

UKPMS VISUAL SURVEY
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VOLUME 2 - CHAPTER 10
ANNUAL ENGINEER'S INSPECTION
(AEI)

APRIL 2019

UKPMS VISUAL SURVEY MANUAL – “Annual Engineer’s Inspection (AEI)”

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Document Information

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Document History

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1. CHAPTER 1 Introduction

1.1. Introduction

As most Local Authorities have budget restraints, accurate assessment of the pavement and surface distress can provide a consistent and rational method for allocating limited resources.

The Annual Engineers Inspection (AEI) was a survey type used in the original UKPMS logical design trials and highlights areas on the network with the appropriate Engineers treatment and extents. It was envisaged that the AEI survey would be undertaken after a DVI survey had highlighted areas for further investigation. The RCMG have reintroduced the AEI survey as another UKPMS survey type to allow Local Authorities to choose from a valid UKPMS type survey to determine the works required.

It is recommended that an Engineer with experience in Highway Maintenance requirements will carry out the AEI's survey's normally from a slow moving vehicle. The AEI is designed for all road classes and has been developed to allow quick assessment of the highway network. Each carriageway section shall be inspected and the appropriate treatment identified. Footways can also be included if required to ascertain the condition and corrective treatment.

In urban areas where vehicles are parked continuously at the roadside or there is a problem with slow moving traffic which does not allow for good visibility of the road, the assessment shall be re-scheduled at a time when it is less busy or a walked AEI shall be undertaken.

1.2. Overview of AEI Survey Procedure

An AEI survey is normally undertaken from a slow moving vehicle, using the appropriate safety items i.e. Flashing beacons and clear vehicle signing.

For unclassified roads an AEI survey would normally be carried out in one pass and the appropriate treatment identified. For Classified Roads it is recommended that a AEI assessments shall be undertaken in two passes to get a better understanding of the carriageway condition throughout before selecting a treatment this would also apply to busy urban estate bus routes.

The survey will normally be carried out using a designated computer/data capture device which has the appropriate software and relevant highway network installed. The device should be configured to allow input of the carriageway, and if required, footway treatments.

It is advised that the vehicle should be equipped with an accurate, calibrated trip meter or odometer, configured to read in metres. This will help assist with sections that require splitting due to having more than one treatment and also where the carriageway or footway surface changes.

It is recommended that AEI surveys are pre planned and assessment routes developed and programmed to minimise travel between sections. The survey is normally carried out over a whole section and on classified sites where it is deemed busy, a second person may be required to assist with the driving. This will all be part of the pre survey works planning.

The AEI assessment has been developed to take into account most highway maintenance treatments. These treatments cover a wide range of highway maintenance remedies from basic maintenance, preventative and major highway resurfacing or reconstruction works. All identified treatments shall be built into the software with the majority of choices being within a “Basket” of preventative maintenance techniques. In accordance with HMEP lifecycle planning is to be adopted by all highway maintenance authorities and it is deemed that with proper timings of preventative maintenance, lifecycle planning will ensure the carriageways can be kept in good condition for many years at a reduced cost minimising major maintenance and reactive works.

1.3. Health and Safety

The following information is only general advice and guidance.

The Engineer or designated person should be made aware of the contractors or Highway Authorities own Health and Safety Policy before they undertake a AEI survey including risk assessments

For AEI surveys, it is advised that the survey vehicle used is equipped with high intensity roof-mounted flashing beacons in accordance with Chapter 8 of the Traffic Signs Manual. As the vehicle will be operating at slow speeds, it is recommended that the rear of the vehicle should be fitted with the appropriate signs explaining the nature of the works.

For example “Caution Surveying in Progress – Slow Moving Vehicle”. It is preferable to use a vehicle with a conspicuous colour such as bright yellow or orange or a vehicle with the appropriate safety features/identity

In planning the survey any traffic sensitive lengths that are best surveyed at off-peak times should be identified prior to AEI work commencing.

1.4. Cross Sectional Positions XSP's:

The AEI survey allows the Engineer the option to target individual lanes for a treatment, along a section length, by recording a Cross Sectional Position as described in the table below.

For example a dual carriageway section could require a treatment in the nearside lane only and the same could apply to a roundabout where only one lane requires treatment.

In this scenario a designated cross sectional position will be allocated to the defective lane.

It is recommended that for classified roads a full xsp is to be used when necessary for identifying/targeting treatments along one particular lane of the section although this is optional. The system allows the engineer the choice of recording either Minimal or Full cross sectional position when carrying out the survey.

At first glance, the sheer number of XSP codes that are available in an AEI can be confusing. By remembering a few simple rules, the codes can always be simply derived.

The Full XSP's are derived as follows:

Carriageway Full XSP's – Minimal & Full

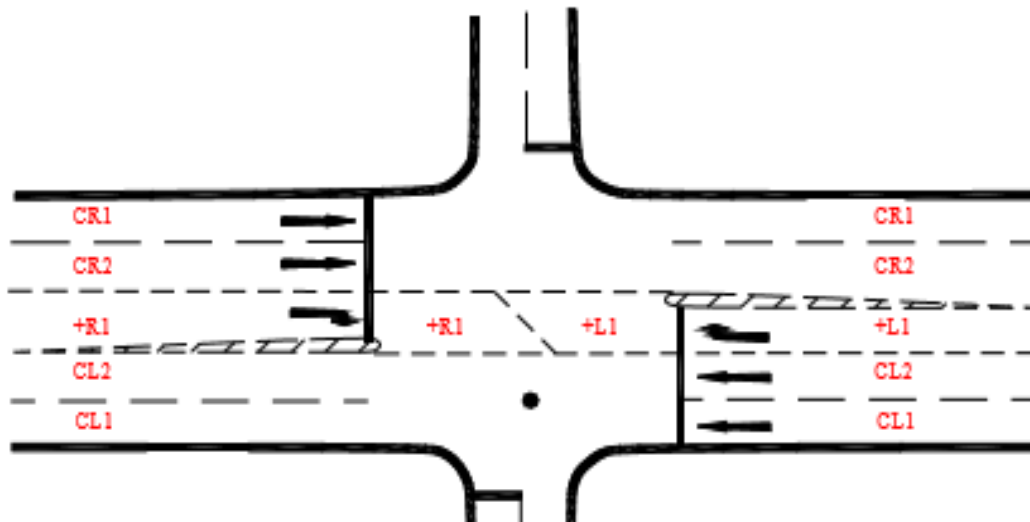
Minimal XSP Referencing Method		Full XSP Referencing Method	
Abbreviation	Description	Abbreviation	Description
C	Carriageway	LH	Left Hard Shoulder
		-L9	Left Additional Nearside Lane 9
		-L3	Left Additional Nearside Lane 3
		-L2	Left Additional Nearside Lane 2
		-L1	Left Additional Nearside Lane 1
		CL1	Permanent Left Lane 1
		CL2	Permanent Left Lane 2
		CL3	Permanent Left Lane 3
		CL9	Permanent Left Lane 9
		+L1	Left Additional Offside Lane 1
		+L2	Left Additional Offside Lane 2
		+L3	Left Additional Offside Lane 3
		+L9	Left Additional Offside Lane 9
		CC	Centre Line
		+R9	Right Additional Offside Lane 9
		+R3	Right Additional Offside Lane 3
		+R2	Right Additional Offside Lane 2
		+R1	Right Additional Offside Lane 1
		CR9	Permanent Right Lane 9
		CR3	Permanent Right Lane 3
		CR2	Permanent Right Lane 2
		CR1	Permanent Right Lane 1
-R1	Right Additional Nearside Lane 1		
-R2	Right Additional Nearside Lane 2		
-R3	Right Additional Nearside Lane 3		
-R9	Right Additional Nearside Lane 9		
RH	Right Hard Shoulder		
RE	Right Edge		

Footway XSP's – Minimal & Full

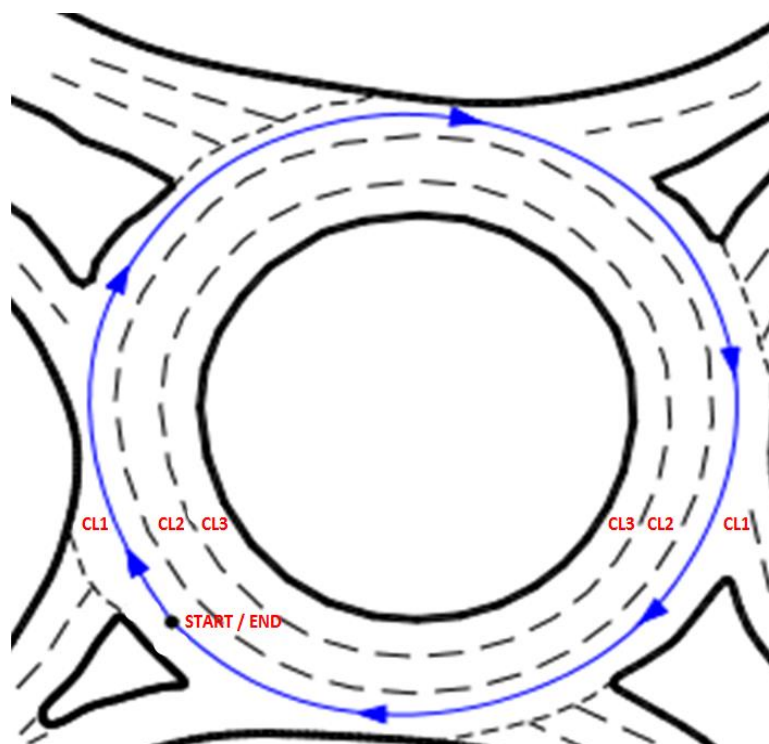
L	Left	LB	Left Boundary
		LA	Left Boundary Area
		L9	Left Off Carriageway Position 9
		L3	Left Off Carriageway Position 3
		L2	Left Off Carriageway Position 2
		L1	Left Off Carriageway Position 1
R	Right	LE	Left Edge
		RB	Right Boundary
		RA	Right Boundary Area
		R9	Right Off Carriageway Position 9
		R3	Right Off Carriageway Position 3
		R2	Right Off Carriageway Position 2
		R1	Right Off Carriageway Position 1
RE	Right Edge		

Below are examples of cross sectional position referencing at typical road layout/locations.

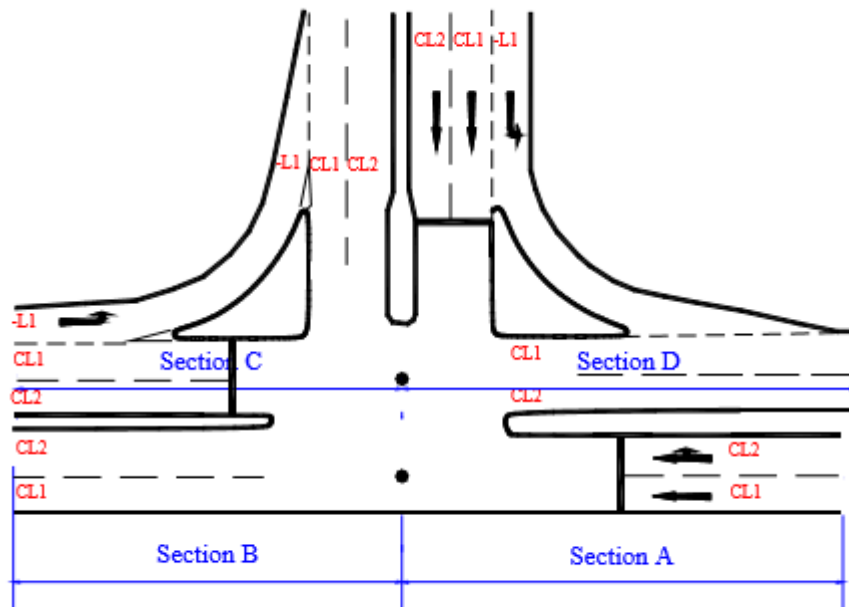
Example of a cross sectional positions along a dual carriageway including turning areas.



Example of cross sectional positions along a three lane roundabout layout.



Example of cross sectional positions at a Junction.



