Why does the A7 need a torque tube?

To understand the purpose of the Torque Tube we must first understand one of the basic laws of physics, namely that every action must have an equal and opposite reaction for a steady state to exist (Newton's third law). For example, if a book is lying on a table, then a combination of its mass and the prevailing gravity will cause what we call the book's 'weight' to act downwards as a force on the table top. For the book to remain in position, then the table must offer an upward force equal to the book's weight otherwise the book would move. In other words, if the table was not sufficiently strong to provide the required upward balancing force, then the book would crush the table and we would not have steady state conditions.

Now relating this to a motor vehicle – as the engine delivers torque through the drive train to the crown wheel pinion (the action), the back axle will naturally try to twist about an axis through the rear wheel centres, caused mainly by friction between the tyres and the road. The nose of the differential case will tend to rise in forward gears and move downwards in reverse, and of course the reverse when braking. This tendency for the back axle to twist must be resisted (the reaction) in order to keep the pinion shaft facing pretty much in the direction of the prop-shaft.

In rigid rear axle vehicles, the provision of torque reaction can take several basic forms …..

- *Axle case firmly attached to semi-elliptic leaf springs* -
  Open drive shaft layout where the propeller shaft universal joints connect to the gearbox and a back-axle drive flange just forward of the differential case e.g. Morris 1000 and RWD Ford Escorts.
- *Axle case connected to chassis by trailing links* -
  Drive flange just forward of the differential as above but torque reaction resisted by trailing arms connecting 'posts' on the axle case to pivot points on the chassis (normally in association with a Panhard rod transverse link) e.g. Sports and racing.
- *Enclosed torque tube* -
  Forward facing structural tube, rigidly attached to the front of the differential housing and pivoted at its front end to the chassis or gearbox e.g. Austin Seven and some transverse rear spring early Fords.

The Ford enclosed torque tube is connected via a flexible coupling directly to the gearbox, whereas on the A7 the forward end of the torque tube is mounted to the rear chassis cross-member by a spherical joint which provides torque reaction to both driving and braking forces.

The rear springs on the Austin Seven being quarter elliptic in form, offered insufficient torque reaction at the single leaf end of the springs so it was entirely appropriate for Austins to adopt the torque tube design. The A7 system is unique and efficient and the use of the spherical joint makes it cheaper than a much longer Ford type tube mounted directly to the gearbox.

Another aspect of torque reaction can arise from the combination of excessive engine rev's and a clumsily engaged clutch, which can cause an A7 (especially the lighter Chummies) to try to lift the off-side rear wheel - sometimes leading to a series of spectacular hops – frequently known as 'kangaroo petrol', a driving technique particularly familiar to learner drivers. Interestingly, quarter elliptic rear suspension did not die-out when A7 production ceased in 1939, it was resurrected in the late 1950s when fitted to the Austin Healey (frog-eye) Sprite which used an open drive prop-shaft together with stabilizing rods to counter drive and braking torque.