded against a single section for inventory and all other survey types. Most examples of this occur at junctions where the off carriageway features are common to two (or more) network sections.

The approach adopted must apply to all UKPMS surveys to ensure that recorded defects correspond to each other and inventory records consistently. The methods described below are not definitive, but are suggested to provide a simple and consistent model to minimise confusion of the location of items collected.

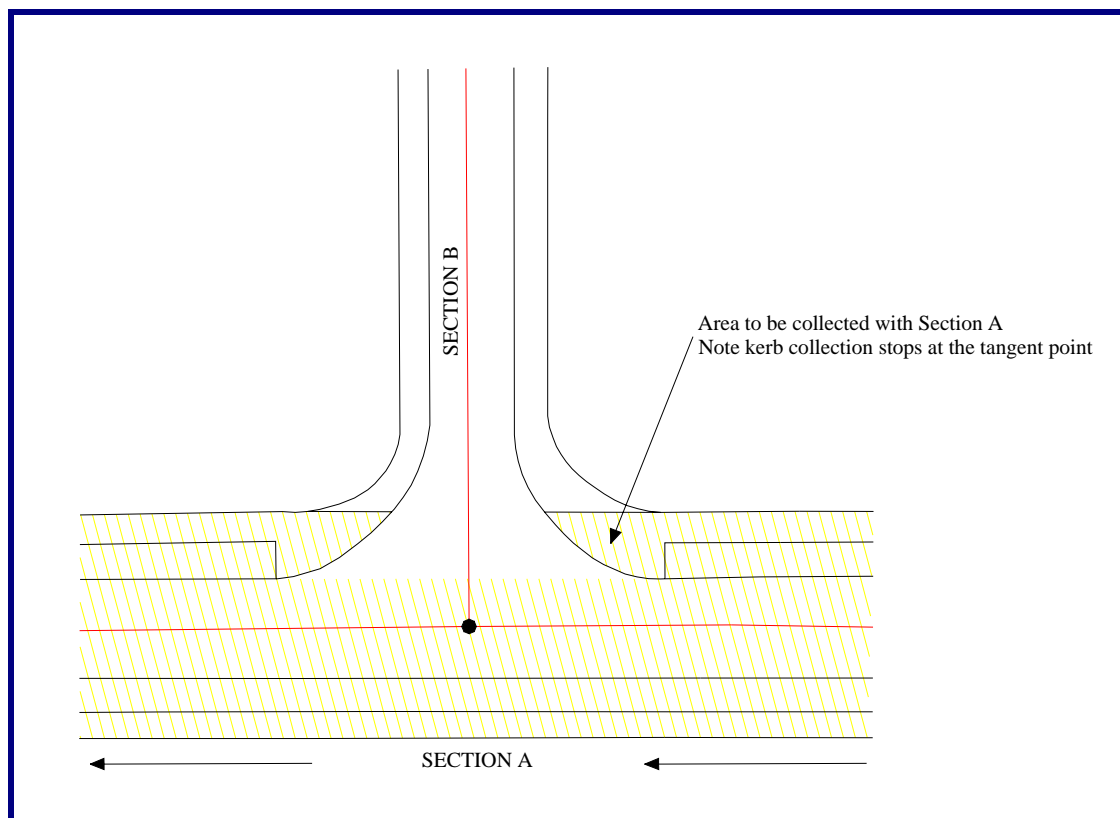
Locally defined methods of data collection must always be followed to ensure consistency with previously and subsequently collected UKPMS data.



4.2.1 Road junctions

When crossing a junction with another road which is a separate section, all off-carriageway items must be end-chained and picked up on the other side of the junction. As shown in the diagram below, to avoid double counting areas, the off carriageway items on the main section should be recorded as if they continue in a straight line to the kerb edge on both sides of the junction.

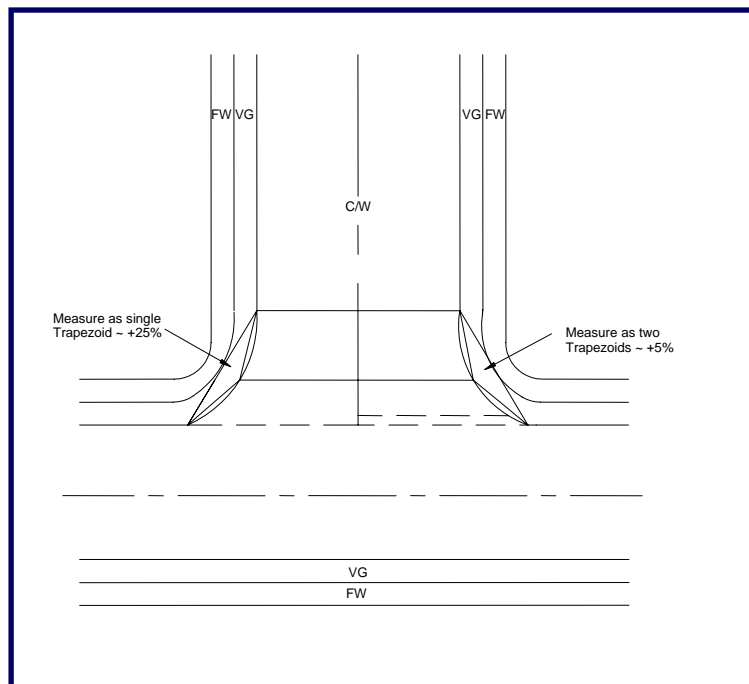
Similarly, when measuring items on the side road (Section B), the carriageway item will start at the white lines of the junction, but the off carriageway items must not be recorded until the start of the area which has not been recorded against the adjacent road section (Section A).