2. CHAPTER 2 – Carriageway and Footway Defects

The main emphasis of an AEI assessment is identifying typical standardised defects along a section of road. Depending on the defect this will predominately determine the best solution in returning the carriageway or footway back to its expected service level as defined within the local authorities Asset Management Strategy.

Defects identified in an AEI assessment can be categorised to provide the correct treatment for a particular section of road or footpath. Consistent structural defects will result in either a resurfacing or reconstruction treatment, alternatively non structural surfacing defects will result in either preventative maintenance treatments or basic maintenance patch repairs. Visual defects are the primary parameters which the AEI assessment relies on to determine the treatment selected. This is the main focus of this manual combined with site data collection.

A description of common defects will determine the overall methodology and structure of the AEI survey and it is important to have a full understanding of all defects and the corrective treatment to return the carriageway or footway back to a safe and satisfactory service level.

All the defects discussed within this manual are also contained in other UKPMS survey documents to allow for correlation between the survey types.

The following paragraphs describe typical standardised defects for both carriageways and footways that can be recorded in a AEI survey.

Major Cracking

Cracking results from partial or complete fracture of the surfacing and can happen in a wide variety of patterns as described below. Only cracking identified or deemed greater than 2mm is to be considered for this defect.

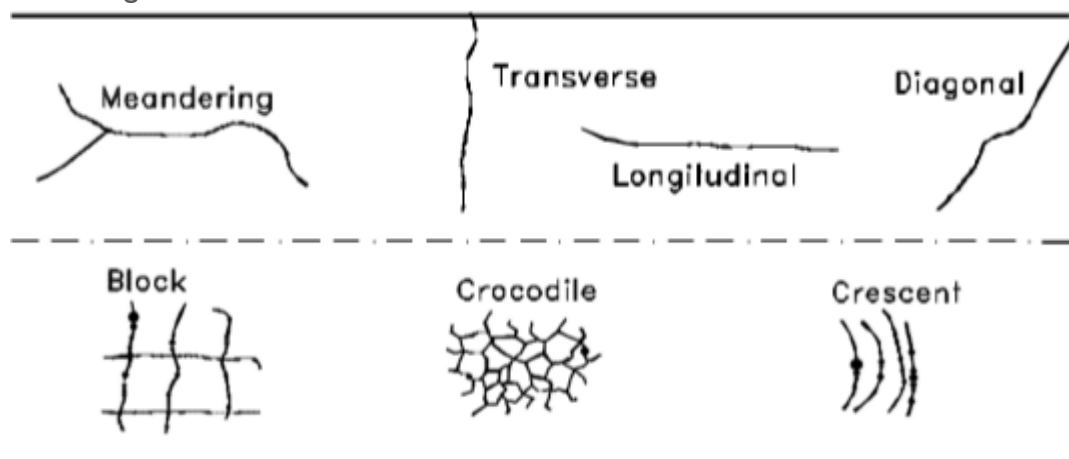
Factors that may contribute to cracking include

- Deformation.
- Age of the surfacing.
- Reflection or movement within the pavement structure.
- Shrinkage.
- Poor construction.
- Joints not formed correctly.
-

Crack patterns either alone or together with deformation are useful in assessing the likely causes of surface distress. Cracking can appear in various forms.

- Meandering.
- Transverse.
- Longitudinal.
- Diagonal.
- Block.
- Crocodile.
- Crescent. (i.e HRA rolling cracks)

Examples of cracking.



Structural cracking is generally traffic load induced and indicates a failure in one or more layers of the pavement structure. For asphalt flexible pavement structural cracks normally occur in the vicinity of the wheel paths initially showing up as longitudinal cracking and propagate away from the wheel path forming with transverse cracks.

Non structural cracking that occurs without traffic loading is mainly due to environmental effects such as the change in moisture, expansive subgrades, oxidation of seal or reflection cracking through shrinkage and cracks in stabilised layers. Although there may be no immediate loss of structural strength or surface shape, environmental cracking if left untreated can often lead to pavement failure so it would be advisable to seal the surface course with a preventative method.

All types of cracks whether it is structural or environmental should be treated with caution as a cracked surface results in the loss of water proofing for the layers below. Moisture ingress to binder and sub-base layers could result in the loss of fines through erosion and pumping and contribute to early signs of structural failure.

Based on the information described above it is important that the Engineer identifies cracking correctly. Where extensive structural cracking appears combined with major fretting, potholing and rutting the engineer would consider resurfacing or partial/ full reconstruction treatment as the correct treatment.

In areas of minor surface cracking and localised fretting, a surface dressing or a micro asphalt treatment would be likelihood whereby footways exhibiting the same conditions would potentially require a slurry or patching treatment.

Attribute = Major Cracking



Description 1	Crocodile Major structural cracking combined with rutting
Description 2	Meandering Cracking

Attribute = Major Cracking



Description 1	Single Wheel Track Cracking
Description 2	Multiple Wheel Track Cracking

Attribute = Major Cracking



Description 1	Block Cracking – Non Structural
Description 2	Crocodile Cracking

Mud Pumping

Where traffic loading or movement in wet pavements can create a pumping action due to build-up of pore pressure from the moisture, pumping fine materials from the base layers up through the cracks. Loss of fines reduces the strength of pavement as it reduces the interlocking actions in the granular material.

If this defect is consistent throughout the section combined with other areas of structural failure the Engineer would consider a resurfacing treatment with binder course replacement or partial/full reconstruction, dependant on the type of structural failure present.



