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Guide to Surface Inspection Rating

For Pavements Surfaced with Sprayed Seals and Asphalt

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VicRoads Technical Bulletin 50

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1. INTRODUCTION

1.1 General

Surface Inspection Rating (SIR) is a standardised system for assessment of the pavement surface condition for sprayed seal and asphalt wearing courses based on visual inspection.

This document provides a guide to the use of SIR for evaluation of the condition of sprayed seal surfaces and asphalt wearing course surfaces by means of a combination of a visual "walkover" inspection, carried out at strategic locations on the pavement surface, and other information available on performance and serviceability.

SIR is to be adopted by all personnel responsible for undertaking surface inspections, as stipulated in the Pavement Conditions Inspections Policy. This will assist in ensuring a more consistent and repeatable approach to the visual assessment of sprayed seal and asphalt wearing course surface conditions.

Detailed definitions, conventions, information and photographs are provided to assist with the SIR assessment. Separate visual assessment criteria are provided for sprayed seals and asphalt as there are fundamental differences in the manner in which the two surface types behave and deteriorate.

1.2 Background

SIR is a tool to uniformly assess the existing condition and estimate the remaining service life of sprayed seals and asphalt wearing surfaces, which may then be used to assist in identifying and prioritising pavement resurfacing.

This process replaces unsystematic procedures that were often used to determine the need to resurface roads based on the age of the existing treatment and/or reports from local maintenance crews indicating loss of serviceability, and a very quick visual inspection of nominated sections to try and set priorities.

SIR is a systematic process that provides the basis for optimisation of available funding for periodic maintenance and the economic service life of surfacing treatments.

1.3 Modes of Distress

1.3.1 General

The main purpose of a bituminous surfacing is to protect and waterproof the pavement and to provide a durable and safe surface to travel on. Sprayed seals and asphalt surfaces are, over time, subject to surface condition deterioration and onset of distress and traffic safety related issues. In a properly designed and constructed surfacing, surface condition distress is generally due to one, or a combination, of the following:

- Hardening of the binder over time leading to loss of surface aggregate or cracking of the surface;
- Cracking due to shrinkage or lack of support of underlying materials;
- Loss of shape due to deformation of asphalt surfaces or deformation of base materials;
- Loss of texture due to flushing of bituminous binders or embedment of sprayed seal aggregate into underlying surfaces.

The nature and volume of traffic will also have an impact on the deterioration rate, or development of distress, for bituminous surfacing treatments.

By visually identifying the types of distress and assigning distress condition ratings, a realistic estimate can be made of the remaining service life of the surfacing.

1.3.2 Identifying Distress

In many cases, the identification of the mode of distress will be relatively straight forward, but in others may require further consideration.

Many pavements will exhibit more than one mode of distress. Often, these distress modes may relate to the same cause, or one distress mode may have developed from another. For example, potholes may have developed from cracking in the pavement surfacing.

Each mode of distress must be considered and assessed separately. It is not essential to identify the initial mode of distress, as the accumulated effect reflects in the total distress rating and provides an indication of the rate of deterioration. Performance history of the section of pavement being assessed may also provide some indication of the rate of deterioration of the pavement or its surfacing. Therefore, identification and assessment of distress needs to take into account:

- Mode of distress;
- Extent (e.g. area affected);
- Severity (e.g. widths of cracks);
- History of the pavement or surfacing treatment.

1.4 Life Expectancy of Bituminous Wearing Surfaces

1.4.1 Sprayed Seals

Sprayed seals are generally used as initial treatments and retreatments in rural areas and provide an effective and economical surfacing for granular pavements. Sprayed seals may also be used as retreatments on asphalt pavements and high traffic roads to provide a waterproof and well textured surface.

When a sprayed seal has been adequately designed, constructed and placed on a sound pavement, the service life of the surfacing is influenced by:

- Size and quality of the aggregate;
- Durability of the binder;
- Climatic conditions;
- Traffic volume and composition;
- Site conditions (e.g. curves, intersections).

Traffic and environmental conditions will significantly influence and affect the service life of sprayed seal treatments. On light to moderately trafficked roads, which comprise a significant proportion of the rural road network, sprayed seals generally deteriorate by hardening of the binder, leading to loss of aggregate from the surface or minor cracking that further leads to entry of moisture, increased cracking and formation of secondary distress such as potholes and shoving. On more heavily trafficked roads, texture loss from aggregate wear and embedment, as well as pavement structural factors, can also influence seal life and retreatment needs.

An important factor in the preservation of sprayed seal assets is an effective program of maintenance reseals. Timely resealing prevents stone loss that results from hardening of binder and prevents, or seals, minor cracking. Deferment of such periodic maintenance can lead to a rapid increase in routine maintenance and accelerated pavement deterioration. On the other hand, retreatment based on seal life alone can result in unnecessary resurfacing of sprayed seals that may continue to provide several more years of effective service.

The visual rating process provides criteria for assessing binder condition, texture loss and binder loss as additional predictors of remaining seal life, rather than relying solely on the more visible indicators of actual stone loss, visual cracking and maintenance patching activity.

1.4.2 Asphalt Wearing Courses

Asphalt surfacing is generally used on more heavily trafficked roads, particularly in urban areas, to provide greater resistance to traffic stresses. Asphalt is used less frequently on rural roads, usually at specific locations such as intersections and roundabouts, or to improve ride quality. Asphalt surfaces are also often used in residential streets and other light traffic applications due to reduced maintenance requirements.

Like sprayed seals, asphalt wearing surfaces will gradually deteriorate due to hardening of the binder and loss of aggregate from the surface. This is a very slow process. It is difficult to apply a simple visual assessment to the rate of hardening of binder in asphalt as a predictor of remaining life. In most cases the rate of stone loss from Dense Graded Asphalt (DGA) and Stone Mastic Asphalt (SMA) surfaces will be very slow and the appearance of the asphalt may remain unchanged for many years.

Eventually surface stone loss in asphalt (ravelling) will be revealed as complete loss of surfacing material and emergence of the underlying surface or by evidence of level difference against adjoining structures.

Provided that the asphalt has been properly designed and constructed, the life of DGA and SMA, due to weathering alone, should be in excess of 20 years. On more heavily trafficked roads, or roads with a high percentage of commercial vehicles, other factors such as skid resistance, surface rutting, shape loss, or cracking due to deficiencies in base materials, tend to have a greater influence than durability, so that the average life of DGA and SMA on such roads is more commonly 12 – 15 years.

Porous asphalt surfaces such as Open Graded Asphalt (OGA) and Ultra Thin Asphalt (UTA), however, have a shorter life due to exposure of binder to oxidation for the full depth of the layer. The average life of OGA and UTA is around 10 years for conventional bitumen binders and up to 12 – 15 years for polymer modified binders. Deterioration of porous surfaces will progress more rapidly once ravelling starts to appear. Rather than a uniform loss of surface material it will usually appear as more rapid deterioration in wheel path areas progressing to isolated areas of loss of the full depth of the layer.

1.5 Determining Resurfacing Priorities

The SIR provides an indication of the condition of the existing surfacing. The rating system has been confined to a few basic criteria to minimise influence of observer skill or bias and to avoid implying an unrealistic level of accuracy.

The rating procedure provides a tool to assist in ranking priorities for resurfacing. It is, however, limited to factors related to the serviceability of the wearing surface and does not take into account operational issues such as the importance or classification of the road, prevailing weather conditions, traffic types and volumes, funding arrangements, other performance standards such as ride quality or skid resistance, or the structural adequacy of the underlying pavement.

The ratings determined from the SIR thus cannot be used to directly compare priorities for sprayed seal and asphalt, due to the different number and nature of distress criteria assessed as well as other factors to be considered in data analysis and development of the final surfacing program.

Other factors that may influence the need to resurface a pavement include:

- Skid resistance;
- Pavement structural adequacy;
- Noise levels;
- Water spray generation;
- Accident/safety;
- Roughness.

The ratings are also only intended to be used to determine the potential need for treatment and not to establish the cause of distress or selection of treatment type, which may require further field investigation and testing.

2. VISUAL ASSESSMENT CRITERIA

2.1 General

To provide some background, and a reference, the following section describes the various distress modes that may be encountered during an inspection.

Descriptions are based on information from "*Guide to Pavement Technology, Part 5: Pavement Evaluation and Treatment Design*" (Austroads 2009) which presents a comprehensive and detailed description of the most common types of pavement and bituminous surfacing distress, including photographs illustrating typical forms of the distress.

2.2 Cracking (Sprayed Seals and Asphalt)

Cracks are fissures resulting from partial or complete fractures of the pavement surface ranging from isolated single cracks to an interconnected pattern extending over the entire pavement surface. Cracking has many detrimental effects, including the loss of waterproofing and load spreading ability that usually leads to accelerated deterioration of the pavement condition.

2.2.1 Block Cracks

Interconnected cracks forming a series of blocks, approximately rectangular in shape. Commonly distributed over the full pavement. Cell sizes are usually greater than 200 mm and can exceed 3000 mm.

Possible causes:

- Joints in underlying concrete layer;
- Shrinkage and fatigue of underlying cemented (either introduced or naturally occurring) materials;
- Shrinkage cracks in asphalt surfacing owing to daily temperature cycles.

2.2.2 Crescent Shaped Cracks

Half moon or crescent shaped crack, commonly associated with shoving, often occurring in closely spaced, parallel group. Mainly associated with asphalt surfacing.

Possible causes:

- Poor bond between wearing course and underlying layers;
- Low strength base course;
- Thin wearing courses;
- High stresses due to braking and acceleration movements.

