Bump Steer

One of the primary design requirements of the new upright was to correct the inherent *bump steer* resulting from the current location of the steering arm mount. Double wishbone suspension and the resulting steering geometry are extremely complex and active systems in which any minute change can have a significant effect on system dynamics.

When going through suspension travel, each front upright connection can be thought to travel a path roughly defined by an arc. In double wishbone suspension, the system has an instant axis of motion or, instant centre, located at the extended imaginary intersection of the two A-arms as shown below in Fig X1. When the imaginary tie rod extension does not pass through this instant centre, a significant difference of path is observed. In the case of QEV4, this misalignment created significant toe out when the suspension was compressed and had potential to result in significant vehicle instability.

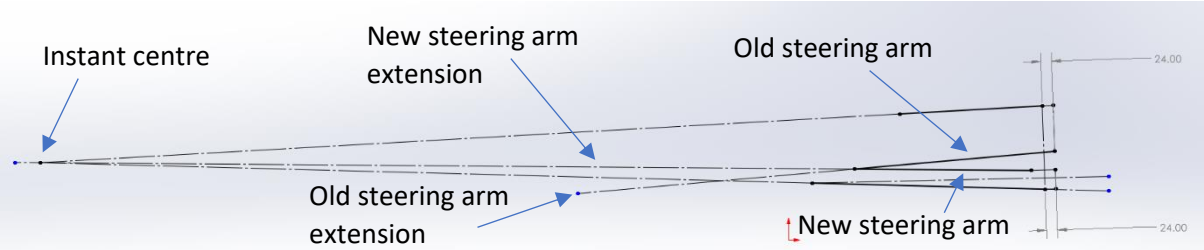

Figure 1: Standard ride height geometry

By simply moving the steering knuckle vertically along the upright, the steering arm can be made to extend through the instant centre of the system at standard ride height (Fig X1). This provides significantly reduced toe changes as illustrated by the relative measurements below in Fig X2.

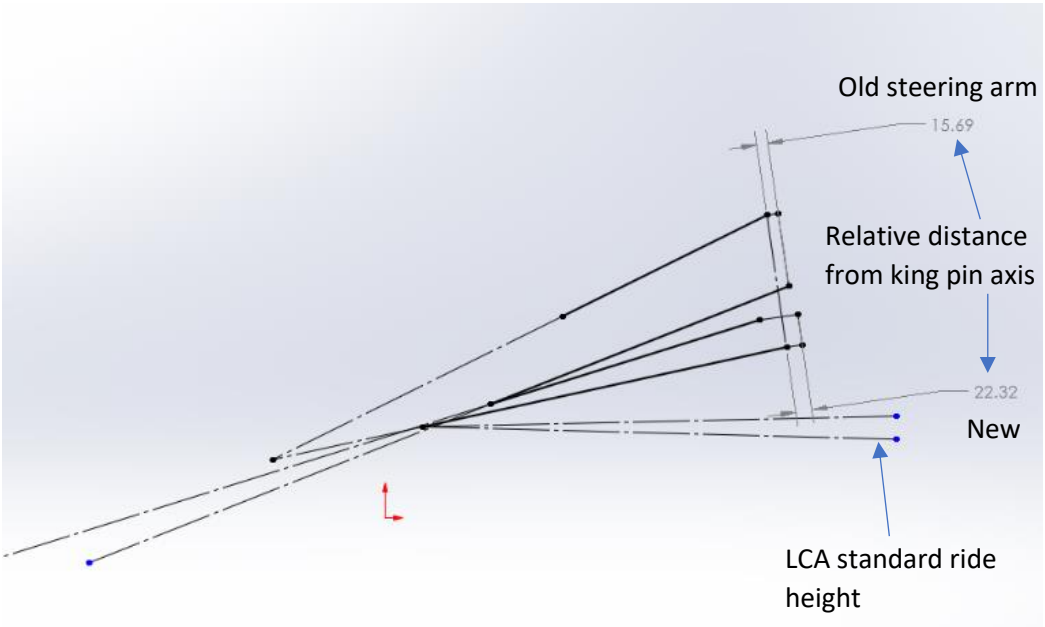

Figure 2: Exaggerated example of suspension compression

Ackerman

Another key consideration when determining steering knuckle location is the Ackerman geometry. The existing steering mount resulted in severe anti-Ackerman, not ideal for the conditions QEV4 is actually used in.

For QEV4, it was decided to accommodate for three Ackerman settings, neutral, parallel and anti.

The rough way to achieve neutral is to place the steering knuckle at the inter section the new steering arm makes with the line connecting the king pin axis to the centre of the rear axle. It is very important to angle the steering bracket to be inline/parallel with the steering arm at ride height. This will ensure no additional bump steer is induced when adjusting Ackerman settings.