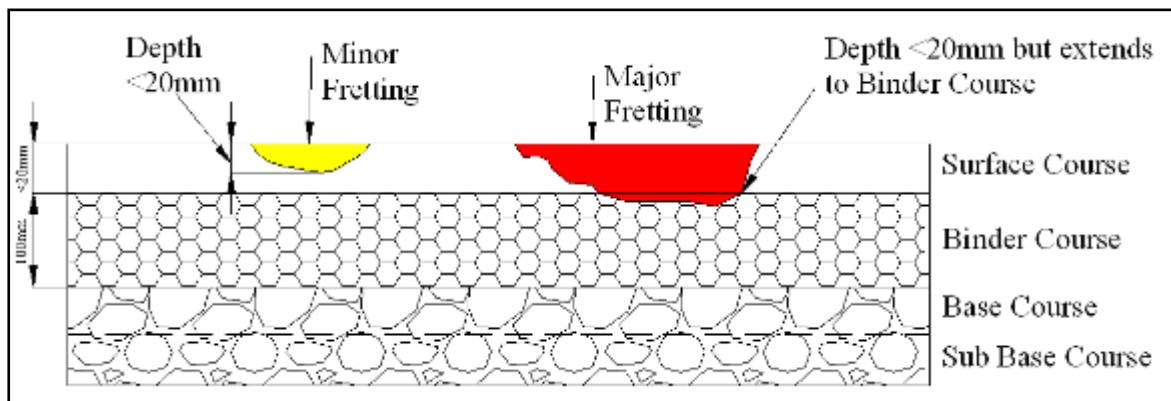
Major Fretting, Pothole

Major fretting and potholing occurs in the pavement due to breaking up and loss of the surfacing material. Extensive areas of fretting combined with structural cracking would indicate that the carriageway is in need of resurfacing works.

Loss of material other than surface applied chippings from the surface course or potholing to the degree that the original surface course is no longer discernible or loss of material from the surface matrix to a depth greater than 20mm would fall into this category.

Based on these defects and the quantity the Engineer will consider a resurfacing treatment, dependant on the amount of failure present.

Example of Major Fretting v Minor Fretting



Attribute = Major Fretting & Potholing



Subsidence and Settlement, Shoving and Corrugations

Subsidence and settlement can appear anywhere along the carriageway and this includes patching and utility reinstatments. Heaving would also be included where tree root damage is present.

Displacement of material (Shoving) and corrugation or transverse shoving usually takes the form of fairly regular waviness in bitumen surfaces in the direction of the wheel paths and in areas of braking, acceleration or cornering.

Settlement or subsidence producing a difference in level greater than 30mm would be categorised as severe.

Basic maintenance inlay patch repair would be recommended in areas of localised settlement

Where settlement exists in the surface layer i.e. shoving and corrugation and areas of failure are not localised, and where other major defects are coincidental the Engineer would consider a resurfacing treatment with localised binder course replacement in areas where severe settlement exists.

Attribute = Subsidence and Settlement, Shoving and Corrugations



Material Movement



Plastic Deformation



Wheel Track Rutting

Wheel track rutting takes the form of depressions along the wheel path and is clearly visible along the road surface. Rutting is common in pavements that are not thick enough to take loads imposed by the traffic using them. This may be due to the pavement being incorrectly designed or possibly because the actual traffic levels are higher than it was designed for. Possible causes could be due to inadequate pavement thickness, structural deficiencies in the pavement material or poorly constructed. A combination of rutting and cracking would potentially indicate a structural discrepancy in the pavement which could from an AEI assessment trigger a resurfacing/reconstruction recommendation. This would be dependant on how consistent the rutting, assuming structural, and other contributing defects along the section.



Patching Failure

Failed patching would also indicate fatigue and potential structural deficiencies resulting in patching breaking up and in some instances combined with depressions/settlement. Failed utility work in the carriageway would also fall into this category.



Surface Deterioration and Minor Fretting

Surface deterioration can cover a wide range of defects common to a carriageway which has historically undertaken a cosmetic treatment such as surface dressing or micro asphalt and is at the point where the surface is beginning to show signs of failure.

The main defects which are generally associated with surface deterioration includes stripping, fatting and polishing common to surface dressing and delamination which can be found on thin surfacings such as micro asphalt beds.

Stripping is the loss of bond between aggregate and binder causing the aggregates to become loose. The possible causes are low binder content, poor binder to stone adhesion, inadequate rolling, excess moisture, temperature discrepancies and additionally stone contamination.

Polishing appears as a smoothing or rounding of the upper surface of the aggregate giving a smooth appearance.

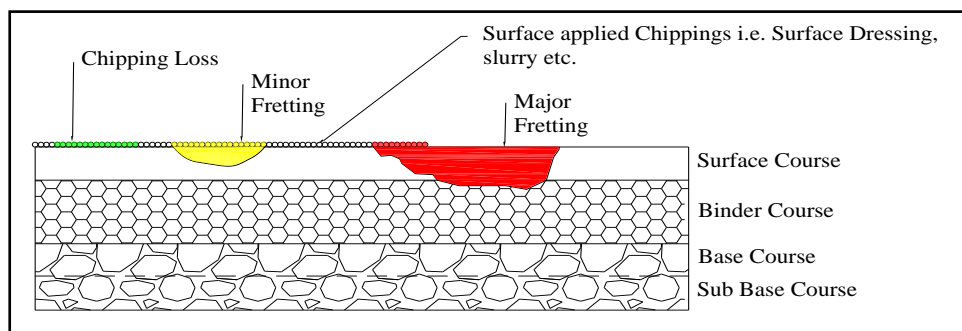
Fatting or bleeding can be caused by excessive application of binder, penetration of aggregate into the original wearing course, poor sealing and hot weather conditions.

Delamination consists of the loss of large and discrete areas of the thin wearing course. This is quite common with micro asphalt where the bond between the original surface course and the thin surfacing breaks down over a period of time.

These defects are common on both classified and urban unclassified sites. When presented with these issues the engineer would need to consider if a further preventative maintenance treatment can be carried out successfully, with minimal patching.

It is quite common to apply more than one preventative maintenance treatment to a section dependant on maintenance hierarchy.

Examples of Chipping Loss/Minor Fretting v Major Fretting



Attribute = Surface Deterioration/Minor Fretting



Description 1	Surface Dressing Stripping
Description 2	Surface Dressing Fatting

Attribute = Surface Deterioration/Minor Fretting



Description 1	Surface Dressing Polishing/Fatting
Description 2	Micro Asphalt Delamination

Concrete Defects

There are several defects associated with concrete pavements.

- General concrete slab cracking (single or multiple)
- Corner cracking
- Corner break
- Longitudinal and Transverse joint cracking
- Spalling
- Joint faulting
- Settlement
- Defective patch
- Joint condition
- Surface dressing stripping

During an AEI survey, on a concrete pavement, the engineer would need to decide on the severity of the defects present and what would be the best solution regarding repair and keeping the concrete surface sealed.