2.2.3 Crocodile Cracks

Crocodile cracks may also be known as alligator, chicken wire, fish net, polygonal cracks or crazing. They are interconnected or interlaced cracks forming a series of small polygons resembling a crocodile hide. They are usually associated with wheel paths and may have a noticeable longitudinal grain. Cell sizes are generally less than 150 mm across but may extend up to 300 mm.

Possible causes:

- Inadequate pavement thickness;
- Low stiffness/strength base;
- Brittle base or wearing course.(e.g. cemented, aged);
- Fatigue cracking in brittle (aged) asphalt wearing course.

2.2.4 Diagonal Cracks

An unconnected crack which generally takes a diagonal line across a pavement.

Possible causes:

- Reflection of a shrinkage crack or joint in an underlying cemented material;
- Differential settlements between embankments, cuts or structures;
- Tree roots;
- Service installation.

2.2.5 Longitudinal Cracks

An unconnected crack running longitudinally along the pavement. Can happen singly or as a series of almost parallel cracks.

Possible causes:

(i) Occurring singly:

- Reflection of a shrinkage crack or joint in an underlying base
- (commonly Portland cement concrete, cemented base or asphalt base);
- Poorly constructed paving lane joint in asphalt surfacing;
- Daily temperature cycles, or asphalt hardening;
- Displacement of joint at pavement widening.

(ii) Occurring as a series of almost parallel cracks:

- Volume change of expansive clay subgrade, due to moisture;
- Cyclical weakening of pavement edge;
- Differential settlement between cut and fill.

2.2.6 Meandering Cracks

An unconnected irregular crack, varying in direction, usually occurring as single cracks.

Possible causes:

- Reflection of a shrinkage crack;
- Weakening of the pavement edge due to moisture;
- Differential settlement between embankments, cuts or structures;
- Tree roots.

2.2.7 Transverse Cracks

An unconnected crack running transversely across the pavement.

Possible causes:

- Reflection of a shrinkage crack or joint in underlying base;
- Construction joint, or shrinkage crack in asphalt surfacing.

2.3 Loss of Aggregate from Sprayed Seals

The loss of aggregate from a sprayed seal is usually referred to as “stripping”.

It may be due to poor initial adhesion between the aggregate and the binder, or loss of adhesion of the binder (and its ability to retain aggregate) due to oxidation and hardening over time.

The effect may be a loss of individual aggregate particles or a complete loss of aggregate in a localised area(s).

Possible causes:

- Low binder contents for the aggregate size and conditions;
- Poor binder to stone adhesion;
- Ageing or absorption of binder;
- Aggregate particle deterioration;
- Incorrect blending of binder;
- Inadequate rolling before opening the seal to traffic.

2.4 Loss of Aggregate from Asphalt

2.4.1 Ravelling

Loss of aggregate from asphalt is usually referred to as “ravelling” but may also be termed “fretting”. Initially, a small amount of ravelling occurs due to weathering of surface binder and fine aggregate, leaving the coarse aggregate exposed as the predominant texture in the mix. An asphalt surface can remain in this condition, visually unchanged, for many years. Eventually, further hardening of the binder can lead to increasing loss of both coarse and fine particles that finally becomes noticeable as exposure of areas of the underlying layer, or loss of level against adjoining structures.

More rapid, and serious, ravelling may show up as marked loss of material in wheel tracks, compared to other areas, or accelerated loss from areas of poor compaction such as joints and handwork.

Behaviour of OGA and UTA is slightly different to dense asphalt mixes in that there may be little indication of ravelling for some time, depending on binder type, but then proceed quite rapidly with total loss of the surfacing layer in wheel paths and other areas of significant traffic stress.

Possible causes of premature ravelling in asphalt mixes are:

- Deterioration of binder and/or aggregate particles;
- Inferior asphalt mix design;
- Inadequate compaction, construction during wet or cold weather;
- Using aggregates with poor binder adhesion properties

2.4.2 Delamination

Delamination may also be referred to as “peeling”, “surface lifting” or “seal break”, and is normally associated with the loss of discrete and large areas of asphalt to the full depth of the wearing course layer. Usually there is a clear delineation of the wearing course and the layer below.

Possible causes:

- Inadequate cleaning or inadequate tack coat before placement of upper layers;
- Seepage of water through asphalt (especially in cracks) to break bond between surface and lower layers;
- Weak, loose layer immediately underlying seal;
- Adhesion of free surface binder to vehicle tyres.

2.5 Binder Condition (Oxidation) in Sprayed Seals

Bitumen hardens under the influence of heat and oxygen in the air. The rate of hardening (oxidation) is influenced by many factors, but the main factors are the prevailing climatic conditions, the bitumen thickness and exposure to air. Generally, the hotter and drier the environment the quicker the binder will harden. Also, thin films of binder will harden relatively quicker than thicker films of binder. Therefore, the binder in a size 7mm seal (generally applied at relatively low application rates) is usually harder and more oxidised than a binder in a size 14mm seal (relatively higher binder application rates) under similar conditions and at the same age.

In sprayed seals it may be determined by visually ascertaining the viscosity (consistency) and adhesion properties of the binder sticking to the aggregate particles removed from the seal.

Bitumen viscosity is related to temperature and therefore the temperature at the time of inspection and assessment will strongly influence the condition of the bitumen. It is recommended that the inspection be carried out when the pavement temperatures are at least 20 degrees Celsius. At lower temperatures there may be a tendency to rate the binder at “lower than actual”, and this may therefore introduce a bias into the rating.

2.6 Binder Level in Sprayed Seals

The level of the binder up the aggregate particles will influence the ease with which a piece of aggregate may be dislodged from the binder.

The lower the level of binder (Binder Loss), the less physical support there is for the aggregate and the quicker and easier the aggregate particles are lost under the action of traffic. This may occur more quickly in cool/cold and/or wet conditions.

A higher level of the binder (Texture Loss) up the aggregate particle will provide greater support.

The level of binder, together with the binder condition, provides a practical indication of the remaining service life from the point of view of binder performance.

From a design binder application rate point of view, there is a requirement to compromise between long life and providing adequate surface texture. Generally, the binder level in a sprayed seal with an aggregate size of 10 mm, or larger, should have the binder between half and two thirds up the height of the aggregate particles. This is expected to happen within the first two years after construction of the seal.

2.7 Maintenance Patching (Sprayed Seals and Asphalt)

2.7.1 General

The extent of maintenance patching provides a reasonable indication of the pavement performance with regard to strength and the effect of moisture passing through the surfacing into the pavement.

The amount of maintenance patching carried out depends to a large degree on the maintenance practices and standards adopted in the area.

2.7.2 Potholes

These are bowl-shaped depressions in the pavement surface resulting from the loss of wearing course and base course material. They generally have sharp edges and nearly vertical sides at the top of the hole. Potholes are produced when traffic abrades small pieces of the pavement surface (cracking, delamination, etc) allowing the entry of water. These areas then disintegrate further because of the weakening of the base course or poor quality surfacing. Free water collecting in the hole and the underlying base also accelerates the pothole development.

Possible causes:

- Loss of surface course;
- Moisture entry to base course through a cracked pavement surface;
- Load-associated disintegration of base;
- Pickup of bitumen wearing surface in sprayed seals caused by binder adhesion to tyres.

2.7.3 Patches

A patch is a repaired section of pavement. It may or may not be associated with a loss of serviceability (apart from a loss of appearance) or structural capacity. The extent and frequency of patching can be useful indicators of the structural adequacy of the pavement. Patching usually takes one of the two following forms.

Expedient patches

These are surface repairs without digging out. The deficiency could include deformation cracking, stripping, edge break, etc. An expedient patch will usually not be regular in shape. Multiple expedient patches of different age are usually an indication of continuing deterioration. Such patches may also require some further attention before resurfacing.

Reconstruction patches

These are repairs where material has been removed and the area reconstructed. The repair may be confined to the surfacing course or extend through all courses. Reconstruction patches will usually be regular in shape. The reasons for the reconstruction patch could vary from the need to correct a pavement deficiency, to the provision of a trench for services.

Possible causes:

- Correction of surface deficiencies;
- Correction of structural deficiencies, within surface course, pavement or subgrade;
- Excavation for services.

2.7.4 Edge Defects

These occur along the interface of a bituminous surfaced pavement and the shoulder. They are most significant where the shoulder is unsealed. The detrimental effects of edge defects include reduction of pavement width, loss of ride quality, possible loss of vehicle control, and channelling of water at the pavement edge which leads to shoulder erosion or entry of water into the base. Two types of edge defects are:

Edge Break – the edge of the bituminous surface has fretted, broken, or is irregular.

Edge Drop Off – the vertical distance from the surface of the seal at the edge to the surface of the shoulder. Not usually considered a defect if drop off is less than 10–15 mm.

2.8 Loss of Surface Texture

2.8.1 General

Loss of surface texture in this context refers to reduction in surface macrotexture creating a smoother surface that may also lead to loss of skid resistance and/or increased potential for aquaplaning.

Loss of surface texture may be due to either loss of most or all of the aggregate in a sprayed seal leaving the binder exposed embedment of the sprayed seal aggregate into a soft underlying layer such as poorly compacted patching material, or flushing/bleeding of the binder to the surface in both sprayed seals and asphalt.

Reduction in surface texture due to flushing or bleeding does not usually indicate pavement structural inadequacy, but may have significant influence on the serviceability of a pavement surfacing, especially with regard to skid resistance and ride quality.

Other forms of texture variation include partial loss of aggregate through stripping in sprayed seals and ravelling or delamination of asphalt. These forms of texture variation do not lead to loss of skid resistance and are rated separately as Loss of Aggregate.

