

MEASUREMENT OF TRACK ALIGNMENT FROM A MOVING VEHICLE

This report discusses a scheme for the measurement of alignment of track from a moving vehicle. Alignment is defined as the deviation in the horizontal plane of the track centre line from its design position. Thus in straight track the deviation is from a straight line, in curved track either from a circular arc (in the centre of the curve) or from a spiral (in the transitions).

Unfortunately these reference lines are not available to a moving vehicle and therefore unwanted lateral deviations (alignment errors) are difficult to distinguish absolutely from wanted lateral deviations (curves).

Using modern data storage techniques it may just be possible to store curvature data for large sections of track, but the problem of synchronisation with vehicle position would be almost impossible to solve. This idea is therefore not considered further.

An alternative approach is to attempt to separate the relatively high frequency alignment data from the relatively low frequency track feature information, by means of high pass filters. Some success can be achieved by this approach although problems are encountered with transitions.

The scheme described in this report makes use of high pass filters but also uses a measurement of track cant to derive a further correction. Cant is applied in such a way that at one particular speed - known as the equilibrium speed - the vector sum of the acceleration due to gravity and the centrifugal acceleration is normal to the plane of the track. Thus an accelerometer mounted on the vehicle with its sensitive axis in the lateral direction would (assuming for the moment no body roll) produce no output while the vehicle is travelling round a curve - including the transitions - at the design equilibrium speed. This is a most useful property which provides the possibility of establishing a reference line which is independent of design features such as transitions and curves.

This report shows theoretically how this technique can be developed into a working system by employing electronic double integration of the accelerometer signal, suitably corrected for roll effects and for vehicle speeds other than the equilibrium speed, and employing spatially dependent high pass filters to limit the wavelengths of interest.