Concrete maintenance can be costly and it is quite common to repair defects using bituminous materials especially when patching failed areas within a bay.

If the concrete surface is showing signs of spalling, joint failure and cracking with evidence of slab movement it is a known practice to repair the joints and apply a thin surfacing or micro asphalt treatment to secure and seal the concrete.

This practice of preventative maintenance repair such as surface dressing or micro asphalt is quite common on a concrete surface.

The treatment although effective is a short term solution and over a period of time the thin surfacing could start to delaminate or strip from the concrete surface.

Attribute = Concrete Defects



Description 1	Concrete Single Crack
Description 2	Concrete Defective Joint Seal

Attribute = Concrete Defects



Description 1	Surface Deterioration Concrete Spalling
Description 2	Bituminous Transverse Patch + Defective Joint/Seal

Attribute = Concrete Defects



Description 1	Concrete Settlement
Description 2	Defective Thin Surfacing over Concrete

Attribute = Concrete Defects



Description 1	Bituminous Patch
Description 2	Concrete Bay Corner Break

2.1. Footway, Cycle Track & Paved Verge Defects

As with carriageway defects, an AEI survey can include typical standardised defects along a section to include off carriageway paved areas. Depending on the defect present this will predominately determine the best solution in returning the paved area back to its expected service level. It is expected that each feature will be specified separately for surveying purposes, as this impacts on survey productivity.

Off carriageway defects identified as part of an AEI assessment can be categorised to provide the correct treatment for a particular paved area or for an individual cross sectional position depending on the complexity of the feature position. It is recommended that any complex off carriageway cross sectional positions are identified prior to an AEI survey taking place.

As defined with carriageway defects, consistent structural defects along a paved area will normally result in resurfacing or even reconstruction works. Where localised surface, non-structural, defects occur this will normally result in Preventative Maintenance treatments or Basic Maintenance repairs.

A description of the following footway defects will determine the overall methodology and structure of the AEI survey and it is important to have a full understanding of all footway defects and the corrective treatment in returning the footpath back to a safe and satisfactory service level.

All the defects discussed in this manual are also contained in other UKPMS survey documents to allow for correlation between the survey types.

Listed and pictured below are typical footway defects.

Bituminous paved areas

1. Major cracking and coarse crazing >2mm in width
2. Minor cracking or crazing <2mm in width
3. Major fretting, loss of material from the surface course to the degree that the original surface course is no longer discernible. This may be apparent if the binder course is exposed.
4. Minor fretting loss of material from the surface course.
5. Severe local settlement/subsidence producing a difference in level greater than 30mm including patches and public reinstatements and areas where the footpath has heaved for example due to tree root damage.
6. Moderate to local settlement and subsidence producing a difference in level from 10mm to 30mm

Attribute = Bituminous Footpath Defects



Description 1	Multiple Cracking >2mm combined with Settlement >30mm
Description 2	Multiple Cracking >2mm with Local to Moderate Settlement between 10mm-30mm

Attribute = Bituminous Footpath Defects



Description 1	Major Fretting and Disintegration combined with Severe Settlement >30mm
Description 2	Major Fretting

Attribute = Bituminous Footpath Defects



Description 1	Minor Fretting and Loose Aggregate
Description 2	As above

Attribute = Bituminous Footpath Defects



Description 1	Severe Footway Heaving >30mm – Tree Root Damage
Description 2	Local to Moderate Heaving 10mm-30mm – Tree Root Damage

Block- Footway Paved Areas

1. Depressed or missing blocks or uncracked blocks which have depressions or vertical projections >13mm
2. Depressed blocks which are cracked and have gradual depressions > 13mm associated with the cracking
3. Cracked but level blocks including spalling but have no vertical projections or depressions >13mm
4. Missing Filler or vegetation in joints

Attribute = Block Footpath Defects



Description 1 Cracked and Level Blocks

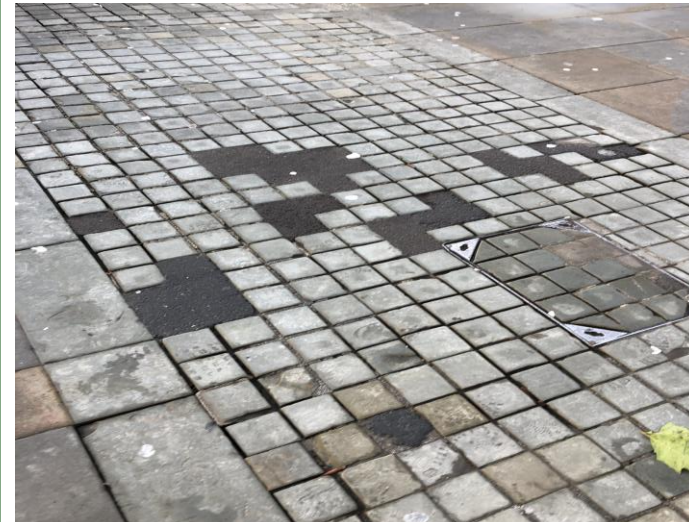
Description 2 Block Disintegration

Attribute = Block Footpath Defects



Description 1	Depressed Blocks >13mm
Description 2	Moss/Vegetation in Joints + Kerb Trip