Loss of skid resistance may be due to loss of surface texture as described above, or due to the aggregate becoming polished by the action of the traffic, particularly from heavy vehicles.

The degree of polishing cannot be quantified visually and loss of skid resistance is therefore not included in the visual inspection rating of surfaces, but may influence priorities for treatment. There are various types of equipment available to measure skid resistance. In VicRoads skid resistance is currently measured using SCRIM (Sideways force Coefficient Routine Investigation Machine).

2.8.2 Flushing

Flushing may also be referred to as “texture loss”, “bleeding”, “fatty”, “slick” or “black”. Flushing can be defined as immersion, partially or completely, of the aggregate into the bituminous binder causing low texture depth and inadequate tyre-to-stone contact.

Possible causes:

Sprayed seals:

- Excess application rate of binder, with respect to stone size;
- Excess primer/primer binder, being incorporated into the new seal;
- Excess binder in underlying surface (patch or flushed area);
- Penetration (embedment) of aggregate into a soft, or low strength, base;
- Cutback bitumen primer/primer seal covered before volatile cutter oils have evaporated.

Asphalt

- Inappropriate mix design with low air voids, high binder content, or low stiffness binder for traffic conditions;
- Poor manufacture with excess binder;
- Heavy traffic causing excess compaction of mix;
- Bleeding of cutter materials from fresh underlying sprayed seal.

2.9 Deformation

2.9.1 General

Deformation or loss of shape is the change in road surface from the constructed (intended) profile. Deformation may directly influence the riding quality of a pavement (roughness), and it may also reflect structural inadequacies in the base or instability of the surfacing material.

2.9.2 Rutting

Deformation (longitudinal) in a wheel path.

Possible causes:

- Inadequate support from the subgrade;
- Inadequate pavement thickness;
- Poor compaction of the base;
- Inadequate strength or stability in the surfacing or base.

2.9.3 Shoving

Shoving is described as bulging of the road surface, parallel or transverse to the direction of traffic, generally in areas of heavy braking or acceleration.

Possible causes:

- Inadequate shear strength or stability in the surfacing or base;
- Inadequate pavement thickness;
- Poor bond between layers;
- Lack of containment of pavement edge.

2.9.4 Depressions

Depressions are localised areas within a pavement with elevations lower than the surrounding area. They may not be confined to wheel paths and could extend across several wheel paths.

Possible causes:

- Settlement of trenches;
- Traffic compaction of soft or poorly compacted areas in subgrade etc;
- Volume changes in subgrade materials;
- Settlement due to instability.

2.9.5 Corrugations

Described as transverse undulations, closely and regularly spaced, with wavelengths of less than 2 metres, can also be referred to as megatexture.

Possible causes:

- Inadequate stability of asphalt surfacing or base course,
- Compaction of base in wave form.

3.1 Definitions and Conventions for Conducting the SIR Visual Assessments

3.1.1 Location System

The location system adopted for collection of condition information on a road network is a central component to the success of asset management systems. A core requirement of the adopted location system is clear definitions for the road start point (road datum). Accuracy of the road start point (road datum) is essential so that segments established during the SIR can be easily located in the future.

3.1.2 Determining Type of Existing Surfacing (S or A)

Separate rating criteria are provided for sprayed seals (S) and asphalt surfaces (A). It is important that the user understands the type of surface being assessed, as the modes of deterioration and hence surfacing priorities may be quite different. Sometimes it is difficult to differentiate between well textured asphalt and a sprayed seal due to similarities in appearance. It may be necessary to look for additional visual clues such as evidence of asphalt paver joints or signs of binder flowing from the edges of a sprayed seal.

The presence of flushed areas of binder in an otherwise well textured surface indicates that the surfacing is most likely a sprayed seal rather than asphalt. Exceptions may occur due to poor maintenance patching, or segregation of binder leading to isolated slick patches, for example during the placing of OGA, SMA and UTA. If in doubt, construction records should be checked.

It is not essential to distinguish between DGA and other types of asphalt such as SMA OGA or UTA as the visual assessment of the distress conditions is currently the same. However, it is useful to know the type of asphalt in order to determine a suitable periodic or rehabilitation treatment.

A further surfacing type that may be encountered is Slurry Surfacing (slurry seal or microsurfacing). This material may be difficult to distinguish from asphalt. A closer inspection of the surface usually shows a longitudinal streaking from the placing procedure and a more random placement of any coarse particles than the texture of paver placed asphalt. For the purposes of visual assessment, Slurry Surfacing is currently rated the same as an asphalt wearing course but the surfacing type should be noted for separate consideration in determining a suitable rehabilitation treatment or resurfacing priorities.

Photographs of typical surfacing conditions have been provided as a reference for assessing a distress condition, and to determine an appropriate rating.

3.1.3 Identifying Defects

To ensure the observer fully identifies a defect, and thus makes an appropriate rating, the pavement must be viewed at various angles, heights and distances. Moisture on the pavement surface affects visible details, sometimes hiding and at other times enhancing the detail. Different light intensity and angle of the sun, or shadows, can sometimes do the same.

3.2 Assessment Criteria

3.2.1 General

The assessment criteria used to visually evaluate the surface condition of a sprayed seal or asphalt wearing course is separated into two parts:

- Core Criteria – items that primarily relate to the integrity and durability of the surfacing;
- Non-core Criteria – items that primarily relate to the effect on users.

Separate criteria are applied to sprayed seals and asphalt wearing courses due to different deterioration mechanisms.

Refer also to:

- Section – 1.3 Modes of Distress, and
- Section – 1.4 Life Expectancy of Bituminous Wearing Surfaces.

3.2.2 Core Criteria Assessment

These are the 'primary' criteria used to estimate the current condition or distress state(s), to establish the integrity of the surfacing layer as an indicator of remaining service life.

This is the minimum level of input required to decide on priorities for resurfacing.

The Core Criteria assessed for Sprayed Seals are:

- Cracking;
- Loss of Aggregate (Stripping);
- Maintenance Patching;
- Binder Condition (Oxidation);
- Loss of Binder.

The Core Criteria assessed for Asphalt Wearing Courses are:

- Cracking;
- Loss of Aggregate (Ravelling);
- Maintenance Patching.

3.2.3 Non-Core Criteria Assessment

These are the 'secondary' criteria used as additional information to indicate the expected performance of the surfacing with regard to issues of traffic safety and ride quality. These criteria are generally related to traffic, construction practices and standards, rather than the age and integrity of the surfacing.

The Non-Core Criteria assessed for both sprayed seals and asphalt wearing courses are:

- Loss of Surface Texture;
- Deformation (loss of pavement shape).

3.2.4 Loss of Binder / Loss of Surface Texture

The evaluation for Binder Loss and texture Loss is conducted in the wheelpaths of the lane being assessed. As the SIR is an overall condition assessment tool the evaluation should also indicate an overall condition rating. The following table gives an indication of how it is rated in the SIR methodology.

CONDITION / DISTRESS STATE	DESCRIPTION	BINDER LOSS	TEXTURE LOSS
		Rating	Rating
Binder at or above the top of the aggregate	Flushed	0	5
Binder ¾ to just below the top of the aggregate	Full	0	3
Binder ⅔ to ¾ up the aggregate	Fine Textured	0	1
Binder ½ to ⅔ up the aggregate	**Good Seal**	**0**	**0**
Binder ⅓ to ½ up the aggregate	Coarse Texture	1	0
Binder ⅓ to just above the bottom of the aggregate	Hungry Seal	3	0
Binder at or beneath the aggregate	Very Coarse Texture	5	0

3.2.5 Evaluation Scale

The Surface Inspection Rating procedure is based on a visual assessment the scale adopted is fairly broad and simple. This will eliminate any tendency to end up with an artificial accuracy. Based on a number of years of past history, and use of similar systems by others, the principles and ratings adopted have been proven to be quite effective in determining the need and priority for periodic maintenance treatments such as reseals and asphalt resurfacing.

The following scale has been adopted to rate each of the distress criteria:

RATING	CONDITION / DISTRESS STATE
0	Good
1	Minor
3	Moderate
5	Extensive

As a general approach, the scale adopted reflects the influence of the level of distress on the estimated remaining life. A rating of 0 indicates that there is nil or little distress, gradually increasing to a maximum rating of 5 that indicates major distress with a strong influence and reduction in remaining life.

3.2.6 Additional Surface Codes

There are many other surfacing types on the network. The following table gives an indication of how to classify the surface type and how it is rated in the SIR methodology.

CODE	SURFACE	COMMENT
A	Asphalt	Rate as Asphalt
C	Concrete	Not Rated
G	Gravel	Not Rated
X	Other	Not Rated
S	Stone Seal	Rate as Seal
U	Ultra Thin Asphalt	Rate as Asphalt
H	High Friction Surface	Rate as Seal

3.3 SIR Inspections

3.3.1 General

Where available from existing records, determine the location of start and finish of each type or size of treatment, as well as the elements included, as a starting point for segmentation during the SIR inspections. Otherwise, the start and finish of each treatment will be as determined on site during the inspections. Accuracy of the existing records will be verified on site during the inspections.

After locating the appropriate surface change or seal join, the initial inspection should be about 50 to 100 m from the start. The inspector should then drive very slowly (< 25 km/h) along the road looking for changes in the condition of the surfacing treatment. If no change is observed, stop every 300 to 500 m along the treatment for a detailed inspection. The final inspection should be at about 50 to 100 m from the end of the treatment (surface change or seal join).

If there is noticeable variation in the condition of the surfacing or types of distress (which will affect the rating), these must be split into separate segments and the location, elements and condition ratings recorded for each (refer to Section 3.5 – Segmentation).

