

# Dragging

Category : Technical Information/Maintenance/

## PROBLEM

An earth or gravel surface is prone to development of surface corrugations

## SOLUTION

Break up corrugations and re-spread material with a drag

## GENERAL DESCRIPTION

If unpaved surfaces have low plasticity and become dry, they are prone to form transverse corrugations under traffic. If corrugations form, they are likely to worsen gradually to the point where travel is either very slow or unsafe. Dragging is a maintenance activity in which a device known as a drag is pulled over an unpaved road surface to break up minor corrugations and/or spread loose material across the surface and into the troughs. Provided that it is carried out before corrugations are deeper than around 5-10 mm, dragging will prevent serious corrugations forming. If corrugations develop further, the surface will need to be graded or reshaped by hand. No watering is applied during the dragging operation and the intention is that the surface will reconsolidate with rain moisture and/or traffic. A drag may be made from various low-cost materials.

## Corrugations

Corrugations are transverse ridges that form on the road surface under the influence of traffic. Corrugations cause discomfort to road users, damage vehicles and, when severe, either force vehicles to travel more slowly or put the driver at risk of losing control.

Corrugations begin when a small bump on the road surface, a stone for instance, causes a vehicle wheel to jump. The wheel tends to consolidate, disperse or pulverise the material where it lands. The wheel then bounces a number of times, affecting the material at each point of impact. Small depressions and ridges are formed. The tyres of following vehicles will bounce off these depressions and a series of ridges are formed. Once initiated, corrugations can develop rapidly and extend over very long distances. Because they are initiated by very small surface bumps, if the material is prone to pulverisation, it is almost impossible to prevent them forming. Corrugations grow rapidly under the following conditions.

- Wearing course of low plasticity and fine grading. Material properties have the greatest effect upon corrugation formation. Development of corrugations is directly related to plasticity and particle grading and, to a lesser extent, the crushing value of the coarser aggregate in the material. Coarse grained and high plasticity materials rarely corrugate. Fine-grained material of low plasticity corrugates most rapidly. Material of PI < 11 and Grading Modulus (GM) < 1.5 or Shrinkage Product < 100 and Grading Coefficient < 18 is likely to corrugate.
- High volume of traffic. Corrugations are the result of a large number of wheel passes. They are therefore rarely a problem on low volume access roads.

- High vehicle speeds. Corrugations are the result of wheels bouncing along a road surface. Wheels bounce more when speeds are higher. Corrugations do not occur when speeds are less than 20-40 km/h and are therefore rare on access roads.
- A high proportion of heavy trucks. The depressions formed by a heavy wheel are deeper than those formed by a light wheel. The wheels of unloaded trucks bounce more and form corrugations more rapidly than those of loaded trucks.
- A high proportion of old vehicles. Old vehicles generally have poor suspension systems which are liable to bounce more than the suspensions of newer vehicles.

A cutting drag will break up minor corrugations so that they do not develop and cause problems to road users.

If a sand cushion has been provided on an unpaved road to prevent gravel loss and dust generation, the surface should be dragged at intervals of around 500 vehicles or 10 days to eliminate the windrows and ruts which form and which can cause vehicles to lose control.

## PURPOSE

Dragging serves three purposes.

- To break up lateral corrugations
- To spread loose material
- To break up longitudinal windrows of loose material

Dragging is a low cost activity and, if carried out at an appropriate timing, can be a very cost effective maintenance activity on roads where corrugations and windrows are likely to form.

## Spreading loose material and windrows

Surface material tends to loosen as the road is trafficked and collect into windrows. These are a hazard to traffic and should therefore be spread back over the road surface. This can be carried out by a grader, but is much cheaper when carried out by a towed drag.

## METHODOLOGY

A variety of means can be used to pull a drag. These include the following.