Attribute = Block Footpath Defects



Description 1	Missing Blocks/Temporary Repair
Description 2	As above

Concrete Paved Areas

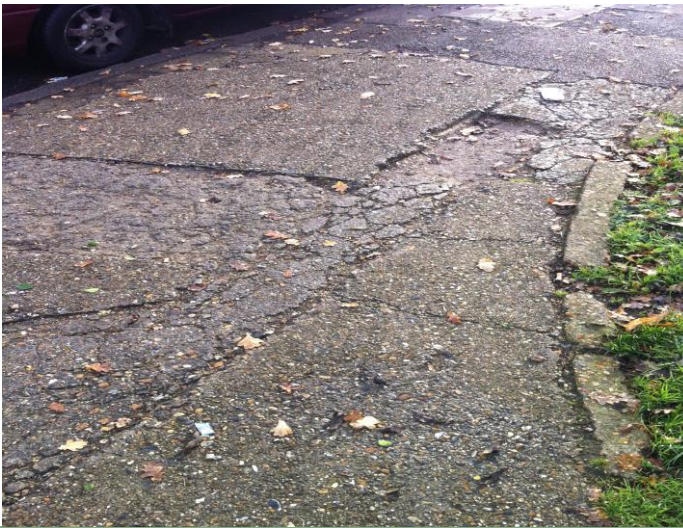
1. Major cracking including wide single and multiple cracks
2. Minor cracking or crazing >2mm
3. Major spalling/fretting with loss of material from the surface leaving the coarse aggregate proud of the matrix or causing loss of coarse aggregate
4. Minor spalling/fretting with loss of material from the matrix causing exposure of the surface of the coarse aggregate
5. Severe local settlement or subsidence producing a difference in level >30mm. Includes patches and public utility reinstatements, gradual depressions associated with cracking of slabs and sudden discontinuities at joints or cracks
6. Moderate local settlement and subsidence producing a difference in level of between 13mm and 30mm.

Attribute = Concrete Footpath Defects



Description 1	Concrete Cracking, Spalling and Settlement between 13mm-30mm
Description 2	Concrete Cracking and Defective Patching

Attribute = Concrete Footpath Defects

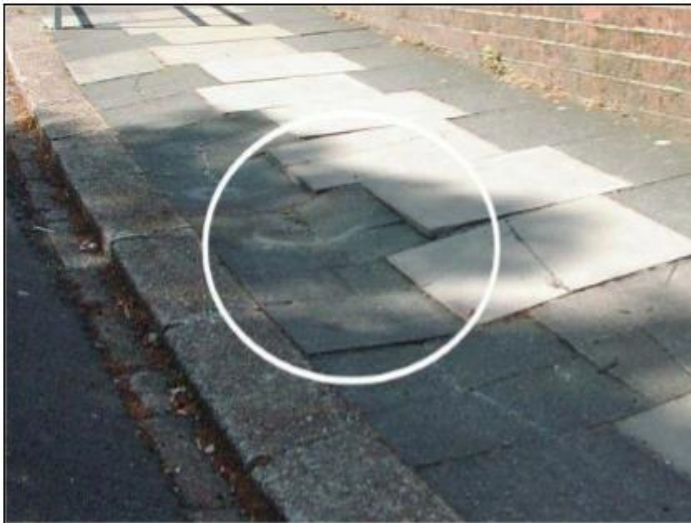


Description 1	Concrete Major Fretting, Spalling, Cracking and Trips
Description 2	Concrete Vertical Trips >30mm and Vegetation along Footpath

Flag Paved Areas

1. Cracked and depressed flags which have a gradual depression or vertical projections >13mm associated with the cracking
2. Depressed flags which are not cracked but have gradual depressions or vertical projections >13mm
3. Cracked flags but have no depressions or vertical projections >13mm
4. Missing filler or vegetation in joints

Attribute = Flagged Footpaths



Description 1	Cracked and Depressed Flags >13mm Trip Hazard
Description 2	As above

Attribute = Flagged Footpaths



Description 1	Cracked and Level Flags
Description 2	Vehicle Override Damage

Attribute = Flagged Footpaths



Description 1	Cracked and Level Flags including Vegetation in Joints
Description 2	Vegetation in Joints

3. CHAPTER 3- Carriageway Treatments

The Engineer during an AEI survey identifies the defects defined in chapter 2 and considers what treatment option should be applied to that road section/treatment length to deliver the correct level of service.

The following treatments have been catergorised as part of the AEI assessment and can be easily edited or updated, as described in Chapter 7 of this manual, based on local rules and needs.

DEFECT CODE	TREATMENT DESCRIPTION
CRSB	Resurface & Binder
CRES	Resurface
CSD1	Surface Dress with >10% Patch
CSD2	Surface Dress with <10% Patch
CMA1	Micro Asphalt with >10% Patch
CMA2	Micro Asphalt with <10% Patch
CHFS	High Friction Surfacing
CPTH	Carriageway Patch
CSDR	Surface Dressing remedial works
CJNC	Carriageway Junction renewal
CJNT	Concrete Joint Repairs incl. overband sealing
CEDJ	Edge Haunching of Carriageway
CEDS	Edge Haunching of Carriageway incl. surface dressing
CRS3	Resurface 3 – 5 years
CSD3	Preventative Maintenance 3 – 5 years
CUTS	Carriageway Up To Standard
CASN	Carriageway As New
CTRK	Carriageway Track / Unmade
CNPR	Carriageway Not Present

Treatment Recorded	Major Cracking		Major Fretting		Settlement / Rutting		Wheel Track Cracking		Surface Detn		Joint Detn		Edge Detn
Resurface Binder	>20	And / Or	>20	with	>5	And / Or	>10	with	N/A		N/A		N/A
Resurface	>20	And / Or	>20	with	<5	And / Or	<10	with	N/A		N/A		N/A
S Dress >10% Patch	>10 & <20	And / Or	<=10	And / Or	>5	And / Or	>10	And / Or	>25%		N/A		N/A
S Dress <10% Patch	<10 & >5	And / Or	>=0	And / Or	<5	And / Or	<10	And / Or	>25%		N/A		N/A
Micro Asphalt >10% Patch	N/A	And / Or	>10 & <20	And / Or	>5	And / Or	>10	And / Or	>25%		N/A		N/A
Micro-Asphalt <10% Patch	N/A	And / Or	>5 & <10	And / Or	<5	And / Or	<10	And / Or	>25%		N/A		N/A
Patching Required	<20	Or	<20	Or	>5	Or	<10	with	<25%		N/A		N/A
SD Remedial Work Reqd	0		0		0		0		>50%		N/A		N/A
Junction Deterioration	>20	And / Or	>20	with	<5	And / Or	<10	with	N/A		N/A		N/A
Joint Repairs	N/A		N/A		N/A		N/A		N/A		>5%		N/A
Edge Haunch	N/A		N/A		N/A		N/A		N/A		>5%		N/A
Edge Haunch + SD	<10 & >5	And / Or	>=0	And / Or	<5	And / Or	<10	And / Or	>25%	With	N/A		>5%
Resurface 3 - 5 Years	>20	And / Or	<5	with	<5	And / Or	<10	with	>5%		N/A		>5%
S Dress 3 - 5 Years	<10 & >5	And / Or	>=0		N/A		N/A	And / Or	>15%		N/A		N/A
Up to Standard	>0 & <5%	Or	>0 & <5%	Or	>0 & <5%	Or	>0 & <5%	Or	>0 & <25%		<5%		N/A
As New	0		0		0		0		0		N/A		N/A
Not Present	N/A		N/A		N/A		N/A		N/A		N/A		N/A