3.3.2 Frequency of SIR Inspections

The SIR inspections are typically conducted annually or in a staged process, such as by inspecting approximately one third of the declared road network each financial year. The result of using a rolling program is that the entire declared road network will only have the SIR data collected every three years.

The SIR process can also be used to conduct additional assessments of pavement segments on an as required basis.

3.3.3 Single Carriageway – Unsealed Shoulders

Single or two lane widths can usually be inspected and rated full width. If there are more than two lanes, or if there is a noticeable difference between the lanes, each lane should be inspected and rated separately.

3.3.4 Single Carriageway – Sealed Shoulders

Generally, assessments are the same as for 3.3.3 Single Carriageway – Unsealed Shoulders, except that the shoulders will need to be inspected and rated separately from the through lanes.

3.3.5 Dual Carriageway Roads

Often the traffic pattern, treatment history and condition are quite different in each direction of dual carriageway roads; therefore, each direction of a divided carriageway is rated separately. If there is a noticeable difference between lanes, each lane should be inspected and rated separately. Any sealed shoulders should also be rated separately.

3.4 Operational Responsibility

3.4.1 General

With the introduction of the Road Management Act in 2004, the demarcation of operational responsibility was identified, this ensured that organisational accountability for road infrastructure assets was clearly defined including the various parts and elements within the road reserve as the accredited SIR inspectors need to collect condition information for the areas and elements under the road owner's responsibility.

Where a specific arrangement between the road owner and a Municipal Council is entered into that changes or clarifies the operational responsibility, it is the road owner's responsibility to inform the SIR Contract Superintendent and the accredited SIR inspector of these specific arrangements.

3.4.2 Freeways

The SIR inspections need to assess the condition of all sealed surfaces within freeway road reserves. This includes all entry and exit ramps, non-commercial truck and rest area parking, and wearing courses on local road bridges over or under the freeway.

3.4.3 Arterial Roads – Urban Areas – Intersections

The SIR inspections need to assess the condition of all sealed surfaces within these demarcation limits.

Generally, the demarcation limits include slip lanes, acceleration and deceleration lanes and roadway area's where detector loops are installed. These minor areas would be included as additional area in the SIR assessment.

3.4.4 Arterial Roads – Urban Areas – Between Intersections

Mid block urban areas include:

- Any arterial roads located 'kerb to kerb' that provides for operation of through traffic
- Shoulders where there are no formal designated parking
- On road bicycle lanes.

Hence, the SIR inspections need to assess the condition of all sealed surfaces that fall within the demarcation limits described in one or more of the above dot points.

VicRoads operational responsibility does not include:

- Service road traffic lanes and shoulders
- Indented parking bays and any other part of the roadway located 'kerb to kerb' that could not be made available for through traffic

3.4.5 Arterial Roads – Rural Areas – Intersections

The SIR inspections need to assess the condition of all sealed surfaces within the demarcation limits for each intersection.

Unless otherwise defined the demarcation limits of VicRoads operational responsibility at the intersection with a local road shall be defined as a line square to the entering roadway that is the greater of:

- The limit of the property splay at the intersection
- The limit of the longest splitter island
- Five (5) metres measured from the stop line.

3.4.6 Arterial Roads – Rural Areas – Between Intersections

The SIR inspections need to assess the condition of all sealed surfaces that fall within the road reserve for rural areas between intersections, with the exception of:

- Service roads
- Off road bicycle pathways
- Other pathways

3.5 Segmentation

3.5.1 General

A segment is defined as an area of pavement, with a 'like treatment' and consistent width and condition parameters, incorporating one or more elements plus additional areas.

Further clarification of the various pavement areas contained within a segment are included in:

- 3.5.2 Elements
- 3.5.3 Additional Areas

The primary purpose of segmenting a road pavement during the Surface Inspection Rating (SIR) inspections is to better trigger the treatments applied at the project level and drive the development of annual maintenance programs.

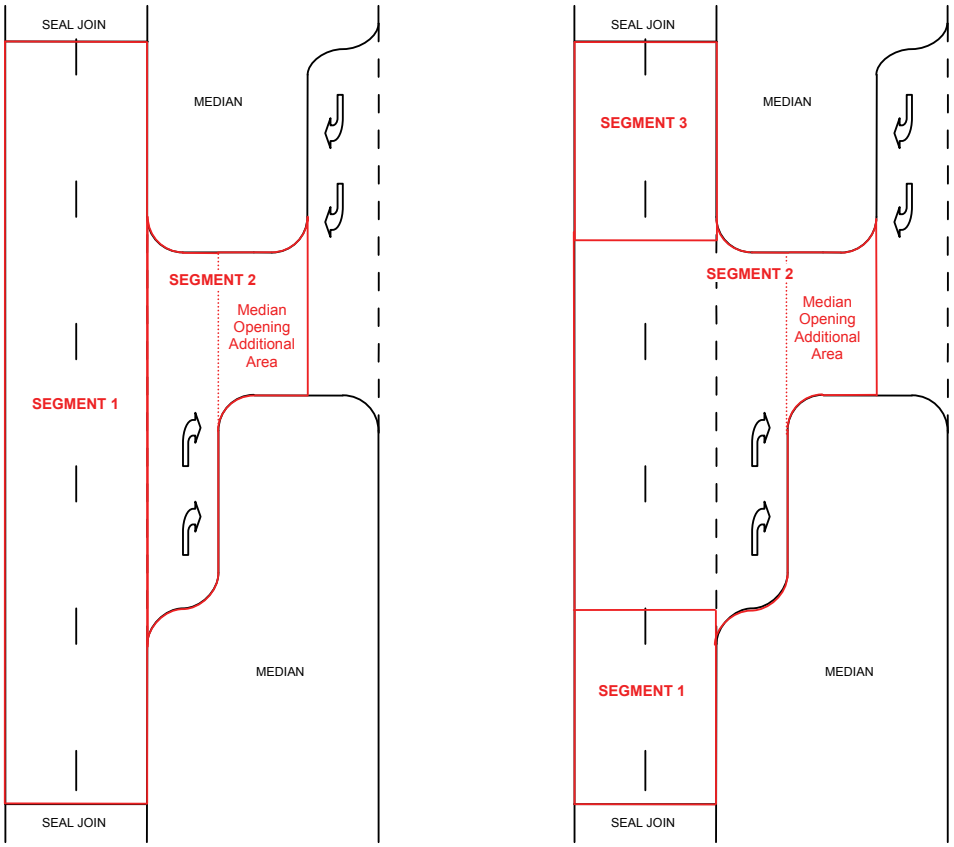
Segmentation of road pavements is required to ensure uniformity of inputs for asset management systems that depend upon data integrity. Furthermore, segmentation of road pavements based on a set of defined rules, will form the basis for consistency and repeatability of data collection during the SIR inspections.

In its simplest form, a road is split up into a number of segments that are uniform in their physical condition. Each segment should ideally be a homogeneous section of road, with a defined start and end point and defined elements. However, due to the inherent variability of pavements, a homogeneous section is purely a theoretical concept. It is therefore necessary to segment a road network based on a set of basic 'rules of thumb'.

The primary 'rule of thumb' for the Surface Inspection Rating (SIR) is segments will be defined according to the limits of the work history. That is, where a 'like treatment' is clearly visible (typically by a surface change, seal join or construction join) then it will be rated as a single segment.

Another primary 'rule of thumb' for the SIR is segments will be defined according to consistent width parameters. That is, where there is a clear change in pavement width (such as a new through lane or turning lane) then a new segment will be rated to ensure the integrity of pavement width measurements.

The following diagrams, with the red outline showing a 'like treatment', provide generic examples of acceptable SIR segmentation procedures, to ensure that the integrity of width measurements is maintained.



Acceptable – Preferred Option Acceptable – Non-preferred Option

Figure 1 Generic Examples of Segmenting Procedures for Width Data Integrity

It is not acceptable to assess the entire area with the red outline as a single segment. That is, the start chainage and the end chainage of the right turn lane constitutes a clear change in pavement width, and therefore requires a new segment to be rated.

Other secondary 'rules of thumb' that should be considered when identifying segments during the SIR inspections include:

- Consistent condition parameters (as much as is practicable)
- Traffic usage and movements (e.g. high traffic intersections or parking areas)
- Similar terrain and environmental conditions (e.g. hilly and wet versus flat and dry).

If segments are carefully selected during the SIR inspections, they will rarely need changing. This will assist in tracking condition history and associated pavement performance parameters, as further data is collected during subsequent periodic condition surveys. Segment start and end points and/or the elements included in a given segment, should only need to be changed where a treatment is partially applied to an existing segment, thus changing the work history and creating a new 'like treatment' segment.

3.5.2 Elements

Elements are used to define the various parts of the road network where a surfacing treatment may be applied. It is reiterated that the primary 'rule of thumb' for the SIR is that segments will be defined according to the limits of the work history (i.e. 'like treatments'). Therefore, in many circumstances, a given segment will incorporate a number of elements or group to represent the 'like treatment'.

Listed below are suggested representative elements for use during the SIR data collection as used by the accredited SIR inspectors.