4.2.2 Junction Bell-mouth areas

Using trapezoidal measures, few items need to be collected to measure a bell mouth area with reasonable accuracy. Also, if many items are collected on short measurements, data could be lost during data fitting. Typically, measuring an entire bell-mouth as one item will overestimate the areas by about 25%, but taking two measures reduces this error to about 5%.



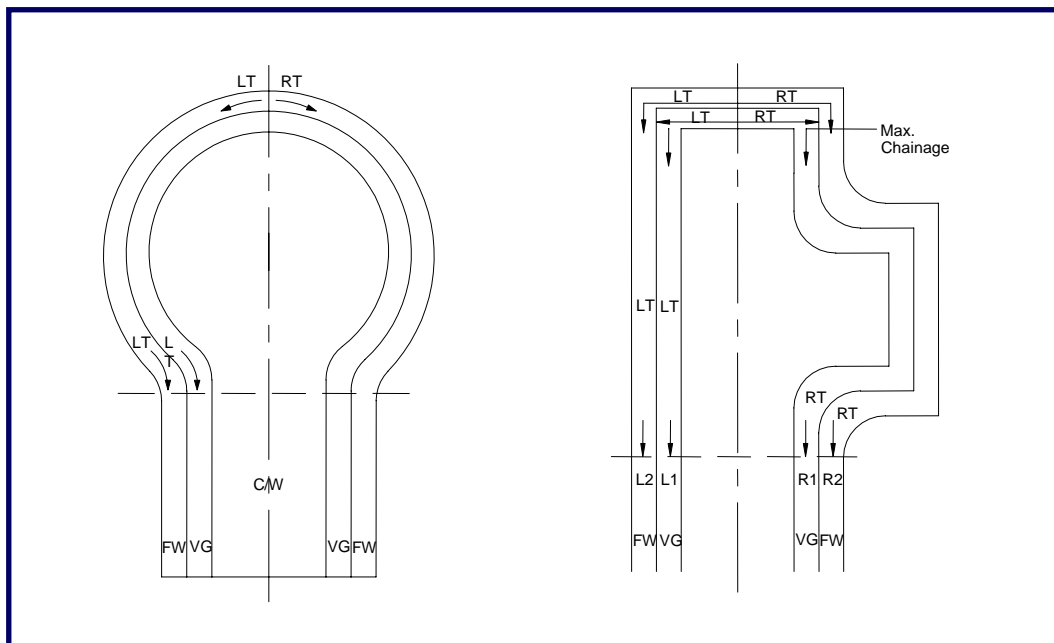
Error of measurement generated by one and two measures across a bell mouth



4.2.3 Turning Heads in Cul-de-Sac roads

Users need to establish their own convention to define when turning head areas should be measured as a change in carriageway width, or when these should be considered as separate sections. Small areas of less than 10 – 20m can be easily recorded as a wider area of carriageway and this will simplify future data collection.

Where a footway runs at the back of the carriageway at the top of a turning head, the recorded Inventory cannot exceed the section length as defined by the carriageway limit. To compensate for this, Transverse XSP codes can be used to record the item, using a dummy start chainage based on measuring the length of the feature back from the end chainage of the section. As the item is recorded against a Transverse XSP code, there will not be a system conflict due to overlapping chainage of features. As with other data collection rules, local decisions need to be made to ensure data consistency, but one method is illustrated below as an example.



Example of off carriageway feature measurements for turning head shapes. If the off carriageway features are always measured backwards from the end carriageway chainage to the tangent point at the start of the turning head feature. Using the appropriate Transverse XSP code, the detail will be consistently picked up and the area of the feature accurately recorded.

If Transverse XSP codes are used, users must beware that the forward survey direction must apply to all surveys for that section. If these are surveyed in the reverse direction the chainages of items will not match the inventory and data may be lost.



4.2.4 Roundabouts

Only larger roundabouts (i.e. with a kerbed central island) should be defined as a separate network section as it would be dangerous, and for machine surveys impossible, to undertake data collection.