- Tractor, large or small
- Small truck
- Harnessed oxen, bullocks, donkeys or horses

Make the first passes along the edges of the surface. Then move towards the centre of the road. It is normally sufficient to make between 2 and 4 passes of the tyre drag over each part of the surface. Alternatively, continue to drag until each pass has no additional effect on the surface.

Output can be up to 30 route-km per 8 hour day (using 4 passes).

## Types of Drag

Drags are usually flat, wide and heavy and can be constructed from a variety of materials. Drags either cut or brush. Cutting drags can break up minor corrugations and are made from steel beams (usually welded together) or assemblies incorporating (old) grader blades. Brushing drags can spread loose material and are made from steel cables, timbers, arrays of old tyres fixed to a frame, short lengths of steel cable fixed vertically into a frame to act as a stiff brush, or small trees. Tyre drags are described in more detail below. Drags can be pulled by tractors, trucks or draught animals.



**Figure 1: Steel Frame Drag**

This drag has been made from grader blades. These blades are sharp and the assembly is heavy enough to break up minor corrugations. The leading blade is angled so that material is spread towards the crown and the camber is preserved. It is reported that a single heavy structural steel beam can also be used with a chain attached to each end from the towing vehicle. Adjustments to the length of each chain determine the angle of the beam, and hence the lateral movement of the loose material.



**Figure 2: Wooden Drag**

This drag is made from two timbers fixed together approximately 1 metre apart. The road in question is not actually corrugated, or even prone to corrugation, and in this instance the drag is being used as a light grader substitute.



**Figure 3: Tyre Drag**

This drag, made from an array of six old tyres, is being used to level a sand cushion and eliminate windrows and ruts. Larger arrays can be used in order to cover a greater width of carriageway.





**Figure 4: Brush Drag**

A tree is being used to drag a surface in which corrugations can be seen starting to form. Their effect may be less uniform across the surface than that of a manufactured drag and there is a risk of a branch cutting a groove in the gravel. Thorn trees and insensitive use in fragile environments should be avoided. Any debris from the tree should be cleared away after dragging.



**Figure 5: Animal Drawn Drag**

Two bullocks are shown pulling a drag comprising a single heavy timber.

## ARRANGEMENT OF A TYRE DRAG

A tyre drag is a very simple assembly. It consists of a frame made of steel, timber, hard plastic or other suitable material. Used tyres are fixed onto the underside of the frame using bolts and washers. The washers should be large enough to prevent the bolt pulling out through a hole in the tyre. Tyres should be set up in rows as in Figure 6.

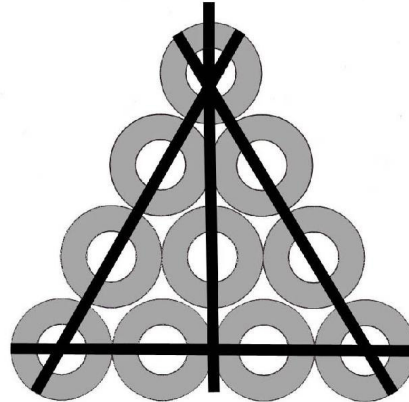


Figure 6: Tyre drag arrangement

## CONTRACT OR PERFORMANCE STANDARD

Dragging is best suited to being instructed on a 'method' specification basis; i.e. by number of route-km and number of passes by approved equipment.

## FURTHER INFORMATION

Transport and Road Research Laboratory, [Overseas Road Note 2](#), Maintenance Techniques for District Engineers, Second Edition, 1985.

TRL Ltd, [Overseas Road Note 20](#), Maintenance of rural road networks, 2003.

World Road Association (PIARC), [International Road Maintenance Handbook](#), Volume 2, Third Edition 2006.

Gongera and Petts, [A Tractor and Labour Based Routine Maintenance System for Unpaved Rural Roads](#), Second Edition, 2003.

## KNOWLEDGE SHARING

If you have any comments or contributions to improve this Technical Information Note, Please contact [info@gtkp.com](mailto:info@gtkp.com)