DESCRIPTION	ELEMENT
Lane 1	L1
Lane 2	L2
Lane 3	L3
Lane 4	L4
Lane 5	L5
Lane 6	L6
Lane 7	L7
Lane 8	L8
Shoulder Left	SL
Shoulder Right	SR
Off Ramp Lane 1	ROF1
Off Ramp Lane 2	ROF2
Shoulder Left Off Ramp	ROFSHL
Shoulder Right Off Ramp	ROFSHR
On Ramp Lane 1	RON1
On Ramp Lane 2	RON2
Shoulder Left On Ramp	RONSHL
Shoulder Right On Ramp	RONSHR
Left Turn 1	LT1
Left Turn 2	LT2
Left Turn 1 Reverse Direction	LT1R
Left Turn 2 Reverse Direction	LT2R
Right Turn 1	RT1
Right Turn 2	RT2
Right Turn 1 Reverse Direction	RT1R
Right Turn 2 Reverse Direction	RT2R
Left Bicycle Lane	LBL
Right Bicycle Lane	RBL
Non Trafficked Zone Left	NTZL
Non Trafficked Zone Right	NTZR
Non Trafficked Zone Median	NTZM
Left Parking Lane	LPL
Right Parking Lane	RPL
Left Indented Parking	LIP
Right Indented Parking	RIP
Clear Zone	CZ
Tram / Bus Lane	TL
Bridge Over Hwy / Fwy	BOHF

NOTE: NON TRAFFICKED ZONES ARE AREAS SUCH AS A PAINTED CHEVRON THAT SEPARATES RUNNING LANES FROM BIKE LANES, PARKING LANES/BAYS, ETC AND CAN BE EITHER LOCATED ON THE LEFT, RIGHT OR USED AS A PAINTED MEDIAN.

3.5.3 Additional Areas

A separate requirement for the measurement and assessment of additional areas is necessary as there are often areas of pavement that fall outside of the basic segment length and width. A typical additional area was described in Section 3.4 Operational Responsibility.

Since it is quite common for a variety of different additional areas to be found along any given segment, or 'like treatment', it is considered prudent to identify the various types of additional area. Identification of the various types of additional area will assist the SIR assessment staff to identify where the additional areas are located. The additional area types, listed below, are suggested representative elements for use during the SIR data collection as used by the accredited SIR inspectors.

Additional Area Type

DESCRIPTION	ELEMENT
Widening	WI
Intersection Splays	IS
Median Openings	MO
Bus Bays	BB
Emergency Phones	EP
Pullovers / Turn Outs	TO
Gore Areas / Painted Chevrons	PC
Slip Lanes	SL
Other Additional Areas	OA

SIR inspectors must classify each additional area with an appropriate code and record the additional area code(s), the associated area(s) the chainage(s) and a site descriptor (e.g. road name). Where there are two or more additional areas in a given segment, the total additional area should be summed and recorded.

Example of additional area information for a segment:

Recorded in the Comments field:

- IS-350 m^2 – Ch 3450 – Johns Rd
- MO-175 m^2 – Ch4180
- IS-780 m^2 – Ch 4895 – James Rd
- BB-360 m^2 – Ch 5100
- SL-180 m^2 – Ch 5450

Recorded in the Additional Area field:

- The total additional area (1845 m^2) for the segment, as shown in the above example.

3.6 Segmentation Concepts and Conventions

3.6.1 General

The inspection procedure (Section 3.3), operational responsibility (Section 3.4) and the adoption of a set of 'rules of thumb' to drive segmentation (Section 3.5) are intended to cover most common circumstances encountered during the SIR inspections. However, it is accepted that there will be exceptions to these definitions and conventions.

Some common anomalies that have been encountered during past SIR inspections are listed below, with a brief description of the proposed solution. It is again reiterated that the primary 'rule of thumb' for the SIR is:

- Segments will be defined according to the limits of the work history (i.e. 'like treatments');
- Segments will be defined according to consistent width parameters.

3.6.2 Minimum Segment Length

Generally, a minimum segment length of 100 m applies to rural areas. Where there is a clearly different treatment over the full width of a segment, which is less than 100 m in length, this treatment shall be considered as a patch and rated accordingly. A minimum segment length of 100 m also applies to mid block urban areas (between intersections). However, specialist treatments at urban intersections, such as intersection asphalting or High Friction Surface Treatments (calcined bauxite), shall be rated as separate segments even if less than 100 m in length.

3.6.3 Cross Road Intersections / Priority Road

Where two declared roads intersect one another, the convention described below shall apply. Where a declared road intersects a local municipal road, reference should be made to Section 3.4 Operational Responsibility.

The area within an intersection shall only be included in one segment and rated once. Intersection areas shall be included with the 'priority road' segment. The intersection area shall not be rated again with the non-priority road.

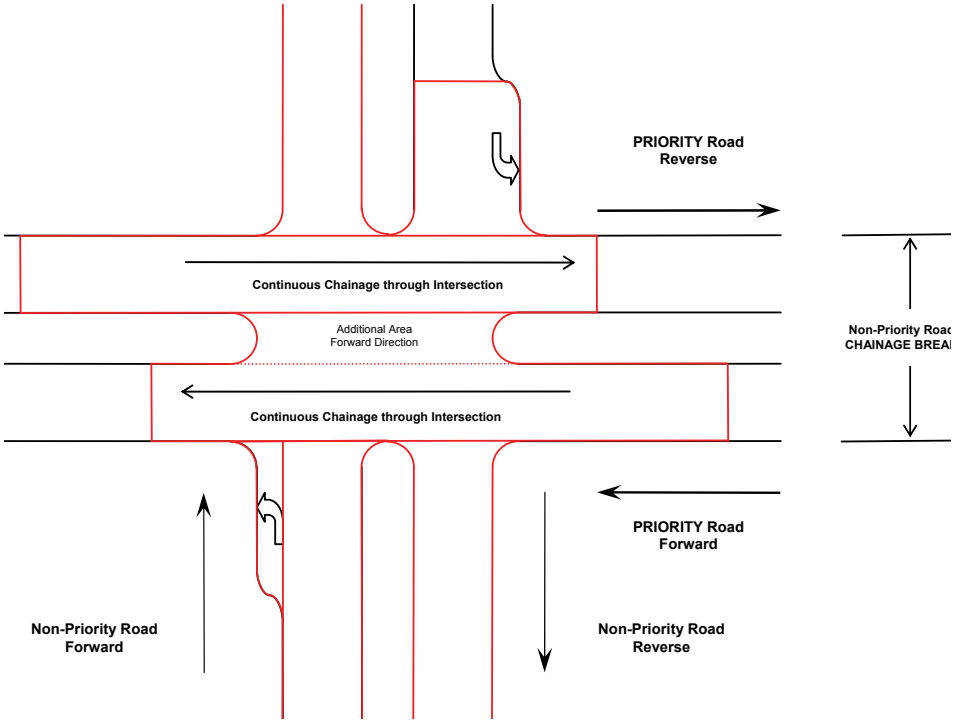


Figure 2 Schematic Sketch of Cross Road Intersection / Priority Road Convention

Where there is a 'chainage break' between segments, such as in the non-priority crossroad in the above diagram, this needs to be noted.

Where it is not clear which of the intersecting roads is the priority road, the SIR inspector will need to make a judgement call, giving due consideration to the existing treatments. Where there is uncertainty whether or not an intersection

has been previously assessed as part of the crossroad, then the SIR inspector should assess the intersection area with the through road. This may result in some intersection areas being rated twice. That is, if the inspector is rating a declared road that is crossed by another declared road, and is unsure whether or not the intersection has already been rated with the crossroad, then the intersection must be rated (potentially for the second time) to avoid missing the intersection area all together.

Additional areas in a cross road intersection shall be rated with the priority road and classified as intersection splays (IS) and then recorded in the comments field.

3.6.4 T-Intersections

Where two declared roads meet at a T-intersection, the convention described below shall apply. Where a declared road intersects a local municipal road, reference should be made to Section 3.4 Operational Responsibility.

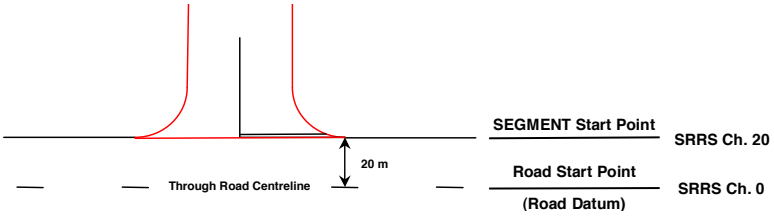


Figure 3 Schematic Sketch of Segment Start Convention

Where there is a 'chainage break' between segments, such as at the start of a road in the above diagram, this needs to be noted.

3.6.5 Roundabouts on Divided Carriageways

For a divided road, the roundabout shall be assessed in the forward and the reverse directions, with the parts of the roundabout applicable to the travelled direction evaluated as additional area median openings. Additional area shall be recorded in the comments.

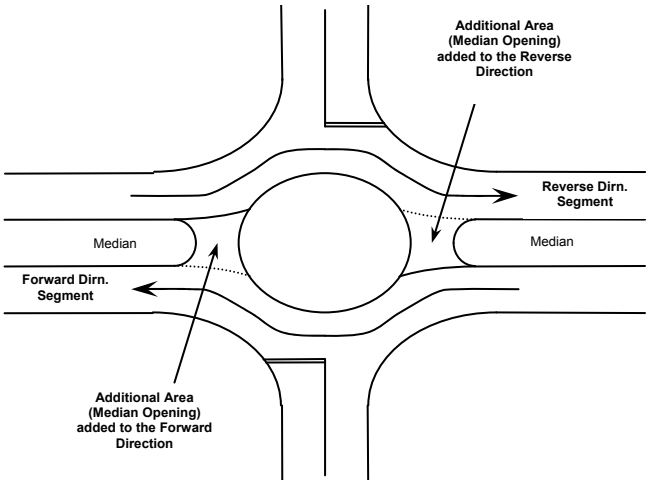


Figure 4 Segmentation Convention for Roundabouts on Divided Carriageways

Note: Where a local municipal road passes through a roundabout on a declared road, Section 3.4 Operational Responsibility defines the demarcation boundaries.