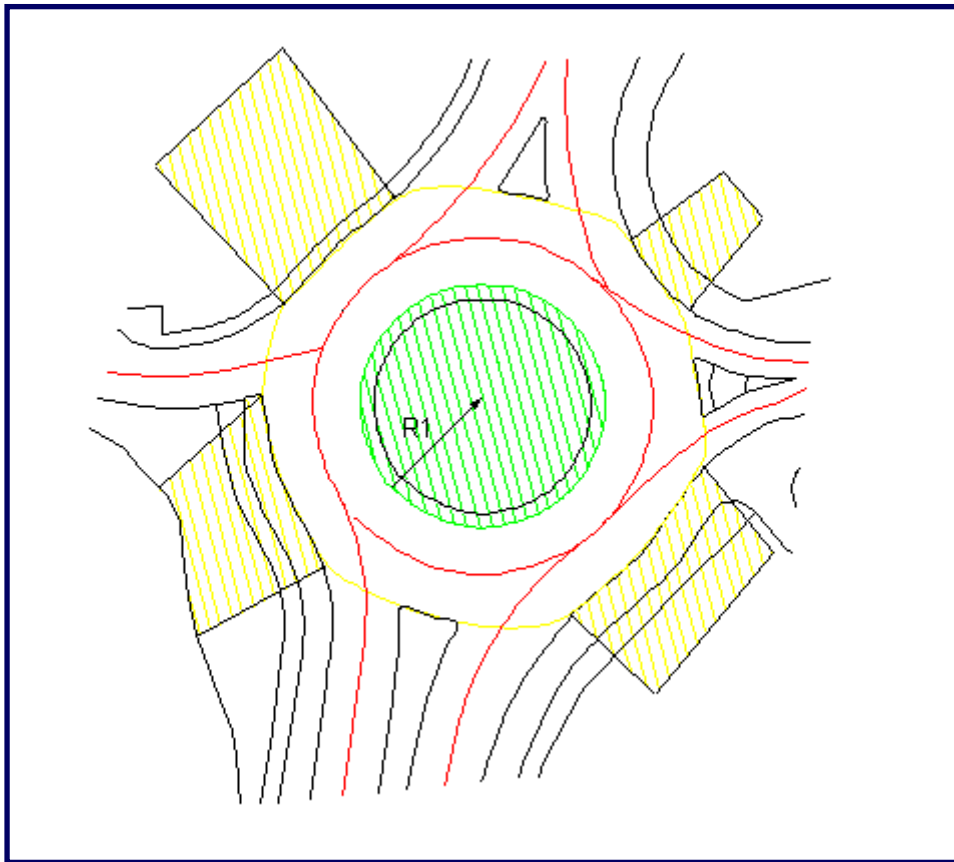
It is recommended that roundabouts be measured around their outside diameter, in the direction of traffic flow. Where features exist on the central island, these should be recorded in XSP position R (minimum XSP's) or R1, R2 etc. (full XSP's). To ensure that the recorded area a central island feature measured to the centre is consistent with the actual area, the radial measurement recorded as the width to the centre of the island must be halved.

The consistent recording of features on the outside of the carriageway around roundabouts is difficult to define to ensure consistency. Essentially there are two choices:

- 1: Record all outside off carriageway items against the approaching sections so no (left, off –carriageway) data is held against the roundabout section.
- 2: Record all details within a boundary traced around the roundabouts outer boundary.

It is recommended that the second option be used as this will make data easier to record, retrieve, interrogate and display graphically.

An approximation of the sort of boundary conditions is shown below. Note that central island features on approaching carriageways are recorded on the (nominated) approach sections, not the roundabout section.



Example of measuring features within the boundary of a roundabout. The central island is measured as a verge in R1. To measure the area of the island accurately, the verge width should be half the radius of the island, and the length the outer edge.

4.2.5 Lay-bys

Where the lay-by is not separated from the road, it should be recorded as CW items in XSP -L1 if using full XSP codes, or as a wider CW item recorded in C if using minimal XSP codes. Where the lay-by is separated from the main carriageway, this can be recorded as a separate section which will ensure that a paved verge between the lay-by and the main carriageway can also be recorded (in the nominated section) and that the distinction between the paved areas can be made using both full and minimal XSP codes.

4.2.6 Remote Footways

Remote footway or those which do not run parallel to the carriageway may be recorded as separate sections. Alternatively they may be recorded as having the same length as the section, but a greater width to account for the difference in area if this is significant or through the use of transverse XSP codes.



4.2.7 Cycle tracks

Cycletracks are an 'off carriageway' item within UKPMS, so only off carriageway cross sectional positions can be used to record their location. As more than one item can exist in a Cross Sectional position, on carriageway cycletracks can be recorded in L1 in addition to footway items.

4.2.8 Change of Cross Sectional Position

Where a new feature starts, for example a footway moving away from the kerbline where a verge starts, the cross sectional position of the item must change at the earliest point.

5.0 Maintenance of Inventory data

Once Inventory data has been collected, it is essential that it is kept current to ensure that other collected defect data will match the inventory features in the system. During automatic pass processing, if defect data does not correspond to inventory data, the condition data is dropped from processing.

New inventory data will need to be collected if the physical layout of the road changes as this will have an effect on previously recorded features and could change the overall section length. Similarly if the construction material of a feature is changed the associated inventory data must be updated accordingly. This maintenance of the inventory data will ensure that data conflicts are minimised and maximum use is gained from other collected data.

If inventory data is not collected, any changes in section length will still need to be recorded in your UKPMS database to prevent data loading problems caused by changes on the ground.