Typical defect quantities to deliver associated treatment

3.1. Resurfacing / Resurface with Binder

If this treatment is selected it indicates that preventative maintenance is no longer an option. Road sections exhibiting major defects combined with structural failure would probably require a resurfacing treatment. Further investigation would be recommended and additionally placed on to a Highways Maintenance Resurfacing Programme for future works.



3.2. Surface Dressing >10% Patch

This item indicated that Surface Dressing is still an option but with a greater need for patching prior to treatment. Caution is required when using this treatment category, if it appears that large amounts of pre patching work is necessary along the section of road. Consideration to the cost and quantity of patching should be taken into account. The option to defer treatment and place on a future Resurfacing Programme may be the better solution if excessive patching is required.



3.3. Surface Dressing <10%

When recommending a Surface Dressing <10% it is expected that the carriageway is at the time exhibiting localised surface defects which will require a certain level of patching prior to surface dressing treatment.

Identify patching requirements and place on a surface dressing programme.



3.4. Micro-Asphalt <10%

Micro Asphalt would be considered a suitable treatment where the carriageway is exhibiting major fretting or cracking of the wearing course <20mm in depth with a sound binder course. When recommending Micro-Asphalt it is expected that the carriageway requires a minimum amount of pre-patching works. Micro Asphalt would be a ideal treatment in areas of surface course delamination.



3.5. Junction Deterioration

If this treatment is selected it indicates that preventative maintenance is no longer a feasible option. It would be expected that the junction area of a road section is exhibiting major defects which will require resurfacing and placing on a maintenance programme for future works. The remainder of the section would be split and an additional treatment selected to reflect the condition of the remaining road section.



3.6 Joint Repair (Bituminous & Concrete)

Selecting this treatment would indicate that defects, associated with joint failure, such as major fretting or breaking away will require joint repair to return the carriageway back to a satisfactory level. Although joint repair is suggested, further investigation would be recommended and a suitable joint seal treatment identified to repair the defect. Concrete joint repairs are also recorded under this item.



Joint Failure



Joint Failure



3.7 Edge Haunch

If this treatment is selected it would indicate that the edge of the carriageway is breaking away with evidence of vehicle damage including lateral movement. It would be expected that by selecting this treatment the edge of the carriageway (within 500mm of the edge) is exhibiting major defects which will require either patching, resurfacing or strengthening. This defect is quite common in areas of deep ditches adjacent to the carriageway.



Edge Failure



Edge Failure



3.8 Edge Haunch with Surface Dressing

If this treatment is selected it would indicate that the edge of the carriageway is breaking away and subject to vehicle overide. It would be expected that by selecting this treatment the edge of the carriageway (within 500mm of the edge) is exhibiting major defects which will require localised patching or partial resurfacing. The remainder of the road section is showing signs of age and requires surface dressing.



3.9 Surface Dress 3 to 5 Years

Selecting this category would indicate that the surface is generally sound and free from major defects but showing signs of age through oxidisation and/or minor surface deterioration. From an engineering perspective it would be considered that the existing surfacing, although not new, would not require any treatment for a least 3 - 5 years and can be monitored via Routine Maintenance or future AEI assessments.



3.10 Carriageway Patching

Basic maintenance patching indicates that the majority of the road section is satisfactory and only requires localised patching works to maintain the service of the carriageway. Sections identified for basic maintenance patch repair would be considered for a future preventative maintenance treatment and placed on a forward works programme if deemed necessary at the time. Monitor via future AEI assessments. Roads exhibiting vegetation growth especially in rural areas shall be recorded under this item.



3.11 Surface Dressing Remedial Work Required

Consider recording this defect when the existing carriageway surface dressing appears new but >50% of the dressing has stripped away. Surface stripping could be due to incorrect rates of spread, contamination, tree over-hang or vehicle damage. Also consideration to any maintenance/warranty agreements that could be in place at the time of assessment. Report to HQ if this is known.



3.12 Up to Standard

Recording up to standard indicates that the carriageway although not new has had a treatment in the last 3 years and requires no remedial works. Monitor via future AEI assessments.



3.13 As New

As New indicates that the carriageway is in excellent condition and less than 12 months old. This could be a recent resurfacing scheme or a preventative maintenance treatment.



3.14 Track/Unmade

Non-metalled roads and public rights of way normally leading to farms or narrow tracks through fields or wooded areas. These would not normally be assessed but reported under site comments at the time of survey with the road construction recorded under the Track/Unmade carriageway feature. These can either be removed from the Highway Network or transferred to a PROW Department for investigation/referencing depending on local rules.



3.15 Not Present

Road does not exist on site. It has been digitised and exists in the UKPMS network but is unable to find on site.

Report this and the relevant section label for further investigation.

4 CHAPTER 4 – Footway Treatments

The Engineer during an AEI survey identifies the defects defined in chapter 2 and decides what treatment option should be applied to that road section/treatment length to deliver the correct level of service. The following treatments have been categorised as part of the AEI assessment and can be easily edited or updated, if required, based on local rules and needs.

The following table outlines the treatments

DEFECT CODE	TREATMENT DESCRIPTION
FREC	Reconstruction
FRES	Resurface
FSTR	Surface Treatment
FRXO	Cross Over Failure
FLAR	Flag Lift and Relay
FRES	Flag Resurfacing
FREP	Flag Isolated Repairs
FMOD	Modular Repair (Block/Setts)
FPTH	Patching
FUTS	Footway Up To Standard
FASN	Footway As New
FTRK	Carriageway Track / Unmade
FNPR	Carriageway Not Present

4.1As New

As New indicates that the footway is in excellent condition and less than 12months old.