3.6.6 Median Openings

Median openings, including where a local municipal road intersects a declared road, shall be assessed as additional area. The median opening additional area shall be attached to either the forward or reverse segment with the 'like treatment'. Where the 'like treatment' is not clear, the median opening additional area shall be attached to the adjacent lane in the forward direction.

3.6.7 Sealed Shoulders

A sealed shoulder may be assessed as a separate segment / element when it is greater than or equal to 0.5 m wide. The width of the shoulder shall be measured from the outer edge of the edge line.

Where a shoulder is less than 0.5 m wide, measured from the outer edge of the edge line, it shall be rated together with the traffic lane(s).

3.6.8 Bicycle Lanes

Bicycle lanes will only be rated as a separate segment where the surfacing treatment is visibly different from the adjacent elements. That is, if a bicycle lane is to be rated as a separate segment, it should have a different 'like treatment' to the adjacent elements. This section was included to clarify that *line marking* of a bicycle lane will NOT necessitate that the bicycle lane be assessed as a separate segment.

Where bicycle lanes are clearly identified with line marking and bicycle symbols, it shall be noted.

3.6.9 Freeway Ramps and On Ramps

Currently the chainage measurements for freeway off ramps and on ramps follow the conventions outlined below, however freeway off and on ramps are soon to be designated as roads, following the change the ramps will be evaluated using the normal road descriptor.

Off Ramps

- Start Chainage – freeway chainage at the ramp nose (concrete bull nose).
- End Chainage – off ramp start chainage (as above) plus the length of the ramp to the T-intersection with the cross road.

On Ramps

- Start Chainage – on ramp end chainage (as below) minus the length of the ramp to the T-intersection with the cross road.
- End Chainage – freeway chainage at the ramp nose (concrete bull nose).

The above definition for on ramps will require the length of the on ramp to be measured, from the T-intersection with the cross road to the on ramp nose. Once the on ramp length has been measured and the freeway chainage of the on ramp nose determined, then the start chainage for the on ramp can be calculated.

Auxiliary ramps will follow the conventions detailed above; however, if an auxiliary ramp is less than 100 m in length then it may be included as additional area, under the slip lane category (see Section 3.5.3).

3.6.10 Local Road Bridges Over / Under Freeways

Chainage measurements for local road bridges over and under freeway road reserves will generally follow the conventions outlined below.

- Start Chainage – equal to freeway chainage recorded for the overpass / underpass
- End Chainage – overpass / underpass start chainage (as above) plus the length of the local road wearing course within the freeway road reserve.

3.6.11 Turn Lanes at Intersections

At intersections along undivided carriageways where there are opposing left and right turn lanes, these shall be assessed as separate areas as shown in Figure 4.

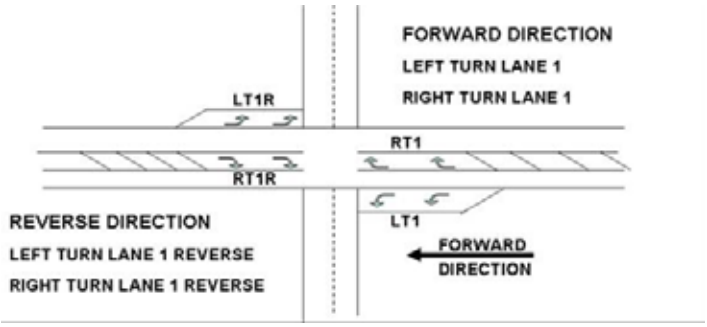


Figure 5 Schematic Sketch of Turn Lanes at Intersections

3.7 Other Information Collected During SIR Inspections

The primary purpose of collecting Surface Inspection Rating data is to assist with triggering periodic maintenance treatments applied at the project level and drive the development of the associated annual maintenance programs. That is, the SIR data is intended to assist staff with the desk top analysis and review of 'potential' periodic maintenance treatments such as reseals and asphalt overlays. It is not the intention of the SIR to replace the need for a field investigation/inspection during the final development of the annual maintenance program. Rather, the SIR data serves as a tool to assist with program development.

Additional data that can be collected during the SIR inspections include:

- Next Treatment
- Binder Modifier (where required)
- Aggregate Size
- Treatment Width
- Treatment Length
- Additional Area
- Total Area
- Recommended Treatment Date (indication only)
- Comments detailing site specific information.

The suggested treatment data is simply another tool to assist staff with the development of the annual maintenance program. After a desktop analysis of the SIR data site inspections should be undertaken to assess the distress mechanism(s) triggering the need for treatment, confirm the need for treatment, establish the most appropriate treatment, treatment limits, associated cost estimates and risk assessments.

4. SPRAYED SEALS

4.1 General

This section sets out the ratings for the evaluation of sprayed seals and includes both core and non-core assessment criteria. The criteria are considered equally applicable for all forms of sprayed seal treatments including those incorporating modified binders and specialist treatments such as geotextile seals and High Friction Surface Treatments such as calcined bauxite, although determination of causes of defects and choice of treatment type may be different.

The Surface Inspection Rating for sprayed seals should incorporate the adopted definitions and conventions detailed in Section 3 – Rating Criteria. Particular attention may need to be applied to separating inspection areas due to different influences of traffic, for example heavily trafficked intersections may require separate assessment to through carriageways and mid block locations.

4.2 Core Criteria Assessment

The tables in section's 4.5 – 4.9 set out the evaluation guidelines to assess the condition and determine a rating for each mode of distress. The Core Criteria to be assessed for Sprayed Seals are:

- Cracking – Section 4.5
- Loss of Aggregate (Stripping) – Section 4.6
- Maintenance Patching – Section 4.7
- Binder Condition (Oxidation) – Section 4.8
- Loss of Binder – Section 4.9.

4.3 Non-Core Criteria Assessment

The tables in section's 4.10 and 4.11 set out the evaluation guidelines to assess the condition and determine a rating for each mode of distress. The Non-Core Criteria to be assessed for Sprayed Seals are:

- Loss of Surface Texture (Flushing) – Section 4.10
- Deformation – Section 4.11.

4.4 Evaluation Guidelines for Cracking

Refer: – Section 2. 2 Cracking

Assessment for cracking is to be conducted across the full width of the area being evaluated, including all types of cracking, both treated and untreated.

The greater the extent and severity of cracking, the greater the loss of waterproofing and the influence on and expected reduction in performance. The SIR evaluation is to be based on a subjective assessment of the percentage (%) of area cracked out of the total area being evaluated with emphasis placed on the extent and severity of the cracking. Generally the more cracks that connect and form into cells, the larger the area of pavement affected.

Careful consideration needs to be given to the types of cracking and their associated influence on pavement performance. For example, significant emphasis needs to be placed on crocodile cracking in the wheelpaths. Conversely, relatively less importance should be placed on environmental cracking between the wheelpaths.

CONDITION	CONSIDERED TO BE	RATING
No cracking	Nil	0
Cracking affecting < 10% of the area. Transverse & longitudinal cracks with few or no interconnections.	Minor	1
Cracking affecting 10 – 20% of the area. Connected cracking, but few, if any, formed into cells.	Moderate	3
Cracking affecting > 20% of the area. Cells developed, interconnections, often some spalling along the edges of the cracks.	Extensive	5

Evaluation Guidelines for Cracking

Rating Zero

Extent: Nil

Comments
Seal in good condition

Rating 1

Extent: Minor

Comments
Single cracking in seal

Rating 3

Extent: Moderate

Comments
Longitudinal and transverse cracks starting to link up

Rating 5

Extent: Extensive

Comments
Cracking developed into cells

4.5 Evaluation Guidelines for Loss of Aggregate (Stripping)

Refer: – Section 2.3 Loss of Aggregate (Stripping) from Sprayed Seals

Assessment of the mosaic and overall distribution, and loss if any, of aggregate particles is to be conducted across the full width of the area being evaluated.

CONDITION	CONSIDERED TO BE	RATING
Aggregate particles closely packed and uniformly distributed, no loss	Good	0
Loss of aggregate particles as single particles or small pockets of two or more particles	Minor	1
Loss of aggregate particles in pockets of two or more aggregate particles	Moderate	3
Widespread loss of aggregate particles, in pockets or as single stone loss, or as a combination of single stones and pockets	Extensive	5

Evaluation Guidelines for Loss of Aggregate (Stripping)

Rating Zero

Extent: Nil

Comments
Closely packed mat of aggregate, no loss.

Rating 1

Extent: Minor

Comments
Loss of single aggregate particles

Rating 3

Extent: Moderate

Comments
Loss of pockets and single aggregate particles

Rating 5

Extent: Extensive

Comments
Loss of larger pockets of aggregate

4.6 Evaluation Guidelines for Maintenance Patching

Refer: – Section 2.7 Maintenance Patching

Assessment of maintenance patching is to be conducted across the full width of the area being considered.

Estimate the area of the potholes, patches, edge breaks etc and calculate this as a percentage of the total area.

Evaluation of maintenance patches refers to current patching of the existing wearing surface, but does not include crack patching which is evaluated and included as cracking.

CONDITION	CONSIDERED TO BE	RATING
No patching or edge defects	Good	0
Patching affecting < 10% of the area. Usually evident as patching of small number of potholes, some edge breaks etc	Minor	1
Patching affecting 10 – 20% of the area. Usually seen as patching of a number of medium to larger areas of potholes and edge breaks etc	Medium	3
Patching affecting > 20% of the area. Usually seen as potholes and cracking which have developed into larger patched areas and longer lengths of edge defects	Extensive	5

Evaluation Guidelines for Maintenance Patching

Rating Zero

Extent: Nil

Comments
Nil patching

Rating 1

Extent: Minor

Comments
Minor single, small patches, widely spread

Rating 3

Extent: Moderate

Comments
Larger patches, in the centre and along the edges

Rating 5

Extent: Extensive

Comments
Large patches widespread

4.7 Evaluation Guidelines for Binder Condition (Oxidation)

Refer: – Section 2.5 Binder Condition (Oxidation) in Sprayed Seals

Assessment of binder condition is to be conducted in the wheel paths.

In practical terms it has been found that the binder condition is similar across the wheel paths and in between the wheel paths, and may be assessed in either of these locations. To minimise the time required for carrying out the evaluation the assessment should be carried out in the outer wheel path and the loss of binder (see section 4.7) assessed at the same time.

The binder condition is evaluated by removing a minimum of three (3) aggregate particles from the seal with a flat bladed screwdriver, and visually assessing the viscosity and adhesion of the binder adhering to the aggregate particles. In some instances it may be very difficult to distinguish between normal bitumen binders and modified binders. Because modified binders are generally tougher than a normal binder, they will often be given the next higher rating compared to a normal binder. This makes only a minor difference in the overall rating.

Viscosity of bitumen is directly related to its temperature. In order to provide a reasonable assessment of the binder condition, the minimum recommended pavement temperature at which the evaluation should be made is 20 degrees Celsius. If this is not practical, and conditions are cool to cold, the aggregate particles should at least be rolled between the fingers in order to bring the binder up towards body temperature. It is further desirable to have a maximum pavement temperature of 50 degrees when assessing binder condition.

CONDITION	CONSIDERED TO BE	RATING
Binder is shiny, adheres to and stains fingers and screwdriver, forms thin “tails”, aggregate particles ease out when removed	Good	0
Binder is shiny, but only slightly stains fingers and screwdriver, may form short “tails”, aggregate particles harder to remove	Minor oxidation	1
Binder dull, hard black coating on aggregate particles, can be made pliable when rolled between the fingers but is not tacky, aggregate particles difficult to remove	Dry, Moderate oxidation	3
Binder is dull brown, may form brownish-black powder, cannot be made pliable between the fingers, aggregate particles pop out after some effort	Brittle, Extensive oxidation	5

Evaluation Guidelines for Binder Condition (Oxidation)

Aggregate easy to remove from the road, likely to have tails of binder attached. Binder soft will stick to the fingers and stains remain on the fingers when the aggregate is removed.	Rating zero Extent: Nil Comments Shiny binder, tails attached after removal
Harder to remove aggregate from the road surface, likely to have no binder tails attached to the aggregate. Aggregate will stick to the fingers and will leave a stain on the fingers when the aggregate is removed.	Rating 1 Extent: Minor Comments Binder shiny, no tails, stains fingers
Much harder to remove the aggregate from the road surface. Aggregate may stick to the fingers but will not leave any binder stain on the fingers when the aggregate is removed.	Rating 3 Extent: Moderate Comments Binder black and shiny, no staining of fingers
Aggregate may sometimes “pop” out easily from the road surface. Binder appears to be a dull brown to black colour. Aggregate will not stick to the fingers and will not leave a stain on the fingers when the aggregate is removed.	Rating 5 Extent: Extensive Comments Dull brownish/black not pliable. No staining of fingers

4.8 Evaluation Guidelines for Loss of Binder

Refer: – Section 2.6 Binder Level in Sprayed Seals

Assessment of loss of binder is to be conducted in the wheel paths and may be assessed at the same time as the loss of surface texture and binder condition (oxidation).

Prior to determining the binder condition, the level of the binder up the aggregate particles should be estimated. The estimated height up the particles is in relation to the height of the aggregate particle as it was positioned in the seal, and the rating is based on the average of the level on the three (3) aggregate particles examined.

CONDITION	CONSIDERED TO BE	RATING
Binder is between ½ and ⅔ up the aggregate (Binder > ⅔ up the aggregate will also have Rating = 0)	Good Seal (& Flushed Seal)	0
Binder is between ⅓ and ½ up the aggregate	Coarse Textured Seal	1
Binder is < ⅓ up the aggregate	Hungry Seal	3
Binder is between very low and beneath the aggregate	Very Coarse Textured & Hungry Seal	5

Evaluation Guidelines for Loss of Binder

Diagrammatic Representation of Binder Loss

Binder Half to Two-Thirds up the Stone

Rating Zero

Extent: Nil

Comments
Binder is between half and two-thirds up the aggregate. Good seal.

Representation of Binder Loss

Binder One-Third to Half up the Stone

Rating 1

Extent: Minor

Comments
Binder is between one-third and half up the aggregate. Coarse textured.

Representation of Binder Loss

Binder < One-Third up the Stone

Rating 3

Extent: Moderate

Comments
Binder is less than one-third up the aggregate. Hungry Seal.

Diagrammatic Representation of Binder Loss

Binder At or Beneath the Stone

Rating 5

Extent: Extensive

Comments
Binder is between very low and beneath the aggregate. Very Coarse Texture and Hungry Seal.

4.9 Evaluation Guidelines for Loss of Surface Texture

Refer: – Section 2.8 Loss of Surface Texture

Assessment of loss of surface texture is to be conducted in the wheel paths and may be assessed at the same time as the binder loss and binder condition (oxidation). Prior to determining the binder condition, the level of the binder up the aggregate particles should be estimated.

Assessment of loss of surface texture refers to the loss of macrotexture of the road surface. Where concern about the level of aggregate polishing or loss of microtexture is identified then reference to the polished aggregate surface should be added to the comments column or be attached in a covering report.

Loss of surface texture (macrotexture) may be due to the seal being flushed and/or bleeding, or loss of the aggregate, and is generally confined to the trafficked areas. An extremely poor standard seal may have loss of texture across the full width.

The assessment is to be based on an estimate of the percentage (%) of the wheel path (trafficked) area that does not meet the requirements for adequate surface texture.

CONDITION	CONSIDERED TO BE	RATING
Binder is between ½ and ⅔ up the aggregate (Binder < ½ up the aggregate will also have Rating = 0)	Good Seal (& Hungry Seal)	0
Binder is between ⅔ up the aggregate and just below the top of the aggregate	Fine Textured Seal	1
Binder just below the top of the aggregate	Full Seal	3
Binder over the top of the aggregate	Flushed Seal	5

Evaluation Guidelines for Loss of Surface Texture

Rating Zero

Extent: Nil

Comments
Well textured seal binder between half and two-thirds up the aggregate

Rating 1

Extent: Minor

Comments
Some loss of texture, binder between two thirds up the stone and just below the surface of the aggregate

Rating 3

Extent: Moderate

Comments
Binder just below the surface of the aggregate, stone still visible at the surface

Rating 5

Extent: Extensive

Comments
Minimal aggregate visible at the surface of the seal, extensive loss of texture (flushed)

4.10 Evaluation Guidelines for Deformation

Refer: – Section 2.9 Deformation

Assessment of deformation is to be conducted across the full width of the area being considered.

Included in the deformation are rutting, shoving, corrugations and depressions.

For each type of deformation, assess the area affected and estimate this as a percentage of the total area. Where there is more than one type of deformation evaluated, the percentages are added in order to determine the total evaluation and a rating.

CONDITION	CONSIDERED TO BE	RATING
No deformation	Good	0
Deformation affecting < 10% of area, or minor longitudinal rutting.	Minor	1
Deformation affecting 10 – 30% of area or moderate longitudinal rutting	Moderate	3
Deformation affecting > 30% of area, or severe longitudinal rutting in the wheelpaths.	Extensive	5

Evaluation Guidelines for Deformation

Rating Zero

Extent: Nil

Comments
Very little deformation

Rating1

Extent: Minor

Comments
Minor deformation, single area only

Rating 3

Extent: Moderate

Comments
Major depression effecting more than 10% of the area

Rating 5

Extent: Extensive

Comments
Continuous rutting in the wheelpaths often associated with loss of texture

5. ASPHALT WEARING COURSES

5.1 General

This section sets out the procedures and ratings for the evaluation of asphalt wearing courses and includes both core and non-core assessment criteria. The criteria for asphalt wearing courses refer principally to dense graded asphalt, but are also to be used for assessment of open graded, stone mastic and ultra thin asphalt surfaces as well as slurry/microsurfacing surfaces, although determination of causes of defects and choice of treatment type may be different.

The Surface Inspection Rating for asphalt wearing courses should incorporate the definitions and conventions detailed in Section 3 – Rating Criteria. Particular attention may need to be applied to separating inspection areas due to different influences of traffic, for example heavily trafficked intersections may require separate assessment to through carriageways and mid block locations.

5.2 Core Criteria Assessment

The tables in section's 5.4 – 5.6 set out the evaluation guidelines to assess the condition and determine a rating for each mode of distress. The Core Criteria to be assessed for Asphalt Wearing Courses are:

- Cracking – Section 5.4
- Loss of Aggregate and Fines (Ravelling) – Section 5.5
- Maintenance Patching – Section 5.6.

It is more difficult to assess the causes of distress and predict future performance in asphalt surfacing than in a sprayed seal. It may therefore be necessary to supplement the visual inspection with further pavement investigation to determine more accurately the overall priority and type of retreatment required. This applies particularly for the more heavily trafficked roads such as freeways and highways.