This could be a recent resurfacing scheme or a preventative maintenance treatment such as a slurry seal surfacing.



4.2 Up to Standard

Recording up to standard indicates that the footway although not new has had a treatment in the last 3 years and requires no remedial works.

Monitor via future AEI assessments.



4.3 Patching

Basic maintenance patching indicates that the majority of the footpath is satisfactory and only requires localised patching works to maintain the service of the footpath. Sections identified for basic maintenance patch repair would be considered for a future preventative maintenance treatment such as slurry seal and placed on a forward works programme if deemed necessary. Monitor via future AEI assessments. Flexible footways exhibiting vegetation growth especially in rural areas shall be recorded under this item.



4.4 Surface Treatment

Slurry or a Micro Asphalt would be suitable treatment where the footway is exhibiting major fretting or cracking of the surface course <20mm in depth with a sound binder course. When recommending a surface treatment it is expected that the footway requires a minimum amount of pre-patching works.



4.5 Flag Lift and Relay, Flag Repair.

Recording this item indicates that flag units will require lifing and relaying due to defects exhibiting settlement, trips and wide gaps.

Localised cracked/damaged flags will requiring replacing/repair.



4.6 Flag Resurface

Selecting flag resurface indicates that the footpath is in critical/poor condition.

Defective and damaged flags will require excavating and disposing followed by renewing or alternately replacing with a bituminous surface depending on local rules.



4.7 Modular Repair (Blocks/Setts)

This item indicates that localised blocks require making safe. Blocks could have become dislodged or missing. If necessary at the time of the survey report any dangerous defects prior to replacing or re-sitting.

Uneven Blocks



Missing Blocks



4.8 Reconstruct/Resurface

Reconstruction or a resurfacing recommendation indicates that the footway is no longer suitable for a preventative maintenance treatment and is exhibiting major fretting, cracking and settlement.

Report any areas deemed dangerous to pedestrians to HQ for temporary repair.

Footway Major Fretting



Major Footway Disintegration



4.9 Crossover Failure

Crossover failure would include vehicle and pedestrian crossings which are defective and require making safe. This includes modular and flexible crossovers.

Localised Fretting at Vehicle Crossover



Major Fretting at Vehicle Crossing



5 CHAPTER 5 – Surface Types

5.1 Carriageway and Footway Surface Types

During an AEI inspection the Engineer will identify and record the surface type of the carriageway assessed. The Engineer has to choose one of the following options for the majority of the treatment length they have defined.

Item	Name/Description	Abbreviation
1.	Hot Rolled Asphalt	HRA
2.	Stone Mastic Asphalt	SMA
3.	Dense Bituminem Macadam	DBM
4.	Concrete	CONC
5.	Block/Setts	BLK
6.	Surface Dress 6mm	SD6
7.	Surface Dress >10mm	SD10
8.	Surface Dress Racked	SDR
9.	Micro-Asphalt	MA
10.	Surface Dress 6mm-2	SD6-2
11.	Surface Dress >10mm-2	SD10-2
12.	Surface Dress Racked-2	SDR-2
13.	Unmade	UM
14.	Unknown	UKN

Items 10,11 & 12 indicates that evidence shows that two or more preventative treatments exists.

During an AEI inspection the Engineer will identify and record the surface type of the footway assessed. The Engineer has to choose one of the following options for the majority of the treatment length they have defined.

Item	Name/Description	Abbreviation
1.	Dense Bituminous Macadam	DBM
2.	Block	BLK
3.	Setts (Stone)	SETT
4.	Flag	FLG
5.	Flag (Stone)	FLS
6.	Slurry/Surface Dressing	FSS
7.	Concrete	CONC
8.	Prestige/Conservation	PRES
9.	Bit/Flag Combined	COMB
10.	Bit/Setts Combined	COMB
11.	Unmade	UM
12.	Other/Unknown	UKN

Stone Mastic Asphalt



Hot Rolled Asphalt



Surface Dressing



Micro-Asphalt



6 AEI HMDIF file structure

The HMDIF file structure for AEI surveys is below.

```
HMSTART ukPMS 001 " " ; , \
TSTART;
SURVEY\TYPE,NUMBER,NAME;
SECTION\LABEL,SURVDIR,LENGTH,SDATE,EDATE,STIME,ETIME,INSP;
OBSERV\NUMBER,DEFECT,XSECT,SCHAIN,ECHAIN;
OBVAL\PARM,OPTION,VALUE,PERCENT;
OBNOTE\NOTE,COMMENT;
TEND\7;
DSTART;
SURVEY\AEI,001,"James";
SECTION\AEI_SECTION_1",F,560,080217,080217,,JSW;
OBSERV\1,CRSB,C,0,100;
OBVAL\1,,100.00,V;
OBSERV\2,FRES,L,0,50;
OBVAL\1,,100.00,V;
OBSERV\3,FRES,L,75,125;
OBVAL\1,,100.00,V;
OBSERV\4,CSD1,C,100,500;
OBVAL\1,,100.00,V;
DEND\12;
HMEND\21;
```


7 Frequently Asked Questions

- Q1. Can AEI Surveys be carried out from a moving vehicle?**
Yes.
- Q2. What is the minimum treatment length to be recorded?**
100m or section length i.e. cul-de-sac
- Q4. What are the requirements for audit on an AEI Survey?**
Auditing should be carried out in accordance with Chapter 4 *QA and Audit* of Volume 2 of this UKPMS User Manual. The auditor should be accredited.
- Q5. Are Left and Right paved areas inspected separately?**
It is envisaged that the left and right paved areas will be inspected separately and you will be required to use the 'master/partial' survey option.
- Q6. Can AEI surveys be used as an alternative to DVI & CVI surveys?**
Yes
- Q7. Can multiple treatments be recorded in the same XSP?**
Normally no, but in the exception of Edge haunch with main surface treatment is an exception
- Q7. Can AEI survey be carried out from video?**
It is not recommended at present due to the difficulties in achieving same level of accuracy as the physical/manual equivalent.

8 Acknowledgements

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