5.3 Non-Core Criteria Assessment

The tables in section's 5.7 and 5.8 set out the evaluation guidelines to assess the condition and determine a rating for each mode of distress. The Non-Core Criteria to be assessed for Asphalt Wearing Courses are:

- Loss of Surface Texture – Section 5.7
- Deformation – Section 5.8

5.4 Evaluation Guidelines for Cracking

Refer: – Section 2. 2 Cracking

Assessment of cracking is to be conducted across the full width of the area being evaluated, including all types and severity of cracking, both treated and untreated.

The greater the extent and severity of cracking, the greater the loss of waterproofing and the influence and expected reduction in performance. The SIR evaluation is to be based on a subjective assessment of the percentage (%) of area cracked out of the total area being evaluated with emphasis placed on the extent and severity of the cracking. Generally the more cracks that connect and form into cells, the larger the area of pavement affected.

Careful consideration needs to be given to the types of cracking and their associated influence on pavement performance. For example, significant emphasis needs to be placed on crocodile cracking in the wheelpaths. Conversely, relatively less importance should be placed on environmental cracking between the wheelpaths.

CONDITION	CONSIDERED TO BE	RATING
No cracking	Nil	0
Cracking affecting < 10% of the area. Transverse & longitudinal cracks with few or no interconnections.	Minor	1
Cracking affecting 10 – 20% of the area. Connected cracking, but few, if any, formed into cells.	Moderate	3
Cracking affecting > 20% of the area. Cells developed, interconnections, often some spalling along the edges of the cracks.	Extensive	5

Evaluation Guidelines for Cracking

Rating Zero

Extent: Nil

Comments
Asphalt in good condition

Rating 1

Extent: Minor

Comments
Single cracks in asphalt

Rating 3

Extent: Moderate

Comments
Longitudinal and transverse cracks starting to link up.

Rating 5

Extent: Extensive

Comments
Cracks developed into cells

5.5 Evaluation Guidelines for Loss of Aggregate (Ravelling)

Refer: – Section 2. 4 Loss of Aggregate in Asphalt

Assessment of the mosaic and overall distribution, and loss if any, of the aggregate particles from the surface of the asphalt, is to be conducted across the full width of the area being evaluated.

CONDITION	CONSIDERED TO BE	RATING
Aggregate particles closely packed and uniformly distributed, no loss other than weathering and wear of surface binder	Good	0
Well developed, uniform texture with loss of fines from around coarse aggregate particles but little, if any visual indication of loss of coarse aggregate	Minor	1
Substantial depth of texture with evidence of advancing loss of both coarse and fine aggregates	Moderate	3
Widespread loss of aggregate, with wheel paths showing faster rate of loss or areas of underlying base showing through surfacing.	Extensive	5

Evaluation Guidelines for Loss of Aggregate (Ravelling)

Rating Zero

Extent: Nil

Comments
Asphalt in good condition

Rating 1

Extent: Minor

Comments
Slightly weathered
and textured asphalt

Rating 3

Extent: Moderate

Comments
Heavily textured asphalt and
significant loss of fines and
coarse aggregate.

Rating 5

Extent: Extensive

Comments
Loss of areas of asphalt
to the full depth of the wearing
course layer

5.6 Evaluation Guidelines for Maintenance Patching

Refer: – Section 2.7 Maintenance Patching

Assessment of maintenance patching is to be conducted across the full width of the area being considered.

Estimate the area of the total potholes, patches, edge breaks etc and calculate this as a percentage of the total area.

Evaluation of maintenance patches refers to current patching of the existing wearing surface, but does not include crack patching which is evaluated and included as cracking.

CONDITION	CONSIDERED TO BE	RATING
No patching	Good	0
Patching affecting < 10% of the area. Usually evident as patching of small number of potholes, some edge breaks etc	Minor	1
Patching affecting 10 – 20% of the area. Usually seen as patching of a number of medium to larger areas of potholes and edge breaks etc	Medium	3
Patching affecting > 20% of the area. Usually seen as potholes and cracking which have developed into larger patched areas and longer lengths of edge defects	Extensive	5

Evaluation Guidelines for Maintenance Patching

Rating Zero

Extent: Nil

Comments
Nil patching

Rating 1

Extent: Minor

Comments
Minor single small patches, widely spread.

Rating 3

Extent: Moderate

Comments
Larger patches, more extensive

Rating 5

Extent: Extensive

Comments
Extensive multiple patches, widespread

5.7 Evaluation Guidelines for Loss of Surface Texture

Refer: – Section 2.8 Loss of Surface Texture

Assessment of loss of surface texture is to be conducted in the wheel paths and refers to the loss of macrotexture of the road surface. Where concern about the level of aggregate polishing or loss of microtexture is identified then reference to the polished aggregate surface should be added to the comments or be attached in a covering report.

Loss of surface macrotexture may be due to the asphalt being flushed and/or bleeding caused by compaction and/or deformation of the asphalt by the traffic and is therefore generally confined to wheel paths, stop/start areas etc. In extreme cases, the asphalt may have loss of texture across the full width.

The assessment is to be based on an estimate of the percentage of the wheel path (trafficked) area that does not meet the requirements for adequate surface texture.

CONDITION	CONSIDERED TO BE	RATING
No loss of surface texture	Good	0
Loss of surface texture is < 5% of area	Minor	1
Loss of surface texture is between 5 – 15% of area	Moderate	3
Loss of surface texture is > 15% of area	Extensive	5

Evaluation Guidelines for Loss of Surface Texture

Rating Zero

Extent: Nil

Comments
Well textured asphalt

Rating 1

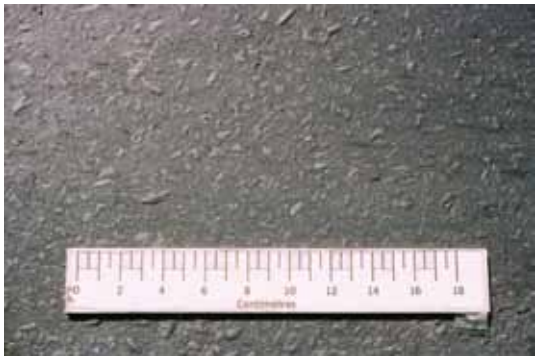
Extent: Minor

Comments
Some loss of texture within the wheelpaths, very fine surface texture.

Rating 3

Extent: Moderate

Comments
Reduced texture, quite black in parts with binder near the top of the aggregate.



Rating 5

Extent: Extensive

Comments
Extensive loss of texture with aggregate almost covered by binder

5.8 Evaluation Guidelines for Deformation

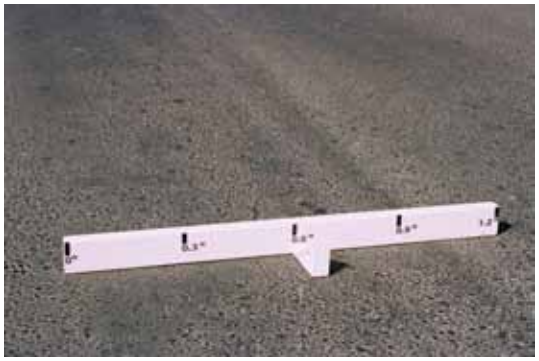
Refer: – Section 2.9 Deformation

Assessment of deformation is to be conducted across the full width of the area being considered.

Included in the deformation are rutting, shoving, corrugations and depressions. For each type of deformation, assess the area affected and estimate this as a percentage of the total area. Where there is more than one type of deformation evaluated, the percentages are added in order to determine the total evaluation and a rating.

CONDITION	CONSIDERED TO BE	RATING
No deformation	Good	0
Deformation affecting < 10% of area or minor longitudinal rutting.	Minor	1
Deformation affecting 10 – 30% of area or moderate longitudinal rutting	Moderate	3
Deformation affecting > 30% of area, or severe longitudinal rutting in wheel paths	Extensive	5

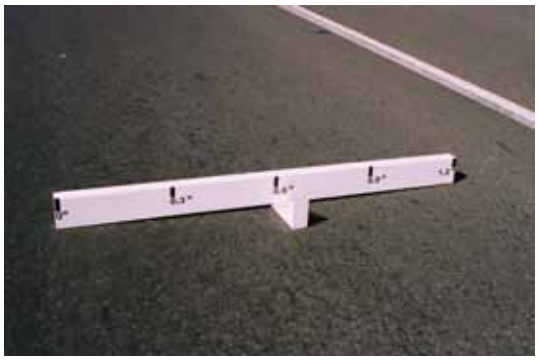
Evaluation Guidelines for Deformation



Rating Zero

Extent: Nil

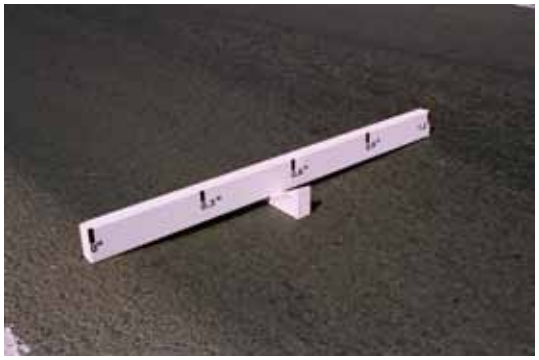
Comments
Very little deformation, would not be rated.



Rating 1

Extent: Minor

Comments
Minor rutting, may not be rated depending on guidelines, but would need to effect more than 10% of the area



Rating 3

Extent: Moderate

Comments
Increased rut depth, would need to effect 10% of the area or more to be rated.

Rating 5

Extent: Extensive

Comments
Severe rutting in the wheelpaths or major depression, large area effected.

REFERENCES

Austroads (2009) Guide to Pavement Technology,
Part 5: Pavement Evaluation and Treatment Design

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